

Evaluation of Fire Detection and Protection System for Enhancing Fire Safety by Using NBC in High-Rise Buildings

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Abstract: Fire hazards continue to be a major global challenge, threatening property, investments, economic development, and human life. Effective fire safety management is essential to protect lives, minimize financial losses, and reduce the risk of legal consequences following fire incidents. Fires also have severe environmental effects due to the release of smoke and combustion by-products. Despite these risks, fire remains indispensable to socio-economic, technological, and industrial advancement, highlighting its continued significance to humanity. High-rise buildings face numerous inherent challenges due to their increasing complexity and advanced design, utilities, and services. These challenges include: height-related limitations that hinder fire equipment access, issues with stairwell egress and smoke stack effects, uncoordinated and inconsistent fire safety management across different floors, frequent redesigns and changes from the building's original intended use; and the complexity of managing vertical utility systems such as Heating, ventilation, and air conditioning ducts and conduits. In light of these challenges, this study aims to conduct a practical evaluation of the integration and effectiveness of fire protection systems in addressing fire safety issues specific to mixed-use high-rise buildings. The research adopted a combination of quantitative and qualitative methods. A random selection of high-rise buildings within city formed the sample size. Primary data was collected through observations, questionnaires, document reviews, and interviews with key informants. To assess the performance of various fire protection systems and methods, a multi-attribute evaluation model was utilized. Performance indexes were calculated using percentiles, and the findings were presented using pie charts, histograms, and tables. In conclusion, the study found that achieving effective fire protection requires the integration of both structural and non-structural fire protection systems and methods during both the design and occupancy phases.

Keywords: National Building Code (NBC), high-rise structures, fire hazards, fire protection strategies, fire detection systems, fire behavior (fire triangle), occupational health and safety, and related safety measures

