

Fire hazards in apartments

Wakeup call for architects, planners and engineers

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As with most problems in this country, lack of awareness is one of the major impediments in making our buildings safe from fire-related accidents. The difference here is that instead of going by the cliché of developing consciousness among the public, it is the professionals (architects, planners and engineers) who have to first understand the emerging and growing need to be knowledgeable about fire, its dangers, causes and consequences, and then evolve design solutions that make a safe living environment.

Traditionally interiors of urban buildings were of non-combustible materials. Further, being dependent on natural ventilation, the circumstances did not usually permit the spread of fire internally, nor did a fire have the scope to develop rapidly in magnitude so as to affect the inmates.

However, recent trends show that the use of combustible materials for interior decoration is increasing, and that more and more spaces are becoming air-conditioned. Windows, which were once open for ventilation, are now closed; thus increasing not only the possibility of a fire developing, but the enclosed situation also contributes to jeopardizing escape of affected persons.

The possibility of a fire breaking, the potential fire area, the likelihood of a fire starting, the possible risks to life, and the extent of damage increase with the size of a building; the increase in height can only make the situation worse. Needless to argue that the potential risk of fire is higher in garment factories, industries, cinema halls, offices in tall buildings, and shopping centres, but there is no cause for complacency with regard to the implied dangers at home; particularly now because apartments are being housed in tall buildings.

That our city planners, architects, engineers, constructors and building owners are oblivious of the dangers of fire is evident from one simple

observation. Although buildings are not incorporating a sprinkler system, tall buildings are erected beyond the height limitations of escape ladders and water jets of the Fire Services. Presently, in Dhaka there is only one engine, which can jet water to a height of 150 feet and there is one each in Dhaka, Chittagong and Khulna, which can reach a height of 90 feet.

In spite of the flattering statistics, i.e. low casualty at home, the dangers of fire in residential buildings cannot be over-emphasised particularly because children and the elderly are present. In the home there will be the risk of fire associated with the pattern of its use. More than causing damage to the building a fire in the home may be fatal for the home user. It is therefore necessary to follow some simple rules in a Bangalee home to substantially reduce the possibility of a fire starting. There are some things, which should be prohibited at home. For instance, DO NOT

- Keep a pan, pot or kettle on the burner unattended.
- Keep the gas fire 'on' when not in use.
- Smoke in bed, particularly not inside the mosquito net.
- Ignore the potential danger of a mosquito coil.
- Work in the kitchen with loose clothing.
- Keep oil close to the burner.
- Make electrical connections without professional help, or tamper with electricity

In constructing residential buildings, particularly high-rise apartments, emphasis at design stage on account of fire protection should focus on the following, (not exhaustive)

- Building capacity: to determine number of doors, size of exits, lobby, and corridor.
- Layout: distance to exit should meet standards. Congestion may impede escape.
- City traffic: location of building, neighbouring land-use, traffic

- behaviour, width and turning radii of roads, over-bridge clearance, etc.
- Finish and furnishing materials: determines how much will burn.
- Water requirement: availability of water, size/type of reservoir/riser.
- Early smoke/heat detection and warning systems.
- Means of Escape: ensure that every person can escape unaided to the plaza level/ safe cell within 2.5 minutes of a fire starting.
- Number and location of fire extinguishers: dependent on organisation, size and volume of space, as well as type of fire.
- Sprinkler system: overhead duct system to douse fire in large/unattended space.
- Emergency lighting: to enable escape when power is cut off during a fire.
- Assembly Point: where escapees will assemble to account for every person in a building.

Preparedness for fire includes exacting inspection of buildings. This is especially true for Bangladesh where building-use is changed at the whim of the owner, stemmed by commercial benefit. In inspecting existing buildings, emphasis should be laid on whether:

- Addition and/or alteration has been made to the building since receiving planning permission, either structurally or with regards to finish materials, number of exits, size of exits, etc.
- Number and type of users have increased.
- New materials have increased the risk and/or magnitude of fire.
- Accumulated rubbish can ignite a fire.
- People are observing 'No Smoking' and other preventive/precautionary signs.
- Requisite number exits are in operation for timely escape by all persons.
- Passage, corridors, lounge, lobby and foyer are clear of

- furniture and rubbish.
- Extinguishers, sprinkler system, hose reels, etc. meet safety requirements.
- In-house staff has training to take charge and operate fire-fighting equipment.
- Telephone number/s of the Fire Services is noted, and a reliable telephone is available in an emergency.
- Fire drill involving all the users is being held at least twice a year.
- An assembly point beyond safe distance, sufficient to accommodate all the users, has been earmarked and displayed as such.

Professionals must take up the challenges that are being generated as part of the boom in the building industry. Being unaware of all the entangling factors could lead to inefficiency and poor economics. Ignoring fire could be disastrous and fatal.

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Unease about fire safety

A study of nine-plus highrise apartment buildings

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CITY life is presently undergoing rapid transformation in a wide range of spheres with housing complexes, mammoth shopping centres and large commercial buildings propping up above its skyline. With Dhaka City in the grip of modernisation, real estate developers in the private sector are looking for each and every open space and turning them into multi-storied buildings.

The increasing city population has made it necessary for high-rise apartment buildings to take precedence over single-unit residential accommodations. While the idea of expanding such housing facilities is gaining momentum, it has become essential to give proper attention to the complex system of services, which needs to be addressed in such development, particularly with respect to fire safety.

Accidents are no simple ill, they come upon us in a number of ways and require remedies as numerous. One of the remedies is safe building design. If not properly dealt with fire accidents in high-rise apartment buildings can be numerous in number and huge in scale. In a safe building design process, possible causes of fire should be

comprehended in the initial stage and measures should be taken to prevent fire from starting and spreading to other buildings.

It is vital to identify the deficiencies and problem areas which require improvement in terms of fire safety aspects in high-rise apartment buildings and consequently to have a complete understanding and necessary information on the contemporary development. That would provide the necessary clues as to what measures should be adopted or incentives given for a safe building design.

This paper investigates the fire safety aspects in Dhaka's plus 9-stories high-rise apartment buildings, their provision and deviation from standard regulations, which affect the safety aspect of the users. Analyses of the actual situation and a careful delineation of existing problems will help towards understanding the divergence from safe building design. This paper tries to emphasise on the importance of the subject matter of fire prevention, precaution and control, which eventually contributes to responsible building design.

Evidences presented in this paper are based on a survey carried out on ten apartment buildings selected randomly from different areas of the

city. The buildings studied are: Western Tower Apartments, Suraiya's Dream, Sky View Heaven, Fortune Tower, Rangs Taj Villa, Green Tower, Marium Tower, Sky View Garden, Hafiz Tower, and The Golf Heights.

Information collected through survey were then analysed on the basis of standard regulations specified by Bangladesh National Building Code 1993 (BNBC). Apartments were evaluated for prevention of fire and protection of the occupants.

LOCATION

The location of the site, adjacent land uses and distances between buildings are primary determinants for fire safety arrangements. The site condition is considered critical when other plots surround it on three sides as it poses certain limitation regarding fire-fighting provisions. Such sites restrict access in to the site and also the exit for users. Although in all the cases, the building setback rules are fairly maintained but in about 60% of the apartment buildings we can see that the building is rather deep, and that it is almost inaccessible for external fire fighting equipment and men.

ACCESS FACILITIES

The means of access to the site, including the building perimeter, for fire-fighting vehicles and equipment are very important. An unobstructed width of 4.5m is recommended for fire apparatus access road and a minimum vertical clearance of 5m is required. In about 30% of the apartment buildings surveyed, approach is from private roads with a maximum width of 3.6-4.2m.

Fire apparatus access roads having a dead-end further than 30m from the main road should be provided with appropriate provisions for turning around of the fire apparatus. For example, the Golf Heights (apartment building) in Banani (along the Airport Road) is accessed by a 4.5m-wide private dead-end road, about 90 m long, with no provision for fire apparatus to turn.

The Green Tower on Green Road is another example in which access to the building is through a 3.6m wide private road, which is also covered by a tinshed with a clear height of maximum 3.6m. The staircase of the building is at a distance of 27.4m from the edge of the main road. The other road adjacent to the building is about 4.2m wide approaching toward Kalabagan. The depth of the building is such that the rear side is almost inaccessible from the main road. Road congestion is also likely to affect emergency service attendance and fire fighting operations (Fig.1 & Fig.2).

SERVICES

It is expected that apartment buildings will be provided with the best possible service facilities for a safe and comfortable urban living. But a critical and thorough analysis will reveal the actual conditions related to fire prevention, precautions and control in these developer built houses. However, the Code provides specific standards regarding the services required in buildings more than 20m high.

LIFTS

Any apartment building more than ten storeys must have at least one lift with stretcher bearing facilities. One or more lifts are required to be provided with standby power. Necessary provisions to prevent spread of fire through the lift well and also to reduce the possibility of spread of fire from the machine room into the lift well is essential. When lifts are located in a central core location of building, exits from lift lobby must be through a self-closing smoke door of half-an-hour fire resistance. In all the

buildings surveyed, adequate number of passenger lifts are provided. But there is no provision of lift to carry stretchers.

For safety reasons, it is of utmost importance that lifts shall not normally serve the basement. One or more lifts are required to be exclusively designed and maintained for the use of firemen in case of emergency. These aspects are not considered by any of the developers.

MEANS OF ESCAPE

A continuous and unobstructed Means of Escape consists of (a) the exit access, (b) the exit and (c) the exit discharge. Although in about 80% of the cases, the number of stairs provided appear to be satisfactory but these stairs cannot be considered as a safe means of escape. In about 50% of the buildings, fire exit is provided as a secondary Means of Escape, but their location and design do not conform to the general requirements.

It is required that exit doorways shall not open directly on a flight of stairs. A space of width not less than the width of the doorway shall be maintained immediately outside the doorway. In Marium Tower and in Suraiya's Dream inadequate number of risers, door swing obstructing the way of exit, All these minor detailing may prove to be unsafe for users in the event of a fire. In other examples, stairs sharing the same lobby with the lift cannot ensure safe exit if fire spreads through the lift core or stairwell, as neither the stairs nor the lift lobby are fire protected. A positive aspect however is that, natural lighting and ventilation in the lift lobby area appears sufficient in 80% of the buildings.

It is recommended that exit facilities should be clearly visible to the occupants and provide a safe continuous passageway where the occupants will not have to travel toward any high-hazard areas. The travel distance to these safe exits from any point in the area served shall not exceed 25m (82ft). Half the buildings surveyed satisfies this requirement. In Green Tower the travel distance to the alternative staircase is 134 ft whereas the nearest stair is at a distance of 80 ft.

In Western Tower Apartments at Segun Bagicha, the access to the fire exit may be difficult for fifty percent of the occupants if the fire and smoke spreads through the lift core. The fire exit is a circular stairway located at the end of narrow passage. Furthermore, a window of the adjacent apartment facing the exit stairway may prove to be crucial in terms of fire spread (Fig.3 & Fig.4). In Sky View Heaven Apartments at Shantinagar, the fire exit is located adjacent to the regular stair and sharing the same lobby area; this is not acceptable for the purpose for which it is meant.

FIRE PROTECTION SYSTEMS

Smoke and fumes are capable of contaminating large voids very quickly. To prevent early smoke spreading especially in to stairs and corridors it is essential to provide smoke detectors for early detection of fires as well as automatic sprinklers. None of the apartment buildings surveyed are provided with such facilities, although in 50% of the buildings, the number of fire extinguishers is satisfactory. In Western Tower, there is only one fire extinguisher in each floor with four apartments. This is contrary to Building Construction Rules 1996. In Green Tower the situation is even worse where there is only one fire extinguisher placed near a lift located at the far end of each floor. Manual fire alarm and standby electricity generator is common in all the cases. In general working condition of fire fighting equipment is rather poor.

AREAS OF SPECIAL RISK

KITCHEN

In residential buildings the possible sources of fire are mainly electrical cooking appliances and equipment, and gas appliances. Therefore, the kitchen can be considered a high fire risk area. Proper location of kitchen and provision for adequate ventilation is fundamental to safety. In 30% of the buildings, kitchen is located too near to the escape route, which may prove to be hazardous if the fire occurs in the kitchen area. Moreover, smoke generating from fire may be drawn towards stairs and corridors due to accelerated airflow through the void. For example, Sky View Garden at Shantinagar.

Exhaust fans used in kitchens are to be placed on a peripheral wall of the building or connected via a duct directly to the outside and needs to be made of non-combustible material. In about 80% of the buildings, the ventilation in the kitchen is satisfactory. But in Green Tower Apartment on Green Road, a kitchen without any window opening to the exterior in one of the unit, provides an example of wrong design.

BASEMENT

A basement must be independently ventilated with the help of grille, pavement lights, etc. Basement staircase has to be encased and placed near the outer edge of the basement with materials having 2-hour fire resistance. The stair must be entered at the ground level from open air so that the smoke from a fire in the basement will not obstruct any exit serving the ground and upper floors. Basement housing hazardous occupancy must have access only from the exterior of the building. Kitchen using gas are not allowed in the basement or sub-basement.

In the surveyed buildings basement stairs are not protected as required by the code. In all the cases stairs go up to the top floor and thus provide a large unprotected shaft for the transfer of smoke and fume generated by fire. In 50% of the apartment buildings, the basement houses danger prone areas, such as rooms for habitation, generator and transformer. Basement rooms used for living can become hazardous if the users use the premises for cooking. In 90% of the cases the authorities concerned said that they do not allow cooking in the basement. In Western Tower a kitchen has been provided on the ground floor for the security personnel. Ventilation at the basement appears satisfactory in 80% of the buildings surveyed.

STRUCTURAL FIRE PRECAUTIONS

It is required that construction of all load-bearing components shall be of non-combustible materials. Internal staircase and lift core walls shall be made of bricks or reinforced concrete with a minimum of 2-hour fire rating. Material used for inner finish are restricted to Class 1 (surfaces of low flame spread: Flame does not effectively spread more than 300mm in the first 1.5 min. with an ultimate value of 600mm) rating of flame spreadability. In all the buildings surveyed, the materials used are non-combustible in nature. Walls enclosing the lift core have a fire resistance rating of 2 hours. But in 90% of the examples we can see that the staircases are not fully protected because of the opening in the wall. Even the fire exits are not always provided with fire doors. For example, Western Tower.

CONCLUSION

The subject matter of fire prevention, precaution and control is of great importance. The potential risk factor of a fire hazard should never be underestimated. Given the traditional outlook, general ignorance and rampant complacency among users and professionals, it may be difficult to implement overnight a standardised system for fire prevention and control. However, setting the safety of the users as the prime goal, architects and planners should come up with economical and practical solutions to prevent fire from starting and spreading. Laws should be enacted and guidelines provided for the developers and professionals to adopt sensible design solutions. Awareness should be increased among professionals and users regarding the potential dangers of fire, including death, injury and loss of property, etc. due to fire.

Dhaka City is at the threshold of urbanisation. Everyday new apartments are being planned and implemented

without adequate consideration for the safety of the users. The need for a fire safe environment must be considered at the very beginning. The methods of maintenance, the type of fire fighting equipment, the type and extent of electromechanical equipment, etc. should also be carefully tailored to suit particular building requirements. Above all, to ensure a responsible building design, the safety aspects should be accommodated as an essential design tool.

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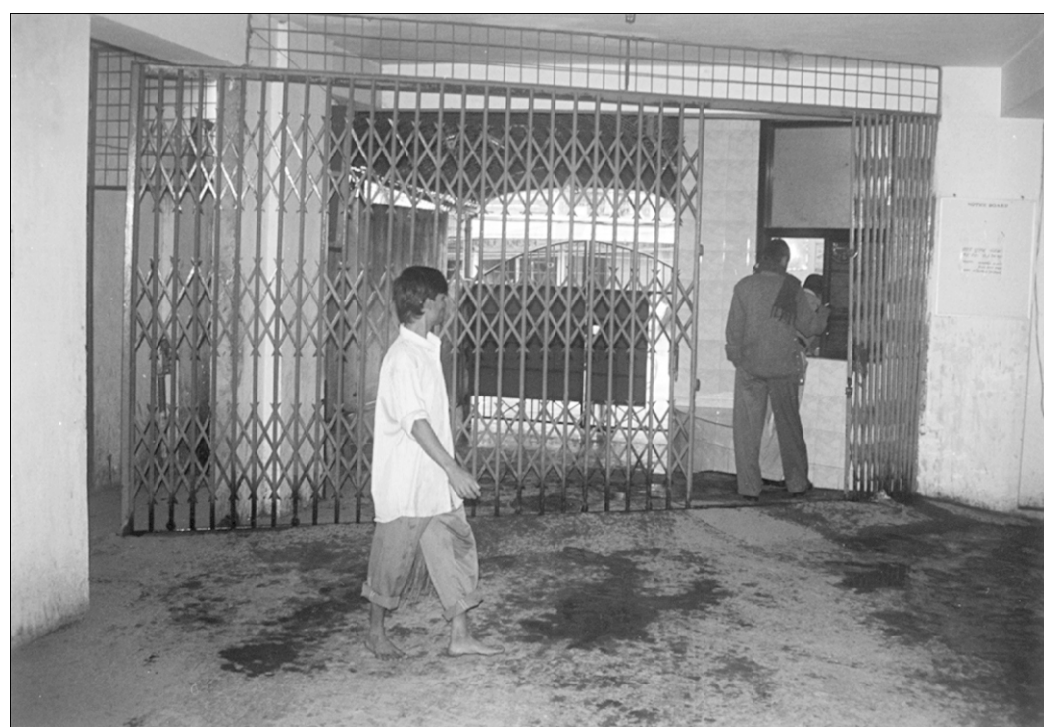


Fig. 1: Green Tower Apartment: 20 ft. long covered approach road restricts the accessibility of the fire fighting vehicle near to the building.



Fig. 2: Green Tower Apartment: Narrow side lane, the only access to approach the rear side of the building.



Fig. 4: Western Tower Apartment: A circular staircase designed as fire exit with a window opening towards it.



Fig. 5: Western Tower Apartment: A narrow passage of 2'-6" width provides access to the fire exit with the only fire extinguisher located at the dead end corner.