The Daily Star

AGENDA FOR URBAN CONCERN

Dhaka, Saturday, March 28, 2009

Designing for fire safety: Case study Dhaka

ARCHITECT DR NIZAMUDDIN AHMED

Figure 1: Islambagh slum after a fire.

1988. Dhaka's Islambagh slum was burnt to ashes in a devastating fire. It was neither the first nor the last time. From the tip of the coconut trees on the premises to the mattress on the mud floor nothing had escaped the wrath of the fire. The site portrays the aftermath of a massive hurricane. (Figure 1)

Locals suspect the fire in this slum and many others in the capital are often deliberately ignited almost at regular intervals, usually annually, for various purposes including eviction of the poorest of the poor from their minimal accommodation in the capital.

The living condition at Islambagh, as in any other slum of this megacity, is basic: onestoried shack, bamboo structure, wall of bamboo mat, roof of C I sheet, floor of mud and limited brick wall.

After the fire was doused a woman and two children were found dead in the only semi-pucca toilet in the slum. They could not escape and took shelter in the brick-walled toilet. As it is, the width of escape path in these slums is often as narrows as two-thirds of a metre.

If people can DIE in a slum fire, in one-storied shacks, so they can in a multi-storied building. (Figure 2) People will die because they will not be able to ESCAPE from a fire. Means of Escape should form the basis of any building of any type and size and height and ocupancy. Each person should be able to escape to a 'place of safety' UNAIDED.

There are two axioms worth noting.

Axiom 1: People will die in a FIRE incident because the Architect or the building occupier did not provide a MEANS OF ESCAPE to a place of safety.

But 'SMOKE' actually kills.

Axiom 2: People will die in a SMOKE incident because the Architect or the building occupier did not provide a MEANS OF ESCAPE to a place of safety.

Fire safety planning begins at the design stage. A typical fire pattern involves initiation, enlargement, rise of smoke, heat and fire due to flue effect (going upwards), leading to structural failure over time and if sufficient combustibles are available.

In designing the layout of a building or space *Door width, *Aisle width, *Distance to exit, *Travel route, *Volume per person, and *Floor finish SHOULD MEET STANDARDS.

Escape routes to a place of safety (ground/plaza level or a fire refuge cell) can be 'unprotected' (fire/smoke can engulf escapee) and 'protected' (fire/smoke CANNOT engulf escapee for a certain period of time, reference fire rating door/wall).

As an example of standards, the width of a corridor in an 'unprotected' route should be minimum 0.9m for an occupancy of less than 50 persons and 1.1m for more than 50 persons, according to Bangladesh National Building Code, 1993 (BNBC). Another example of standards: BNBC states that the escape route will consider that 40 persons can escape via a 32cm opening. Yes, the figures can be confusing but the good news is figures exist, as do architects who are there to guide any building owner.

The BNBC is quite elaborate regarding fire. For example, it details out that 12 persons can be safe with one door in an apartment, and the maximum travel distance to a place of safety should be 23m. There are figures for other occupancy types too. The BNBC recommends that the maximum stories for an apartment building should be six. Unfortunately, the Dhaka Metropolis Building Construction Rules 2008 allows 10 stories residential building with one staircase/exit.

BNBC describes three fire zones: Zone 3 for Hazardous occupancy; Zone 2 for Garage and petrol stations, industrial buildings, occupancies with moderate fire risk and for storage; and Zone 1 for the rest including residential occupancies. The zoning has an effect on precautionary and preventive measures to be taken, and control measures to be installed. These are hardly followed.

People MUST be able to ESCAPE from fire and smoke within 2.5-3 minutes of starting a fire. The travel path should be free from any form of obstacles, be slip proof and directed by effective signage. The door should swing towards the direction of escape, never in the opposite direction.

Congestion should not impede escape. People escaping from a fire should not end up in a bottleneck, either at corridors narrowing or at doors narrow than the corridor.

Related to layout is 'travel distance' which is one criterion at the design stage. The recommended travel distance in a fire from one's station (working, living, etc) to a place of safety (or Assembly Point) is 45m for trained people in low fire risk premises. e.g. offices. It is 30m for people in a hospital, shops, and public assembly buildings. The safe travel distance for hazardous processes and stores depends on the risk.

Type	Occupancy		Fire Zone	One DOOR: P4/3.9		One EXIT: P4/3.14	
	BNBC 1993			Max load	Max travel	Max stories	Max Load/ Travel
	All					1	100p /25m
A1	Residential	Detached 1 family	1	12	23	2	30 p
A2		Apartments				6	12 units
A3		Mess, hostel				4	50 per fl /25m
A4		Min. housing				6	
A5		Hotel				2	50p
B	Educational			50	23	2	200
C	Institutional			12	23	2	200
D	Healthcare			12	23	2	50
E	Assembly			50	23	1	100p /25m

Type	Occupancy		Fire Zone	One DOOR: P4/3.9		One EXIT: P4/3.14	
				Max load	Max travel	Max stories	Max Load/ Travel
F1	Business & Mercantile	Offices	1	50	23	2	100/25m
F2		Small shops & markets					
F3		Large shops & markets					
F4		Garage, Petrol Stations	2				
F5		Essential services					
G	Industrial		2	50	23	2	100/25m
H1	Low fire risk Storage		1	30	30	2	100/25m
H2	Moderate fire risk Storage		2				
J	Hazardous		3	5	8	1	100/25m
K	Miscellaneous		1			1	100/25m

Providing a door is not the solution to escape in a fire situation, especially if the door sports a sign saying, 'Please do not use this door'.

As we already know, because smoke kills, vertical spread (FLUE EFFECT) of fire MUST be avoided. (Figure 3) Open staircases, as in most of our tall buildings, will help fire to spread from floor to floor and they must be enclosed immediately. In open planning, spread of fire cannot be avoided.

Venting can prevent lateral spread of smoke, heat and fire, and is recommended in the BNBC. That is why in a fire ventilated buildings are in some ways safer than air-conditioned buildings with no openings.

Escape staircases MUST be protected against fire. Such staircases must be under positive air pressure, connected through a pressurized lobby.

Alternate route MUST be available in a fire to the extent that even every home MUST HAVE an Escape Plan.

Staircases and alternate exits should be as far apart as possible from each other. (Figure 4) A prior condition for good fire safety design is that alternate staircases MUST be available in a fire

Providing an alternate staircase MAY NOT be the solution towards safety, particularly if the alternate staircase is unusable, unapproachable, unopened, and most importantly inadequate for the number of users. If, say, two staircases (one alternate of the other) are good for 100 people, it cannot provide safety to say 1000 people. More people and bigger the space covered shall require more staircases.

Providing alternate staircase NEED NOT be made difficult. A case in point is the flimsy steel staircases attached to the side of buildings housing garment factories. In a fire situation, when loaded and pounded upon by fleeing workers, the staircase may not hold. To prove me wrong, garment factories should undergo full load drills at least twice a year.

Also staircases so attached to a building need to maintain a safe distance from any window opening that may let out smoke, heat and fire. A distance of 1.8m is recommended.

Alternate staircase need not be an eyesore, as is the case presently in most buildings. They can be designed with the highest sense of aesthetics. (Figure 5)

In designing an alternate staircase, adequacy and location are important. The number of people using the building will decide the width and number of exit/staircases. The travel distance, depending on the expanse of the building, will determine the location of exit/staircase.

We do not want see scenes such as the ones following the fire at ninestoried BSEC building 2004, when people jumped from the upper floors to escape, and swung from telephone cables, some to their death. This calls for an inventory of the equipment available with the Bangladesh Fire Services and Civil Defence. For a fact, the fire services are very poorly paid and equipped. Their men can be given gallantry awards after every operation.

However, the notion is wrong that buildings should only be as high as the highest ladder in a city, most usually owned by the fire services. Cities having 100 stories tall buildings do not even have ladders one-third that height. The solution is elsewhere.

In tall buildings, floor, wall and ceiling with fire rating of 2-4 hours behave as fire separators. These shall contain the fire within a space until the combustibles are burnt out. Tall buildings must be designed with 'refuge cells', preferably every five floors. (Figure 6) People in a tall building need not escape to the ground/plaza floor. It is not possible. They shall take refuge in a 'refuge cell' and fire services personnel shall come and rescue them from within. They will not panic nor jump from great heights in fear, because they would have gone through regular fire drills in the past.

Compared to UK's (population 60million) over 800,000 reported fire incidents, Bangladesh (population 140million) has around 10,000. In the UK there are over 400,000 false alarms. But the firefighters do not get upset. The lesson is you cannot and should not consider fire, however small and however remotely possible, with any degree of complacency.

Incidentally there are over 4000 fire stations in the UK, whereas we are touching the 200 mark. The difference in awareness and approach is clear. There are 13 fire stations in Dhaka City, that is, one fire station and about twenty firefighters for about every eight lakh people. We need to develop volunteer fire brigades in our towns and cities.

The possible causes of low incidence of building fires in Bangladesh are (a) use of fire resistant building materials, (b) space manned always means quick detection, (c) less use of electro-mechanical equipment, particularly in buildings with combustible materials (d) open hearth cooking in rural areas, and (e) not all incidents are reported and/or recorded.

But there is reason to be concerned about fire in Bangladesh today. Fire hazard has multiplied in this country because of (a) Taller buildings, (b) Air-conditioned ENCLOSED space, (c) Increased use of electro-mechanical equipment, (d) Increased use of flammable finish materials, (e) Designers not addressing new hazard dimension.

Fire management falls into three main parts: (a) control combustion process, (b) suppress fire, and (c) control fire by construction. In controlling fire by construction, the designer (i) seeks to control the movement of fire, and (ii) provide structural stability.

TO BE CONTINUED

The author is Consultant to the Editor, The Daily Star, and National Commissioner, Bangladesh Scouts <dmizam@gmail.com>

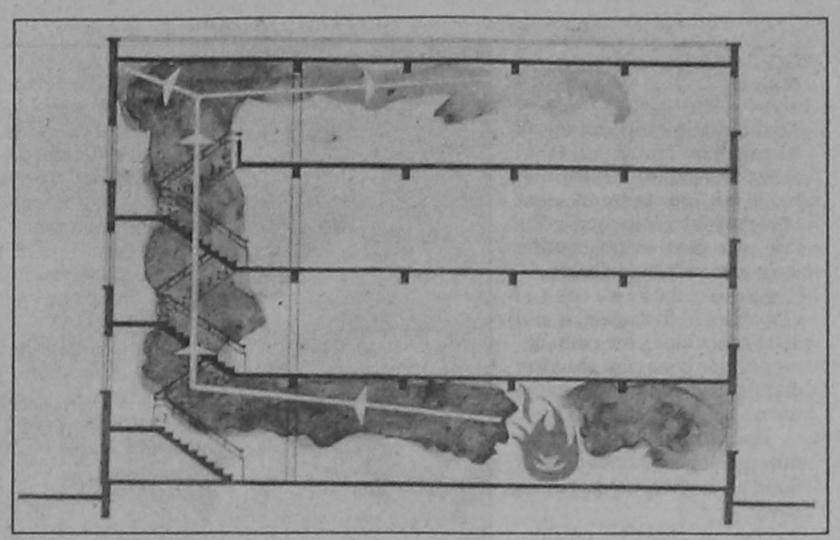

Figure 3: Vertical spread (Flue effect) of fire must be avoided.

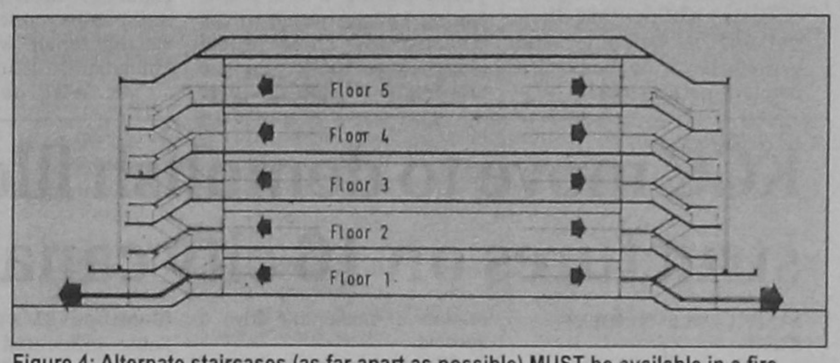

Figure 4: Alternate staircases (as far apart as possible) MUST be available in a fire.

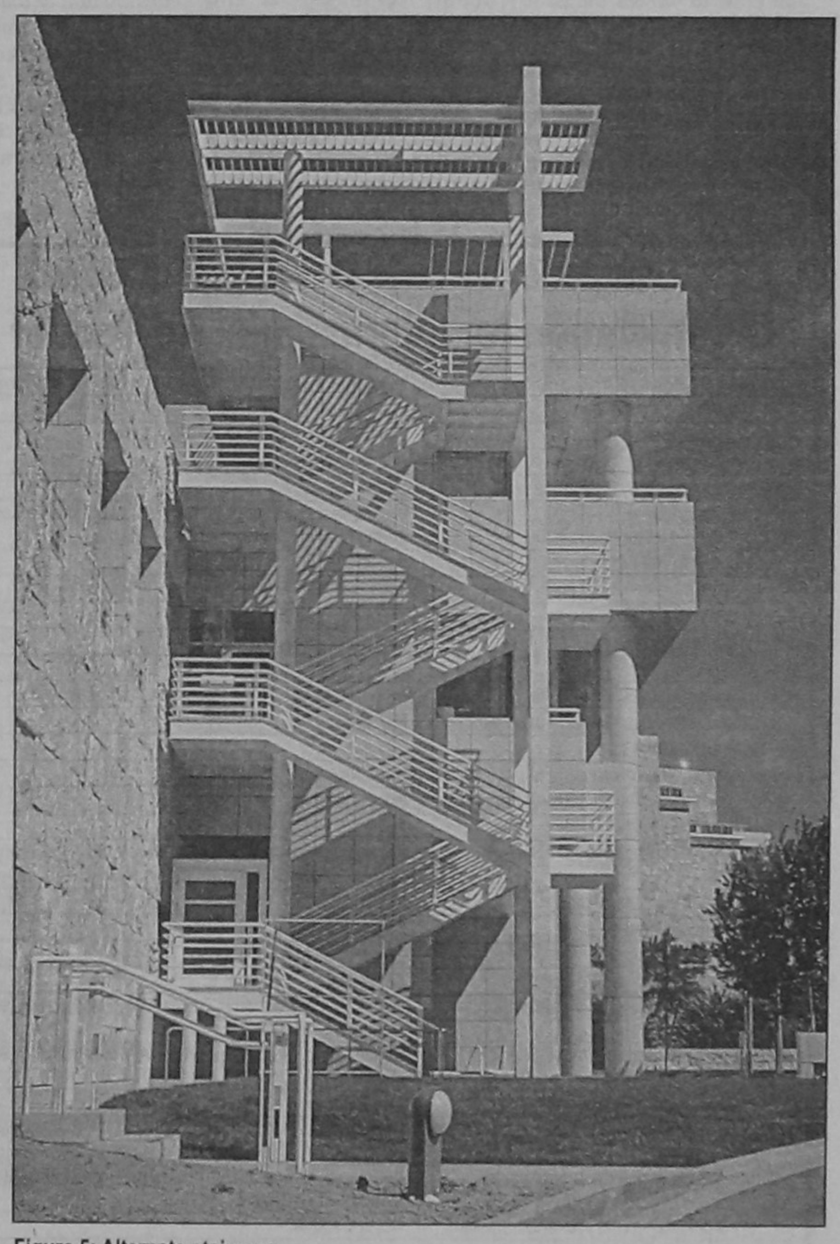

Figure 5: Alternate staircase.

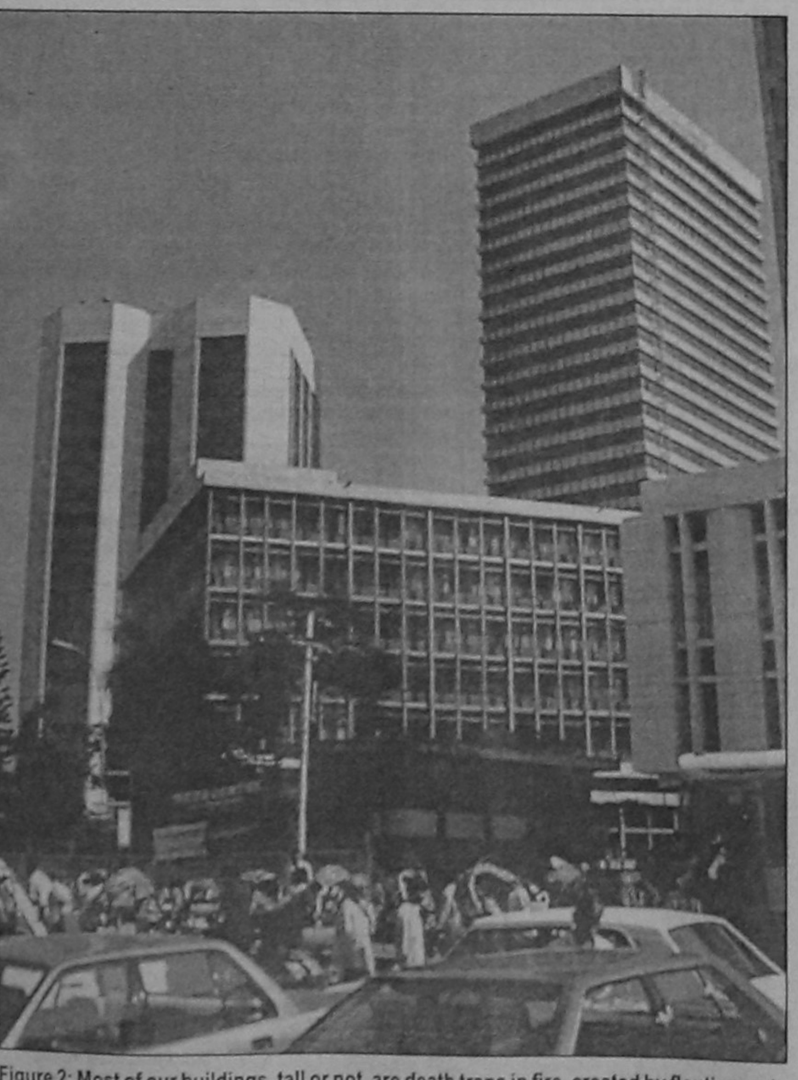

Figure 2: Most of our buildings, tall or not, are death traps in fire, created by flouting code and rules.

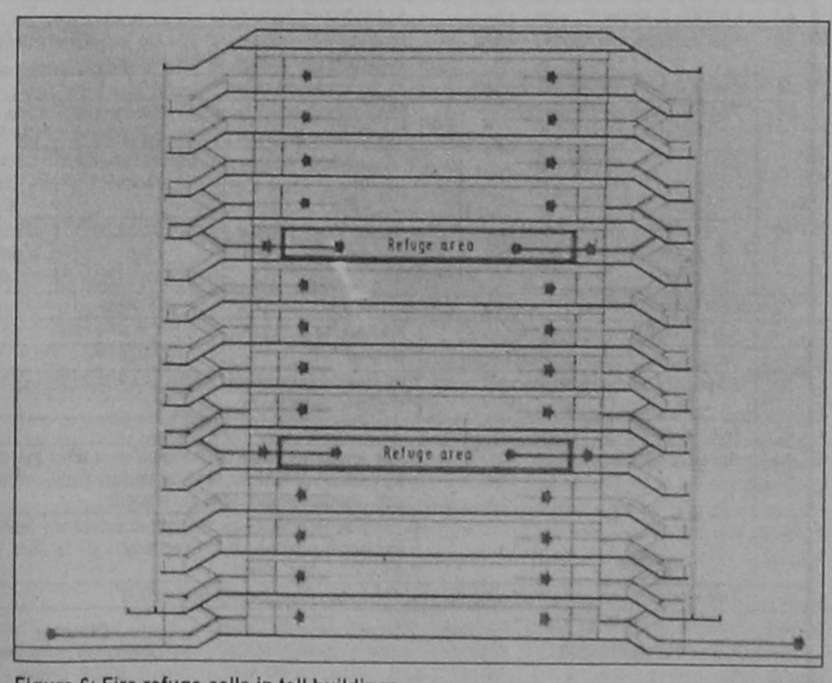

Figure 6: Fire refuge cells in tall buildings.