Report with Recommendations

for

Updated Bangladesh National Building Code-BNBC(Part-4)

Preface:

Bangladesh National Building Code (BNBC) was first drafted in 1993 but not formally reviewed and updated. Since then, major changes have taken place in every discipline of the Building technology. To make this code time worthy, Ministry of Housing and Public Works formed a steering committee with the responsibility ofUpdating BNBC 1993 by a G.O. having circular no. Section 8/IM-5/93(part) 812 (28) date:15.09.2008. The Housing and Building Research Institute (HBRI) has been entrusted with thetask of providing secretarial service to the steering committee and managing theimplementation of the project. In response to the Request for Proposal (RFP) from HBRI,Bureau of Research, Testing and Consultation (BRTC) of Bangladesh University ofEngineering and Technology (BUET) submitted Technical and Financial proposals forupdating the code. Consequently an agreement was signed between HBRI and BRTC on the15th of December, 2009 giving the task of updating the Code to BRTC, BUET. In this regard, An Inception Report to update the BNBC has already been approved by the concerned authority (http://www.buet.ac.bd/ce/pdf/Top%20pages_Inception%20Report.pdf).

Tokyo University of Science (TUS) under the Global COE program conducted A Lecture Course & Seminar in Bangladesh on 21-23 November, 2010 at Public Works Department (PWD) Auditorium in Dhaka, Bangladesh. In that program, there was a request to the TUS-GCOE Team for their academic recommendations on the updating of the proposed upgraded BNBC (Part-4), referring to firefighting/protection technology and building standards in Japan. Therefore, A Committee named **"GCOE Advisory Committee for Updating of Bangladesh National Building Code"** was formed, including members from Tokyo University of Science (TUS), The University of Tokyo, National Institute for Land and Infrastructure Management (NILIM), andBuilding Research Institute (BRI) of Japan.

Members of the Committee:

SL	Name	Organizations	Remarks
01	Dr. Shinichi Sugahara	Professor, Graduate School of Global Fire Science & Technology,TUS, GCOE Project Leader & Former President of Japan Association for Fire Science and Engineering	Chairperson
02	Dr. Makoto Tsujimoto	Professor, Graduate School of Global Fire Science & Technology, TUS,& Vice-President of Architectural Institute of Japan	Member

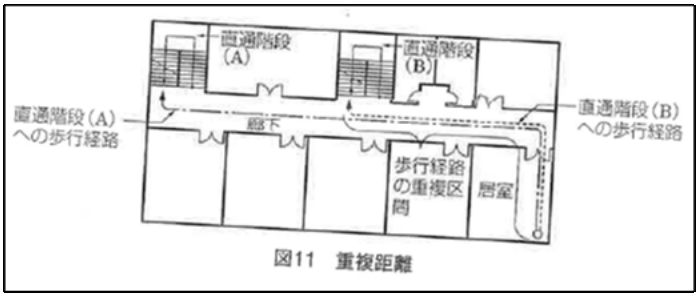
03	Dr. Ai Sekizawa	Professor, Graduate School of Global Fire Science & Technology, TUS, & President of Japan Association for Fire Science and Engineering	Member
04	Dr. KyoichiKobayashi	Professor, Center for Fire Science & Technology, TUS,	Member
05	Dr. Yukio Yamauchi	Associate Professor, Center for Fire Science & Technology, TUS,	Member
06	Dr. Tokiyoshi Yamada	Professor, Department of Urban Engineering, The University of Tokyo	Member
07	Dr. Ichiro Hagiwara	Guest Professor, Center for Fire Science & Technology, TUS & Senior Researcher, Building Research Institute (BRI)	Member
08	Dr. Hideki Yoshioka	Senior Researcher, National Institute for Land and Infrastructure Management (NILIM), Japan	Member

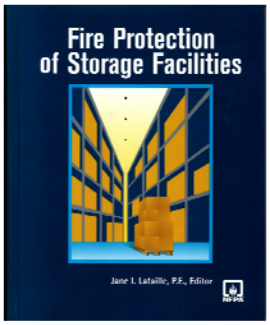
Scope:

To discuss on the proposed recommendations on the Bangladesh National Building Code for updating it, in reference totechnology and standards of firefighting and building fire protection in Japan. Final reports will also be made incorporating all the recommendations of the members of the GCOE Advisory Committee for Updating the Bangladesh National Building Code. Both countries will be enriched from the expected output for the enhancement of fire safety.

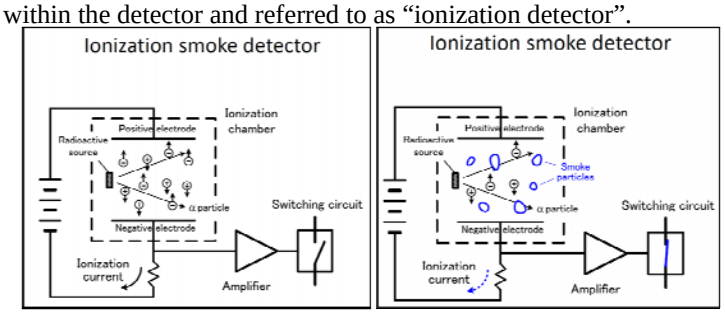
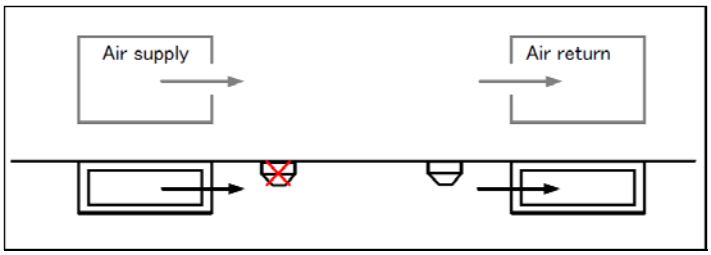
For better output from the committee, the proposed Bangladesh National Building Code (BNBC), Part-4, was distributed among the members assigning specific part to each. Based on the comments of the members, the brief recommendations are mentioned below:

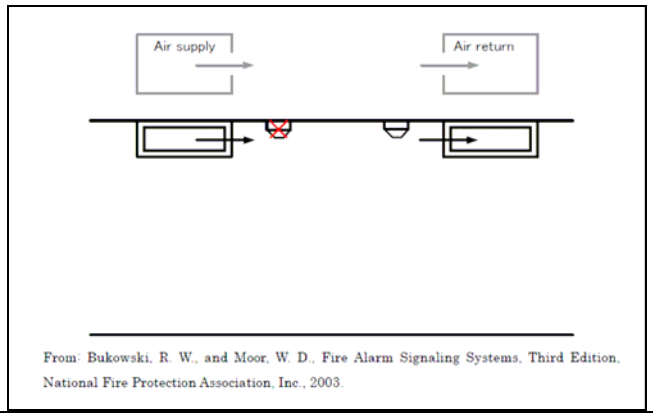
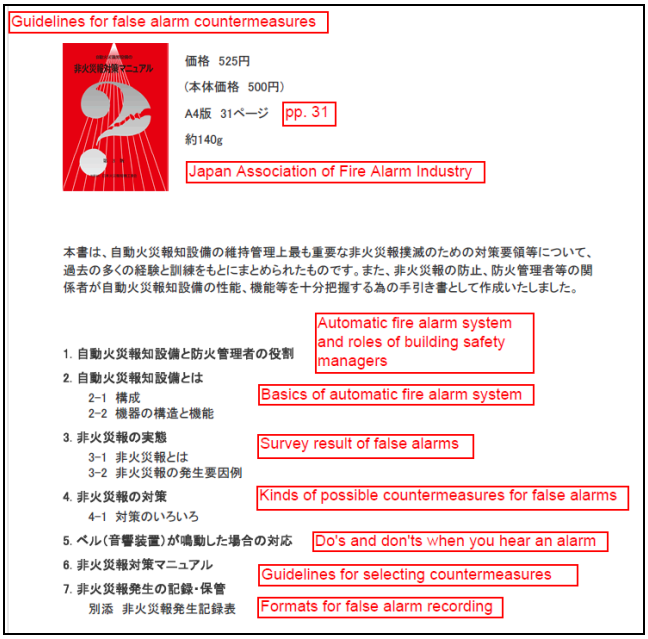
Existing Guidelines	Recommended Guidelines
Chapter 2: **Precautionary Requirements**	In this chapter, there should be detailed guidelines on Fire Compartmentationswhich should include the guideline of walls, openings and others.
2.11: Fire Lifts	In this section, some more guidelines might be included such as Smoke safe construction, water proof design, location to be adjoining to fire proof egress stair etc. For more details, you can collect the BS Standard (UK) and ASME Standard (USA). Japan has also detailed standard but it is in Japanese. Some Japanese guidelines regarding the Emergency Elevator can be found at the Handout on Important Points of Fire Safety Regulations on Highrise Buildings in Japan.
3.9.1: Each occupant of a room or space shall have access to at least one exit or access door.The occupant load per exit door	The arrangement of the exit door is not specified such as the guideline for the overlapping of the distance towards the exits (See the diagram used in Japan)

and the travel distance up to that door shall not exceed the values specified in table 4.3.3.	 図11 重複距離
3.13.4: The minimum fire resistance rating of the walls separating the smoke proof enclosure from thearea of incidence shall be 4 hours with no openings other than the required fire doors for exit.	04 hour fire resistance rating of the walls separating the smoke proof enclosure seems to be too strict. In Japan, fire resistance rating of the walls upto 31 meter high building is 01 hour but the fire resistance rating increases with the increase of the height of the building. Therefore, It can be 01 hour rating for the 20 meter high building and gradually might be increased with the increasing of the height of the building.

Existing Guidelines	Recommended Guidelines
4.2.4: Table 4.4.7: Ceiling Area for a Sprinkler 	Sprinkler heads placed on the ceiling above many racks in a store house, cannot extinguish the fire. Detailed standards are necessary for such type of storehouse. For example, Sprinkler heads should be set on every rack according to the risk of storage facilities, distance between rack and so on. In this regard, SFPE handbook: **Fire Protection of Storage Facilities (Chapter 6 & 7)** might be followed. It is based on the NFPA Standard.
4.2.7.3: The system shall be maintained for safe operating conditions and tested at least once a year.	Maintenance is very important for fire protection equipment or facilities. About maintenance, detailed regulation might be needed than 4.2.7.3. We Japanese established a qualification system for Testing & Maintenance which includes detailed testing regulations in which reporting on maintenance is necessary to the fire station. But maintenance of fire protection equipment or facilities is a big problem for fire safety in Japan. Moreover NFPA Standards such as NFPA 25: Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems, might be used as reference.
4.4.2: Emergency Control Room: At every high rise building, industrial building ware house, big residential area, KPI there an emergency fire control room should be set up. Where operators, emergency commanding officer, fire fighters, rescuers and first aider will remain for 24 hours with their necessary equipment to take immediate necessary preventive action.	It's so difficult for operators in emergency fire control center of large or high rise buildings to operate at a fire where special knowledge and skills are necessary. In Japan, operators should undergo some special courses, lectures, examinations and get a license. These courses are arranged by the local authorities and operated by the professionals of concerned field. The name of the courses are as follows: ➢ Basic Guideline for Building Fire Safety Engineers ➢ Building Fire Protection and Safe Egress Facilities ➢ Safety of Electric Facilities and other facilities which use fuels ➢ Building Egress Simulation 

Existing Guidelines	Recommended Guidelines
4.6: Carbon Dioxide Extinguishing System: Here Carbon Dioxide Extinguishing medium has been excluded from this standard due to its toxicity on human life and adverse effect on environment and ozone layer and therefore NN-100 is proposed to be replaced instead of Carbon Dioxide Extinguishing medium.	In Japan, Carbon Dioxide Extinguishing System is not prohibited. Because Carbon Dioxide used in the extinguishing system is second product of petrochemical plant, not newly produced and has higher cost performance than Nitrogen Fire Suppression System.
5.2.1: Components of Means of Escape for Occupancy A1: Detached Single Family Dwelling (One Storied): Fire detection and fixed fire fighting arrangements shall be required.	It would be too strict for detached single family dwelling (one storied) to be required fire detection and fixed fire fighting arrangements. Because they will face two problems, cost and maintenance. In Japan, Fire Service Law requires all family dwellings to set smoke detectors. But FDMA doesn't recommend requiring them sprinkler systems or hose reel systems. FDMA only recommends them to set portable fire extinguishers. Moreover, Fire Detection and Fixed Fire Fighting Arrangements should be clearly specified.
5.4.3: Occupancy C3: Custodial Institution for the physically incapable: Manually operated electric fire alarm system shall be required. Portable fire fighting appliances shall be kept as per instruction of the concerned authority.	In Japan, Residential type custodial institution for the physically incapable with over 275 ㎡ floor space shall be fitted with automatic sprinkler system.
5.5.1: Occupancy D1: Normal Medical Facilities: Manually operated electric fire alarm system and /or automatic fire alarm systems shall be installed so that the duty personnel received the fire warning well in advance. Requirements of manual or automatic fire alarm system or both shall be decided and approved by the appropriate authority. Portable fire fighting shall be kept as per code.	In Japan, hospital with over 3000 ㎡ floor space shall be fitted with automatic sprinkler system.

Existing Guidelines	Recommended Guidelines
5.6.1: Occupancy E1: Assembly with fixed seats: All auditoriums, corridor, green rooms and canteen attached to assembly buildings shall be fitted with automatic fire alarm systems and the performing stage shall preferably be covered by an automatic sprinkler system. Portable fire fighting appliances shall be kept as per code.	Assembly is one of the most dangerous facilities for fire. But 5.6.1 says only performing stage shall 'preferably' be covered by an automatic sprinkler system. 'Preferably' is too vague. Regulation should be concrete with some criteria such as floor space, height, story and so on. Much more buildings with assemblies should be fitted with automatic sprinkler system. In Japan, following buildings shall be fitted with automatic sprinkler system. a. Total floor space of a building with assemblies is more than 6000 ㎡. b. Floor space of performing stage is more than 500 ㎡ (300 ㎡, in case the stage on underground floor, windowless floor or upper floor than 3rd floor).
5.7.3: Occupancy F3: Large Shops and Markets: Shopping Arcade and Shopping Complex are not required to install sprinkler system except for Underground shopping complex	Large Shops and Markets are one of the most dangerous facilities for fire. Large shops or markets over a given scale should be fitted with automatic sprinkler system. In Japan, shops or markets with over 3000 ㎡ floor space shall be fitted with automatic sprinkler system.
Appendix A: English Text of Instruction: If you would like to leave the building: There are 08 points in this segment.	01 new point might be included as follows: i) Close the door, if you leave the room.
C.2.2: Smoke Detectors: The Second type is actuated by the production on ionization current within the detector and referred to as "ionization detector".	The Second type is actuated by the reduction on ionization current within the detector and referred to as "ionization detector". 
C.8.3: Siting of Smoke Sensitive Detectors: b) Any area of a building provided with mechanical ventilation system results in more than 10 air changes per hours, which caused dilution of smoke and definite air flow pattern is established. In such cases, ventilation inlet and exhaust openings shall be covered by additional detectors.	In such cases, ventilation exhaust openings shall be covered by additional detectors. 

Existing Guidelines	Recommended Guidelines
C.8.3: Siting of Smoke Sensitive Detectors: d) Detectors shall be installed within 1.5 m of duct to monitor inlet duct.	This line may be omitted as it is not reasonable.
C.8.3: Siting of Smoke Sensitive Detectors: e) Detectors shall be installed in the center of inlet of return air duct. Where place above the false ceiling is used as return air duct, the opening to return air shall have a detector every 2 m or part thereof of its length within 250 mm of the opening.	This line may be omitted as it is not reasonable. Installation of detectors near the inlet openings may not be appropriate, as illustrated in the following figure.  From: Bukowski, R. W., and Moor, W. D., Fire Alarm Signaling Systems, Third Edition, National Fire Protection Association, Inc., 2003.
General Information on Fire Detection System	False Alarm in high-rise building is a major concerned factor. It has many adverse effects such as: The ignorance of the people as it may be false alarm, Inconvenience for the people etc. Therefore, detailed guideline should be included here for the Countermeasures for the False Alarm to be taken by the owner and the maintenance company. Japan Association of fire Alarm Industry has made a **Guideline for False Alarm Countermeasures** as shown below: 

Existing Guidelines	Recommended Guidelines
D.4.7: Fire Lifts Irrespective of height lift speed shall be such as to reach the top floor from ground level in 1 minute.	In Japan, In case of high-rise buildings (31m high), the speed of the Emergency Elevator should be more than 60m/min. In reality, the speed of the elevator is more than 60m/min.
D.5.1: Service Ducts The passage of gaps of pipes, cables etc. shall be suitably sealed.	Here, "suitable sealed" terms is not clear. It would be more understandable if specific method is described, such as that gap shall be stuffed by non-combustible materials e.g. mortar.
D.7: Refuge Area: Except multi-family dwelling, all other buildings shall incorporate provision of refuge area on the external walls as cantilever projection or any other suitable manner.	Multi-family dwelling should also install refuge area, such as balcony and roof, where doors could be easily unlocked in case of emergency. The number/area of refuge space(s) and the distribution of them, shall be correlated with the scale and capacity of a certain building.
D.8: Basements D.8.3: d) Floor area exceeding 750 m² shall be compartmented by fire separation walls having 2 hours fire rating. Floor areas provided with sprinklers may be increased by 50 percent.	In Japan, floor area surrounded by fire-resistive walls, can be doubled when automatic sprinklers are installed.
D.9: Building Services D.9.1: c) Openings exerted by the passage of ducts across fire walls or floors shall be properly sealed with fire resisting materials like vermiculite concrete or asbestos fiber materials.	Asbestos are banned in Japan, due to related lung disease.
D.9: Building Services D.9.1: f) Individual floor areas more than 750 m² shall be partitioned for isolation by fire walls and automatic fire dampers.	According to Building Code of Japan for reference, area of each fire compartment where is constituted by fire-resistive walls and floor, shall be 1,500 m2 or less. As per Japan Standard, size of the floor area depends on the following conditions: Over 11th floor: If the interior finish is combustible, the floor area for fire compartment shall be 100 m² Over 11th floor: If the interior finish is Quasi fire resistive, the floor area for fire compartment shall be 200 m² Over 11th floor: If the interior finish is non-combustible, the floor area for fire compartment shall be 100 m² It is to be noted that if sprinklers is installed, the floor area for fire compartment can be double.

Existing Guidelines	Recommended Guidelines
D.9: Building Services D.9.1: j) Treated fresh air conveyance through the vertical shaft shall be of masonry construction.	Intention here is not clearly understood. Masonry may not be the only solution.
D.10: Gas Supply D.10.2: Entire cooking range area in the kitchen shall be covered by an exhaust system of 50 mm²/per m² of hood projected area.	It is better to consider not only hood projected area but also ventilation volume.
D13: Electric Services D.13.1: The electric distribution cables and wiring shall run through separate ducts. The duct shall be sealed with non combustible materials at every floor level having the same fire resistance rating of the duct.	This is good, but content of the second sentence is too strict if sealing material shall have a certain rate of fire resistance. Instead, sealing material shall be just non-combustible. This is because fire resistance is usually concept for each member of building, such as floor and wall, not for material.
D.16: First Aid Fire Fighting Appliances: Fire aid fire fighting appliances shall be provided on all floors, basements, lift room etc. as required by the authority. Location and distributions of fire fighting appliances shall also be as required by the authority.	This is good regulation, and followings are recommended to make this more specific: • Definition of "First aid fire fighting appliances" shall be described, preferably with some real examples, such as hand extinguishers, stand pipes, hose reels, etc. • Who will use "First aid fire fighting appliances"? ➢ Is it professional fire service, or private guard at building, or even ordinary people? • The position where appliances shall be installed, are to be described more in details, because this is really important referring to Bashundhara fire, where hose reels are burned before fire service use, due to the wrong location. ➢ The position where is compartmented by fire-resistive walls, is safe for appliances to be installed, such as, compartmented lobby in front of lifts, staircase with fire-doors closed, etc. • The authority shall be described more specifically, such as fire service and/or building department, etc.

Existing Guidelines	Recommended Guidelines
D.19: Caretaker/Fire Officer All residential, business, hotels and other buildings having height more than 53m, shall keep standby one trained fire officer round the clock under the supervision of a Fire Consultant.	Overall concept of D.19 is very good and reasonable, which is that there has to be someone responsible for fire protection in a tall building. And for further improvement, followings are recommended. ・ "Fire officer" in D.19 should be changed to be something like "fire protection manager," because it is assumed that "fire officer" represents the professional from FSCD. ・ The term "Fire consultant" is not clear. Therefore the qualification of "Fire Consultant" should be clearly specified. ・ The background of 53m is not clear. Revision is recommended.
D.24: Helipad For high-rise building above 60 mm Height, Provision for Helipad should be made.	There is a printing mistake, it should be 60 m not 60 mm In Japan for reference, it is not compulsory but recommended for a building over 31m to have a helipad.
D.27: Fire Safety Clearance: After completion of the construction and before use of the building, the owner should have a clearance certificate from the Fire Service & Civil Defence Directorate with the certification that in building, fire protection and safety measures have been duly installed.	It refers only to the time of "after completion of the construction and before use of the building" and only by FSCD. It is recommended that this code should also include the notification of "after making of plan and before construction of the building", and also by building department. In Japan for reference, client shall follow the steps below: ・ Firstly, plan drawing made by architect, shall be checked by fire service. ・ Secondly, plan drawing made by architect, shall be checked by building department. ・ Thirdly, building is physically constructed. ・ After fire protection equipment is installed before completion of building construction, fire service will check if they are properly installed. ・ After completion of construction before use of building, delegates from building department will check if the building is properly constructed.

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Some Important Aspects of Fire Safety Regulations about High Rise Buildings

Many high rise buildings are being built with unprecedented speed in Japan and Asian mega cities. Many high rise building fires are occurring in Asian countries accompanyingthis rapid trend.

Firstly we explain our experience about fire risk of high rise buildings.

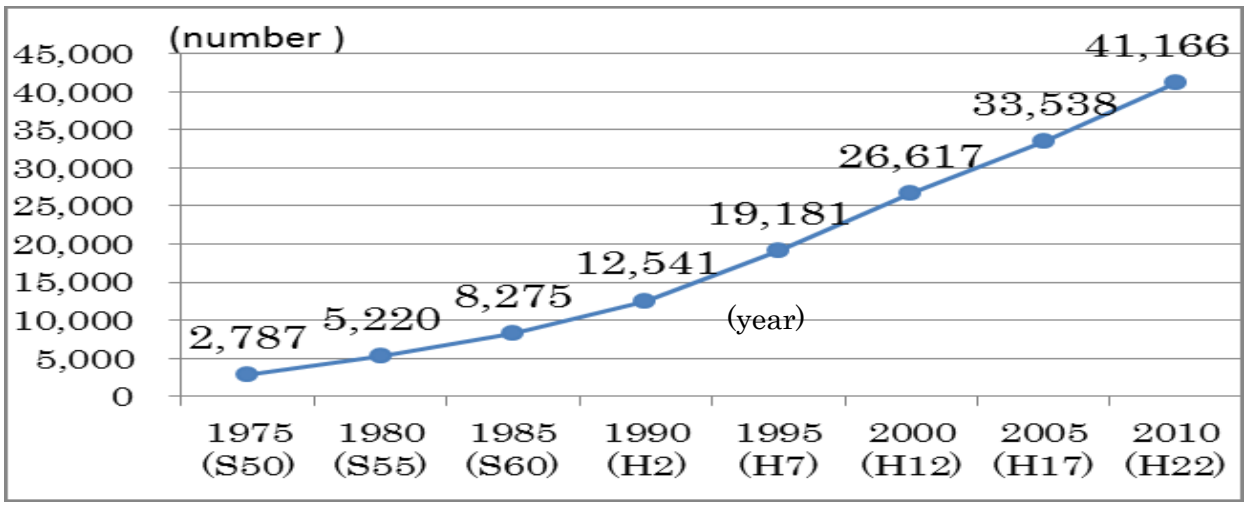


Fig.1 Increasing number of High Rise Buildings in Japan
High Rise Buildings: buildings with over 31m height

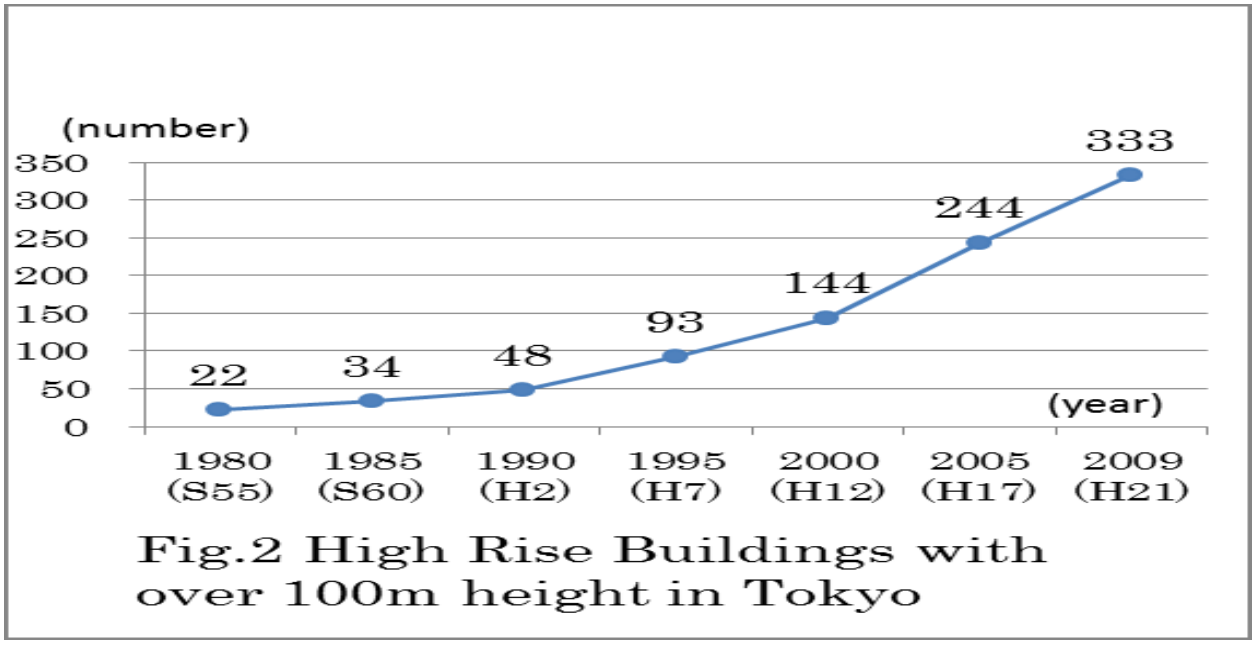


Fig.2 High Rise Buildings with over 100m height in Tokyo

○ **What is the risk of high rise buildings ?**

・Definition of"high rise building"is a building higher than 31 meters in Japan.

→ High rise buildings have higher floors that fire ladder can't reach.

・If fire ladders reach the burning floor, fire-fighters can extinguish and rescue from a comparatively safe place that is outside of the burning building.

・If ladder can't reach, fire-fighters can't avoidentering the dangerous burning building to fight.

○ **Risk of fire-fighters in burning building**

・Inside of a burning building, even it is a lower one, is a very dangerous place with no guarantee for fire-fighters to return alive.

① Possible to lose of retreat by fire or smoke
② Possibility that the whole building may collapse after several hours of burning

・If the height of burning building floor is high, the following problems may arise.

① The route that fire-fighters reach the fire site is longer.
② The route of logistics such as fire-fighting machinery and materials is longer.
③ The route that fire-fighters evacuate in case of danger is longer.
④ Peoples left behind for rescue in the burning building may be much more.

→Fire-fighting may become more difficult.
→Risk of fire-fighters would increase much more.

⑤ In case that the fire floor is above the limit, fire pump can't supply water.

○ **Important points of consideration for high rise building fires**

・It's necessary for high rise buildings to consider the followingfour points to prepare those risks.

1. Protection against fire and smoke
2. Evacuation
3. Fire-fighting
4. Protection against collapse

1. Protection against fire and smoke

① You should decrease the risk of occurring fire as much as possible

→ Japan Building Code (JBC):

・Restriction against flammable materials for ceilings and walls

【BNBC: 2.8 Surface finishers】

→ JapanFire Code (JFC):

・Fire prevention manager

【BNBC: D49 Caretaker/Fire Officer】might be same as Japanese system.

・What will be his legal responsibility, if some people are killed by a fire?

・Flame retardant regulation against curtain, carpet etc.

② If a fire did occur, you should control it as early as possible.

→JFC: Automatic Sprinkler systems (all high rise buildings must place sprinkler systems)

【BNBC: 4.2.4 Design Consideration for Sprinkler System】

・This part prescribes only how to design.

・We can't find the regulation 'all high rise buildings must place sprinkler systems' in BNBC (especially Appendix C).

・Importance of sprinkler systems is much more in high rise buildings because fire-fighters can't extinguish well there.

・We recommend to install sprinkler systems in all high rise buildings.

・Automatic fire alarm systems + fire extinguisher and/or fire hose + fire prevention manager

【BNBC: 4.3 Fire protective signaling or fire alarm system, 4.4 Automatic fire and smoke detection system, 4.10 Portable fire extinguisher, 4.2 Fire protection plumbing, D49 Caretaker/Fire Officer】

・All these provisions are almost on how to design.

・We think more specific rules (such as occupancies, floor space, stories, capacity of customers, and so on) are necessary about which facilities are installed in which buildings.

③ If a fire develops, you should stop or delay the time to flash-over as much as possible

→JBC : Restriction against flammable materials for ceilings and walls

・ Smoke exhausting systems

【BNBC: 2.6 Smoke and heat vents】

【BNBC: Appendix B Fire protection considerations for venting in industrial and storage buildings】

・This part is only for industrial and storage buildings. Guidelines for other occupancies should also be provided.

④ If you could protect occurring flash-over or not, you should enclose the fire and smoke in a room as small as possible.

→JBC： ・Special strict compartmention for high rise buildings (maximum 1000 m2)
【BNBC: 2.5 Openings in separating wall, D9.1】
・Smoke exhausting systems
・Restriction against flammable materials for ceilings and walls

⑤ If you could not restrict a fire in the fire room, then you should enclose the fire and smoke within only the fire floor.

→JBC・Shaft enclosure :Completely separated vertical facilities (every atrium, staircase, elevator, escalator, electric wire plumbing, water supply plumbing, air conditioning plumbing and so on) from other rooms and corridors
・Eaves or windless wall to protect expansion of fire
・Covering in gaps between plumbing and walls or floors【BNBC: D5.1】
These 3 regulations are most important concept for high rise buildings in Japan.
We find few regulations in BNBC. 3.1.3 (Smoke proof Enclosures) is restricted in evacuation facilities.
・Smoke exhausting systems

⑥ If you could not enclose the fire and smoke within one floor, then you should be prepared to restrict fire and smoke not to spread to the next floor one after another.

→JBC, JFC, BNBC: No regulations (This is author's personal idea which needs to be considered, especially in super high rise buildings like more than 200m high or so)

2. Evacuation

① You should arrange well-balanced enough evacuation staircases that could allow all existing peoplein the building escape smoothly before the condition become dangerous.

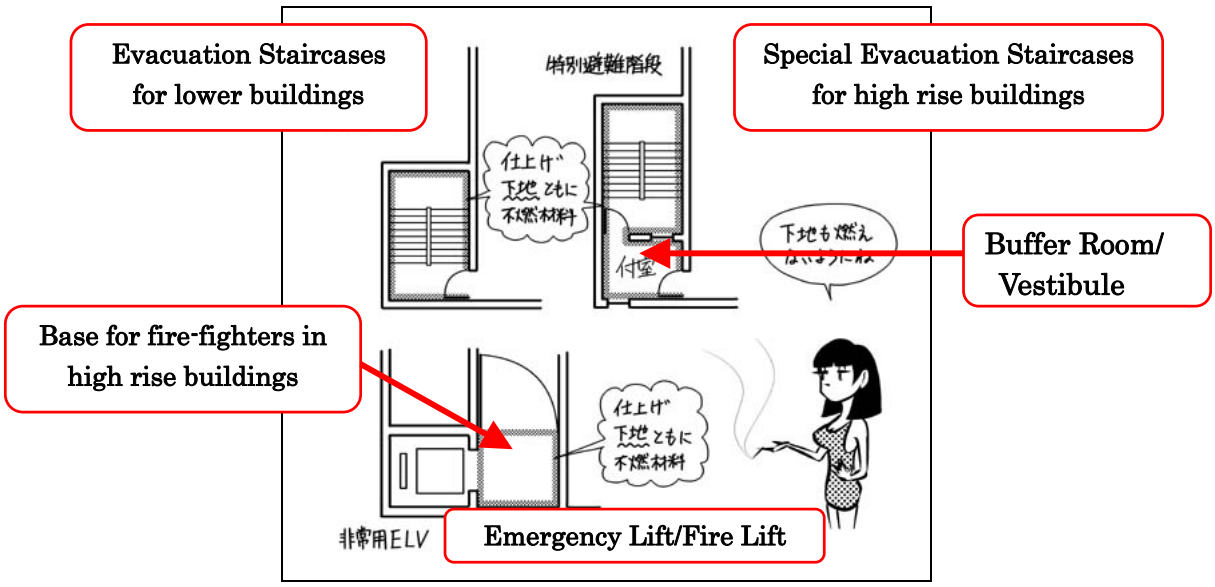
→JBC： ・Regulation about buildings that more than 2 staircases direct to the ground should be placed
・No regulation about quantity and capacity of evacuation staircases without large markets like department stores
[BNBC: 3.10 Stairways】

② Evacuation staircases should be safe against fire and smoke at least while all

evacueesescape to outside safely.

→JBC：Every evacuation staircase of high rise building must place a buffer room against fire and smoke.

【BNBC: 3.10 Stairways】



3. Fire-fighting

① Special elevators onlydedicated to fire-fighters should be placed.

→JBC：Emergency elevator for fire-fighters

a. 1 elevator per floor area 3000 ㎡
b. The elevator must be called back to ground floor by fire-fighters at the command center in the building.
c. The elevator must have a telephone connecting with command center.
d. The elevator must be able to be driven by fire-fighters keeping the door opened.
e. The elevator must have an emergency battery.
f. The elevator must be able to drive more than 60 m/min.

【BNBC: D.4 Fire lifts】

② Bases for fire-fighters should be placed in each floor.

→JBC：Every emergency elevator lobby of each floor must be the bases for fire-fighters.

③ The bases should have the following performances:

A. →JBC：It must be safe against fire and smoke (for example, balcony, a room with

open windows or smoke exhausting systems)

B. →JBC：It must be connected with special elevators for fire-fighters and safe staircases.
C. →JBC：It musthave the provision of enough light in case of power failure.
D. →JFC：Fire-fighters must easily contact with headquarters from the base.
E. →JBC, JFC：Fire-fighters must easily supply water, electricity, air cylinder and other equipments for fire-fighting in the base.
F. →JBC：Floor area of the base must be more than 10 m² per 1 elevator.

④ Water supply should be secured for the fire-fighting continuesfor a long time.

→JFC:Individual water sources (→ BNBC4.2.2.4)

⑤ Water supply should be secured even at the highest floor, such as by a booster pump.

→JFC：Booster pump for fire-fighters hydrants must be placed in buildings more than 70m high.

4. Protection against collapse

・ Fire protection performance of main structures should be secured so that it may not collapse for a desired period.

→ JBC: Fire resistance rate 1～3 hours
【BNBC: 1.5 Fire tests and fire resistance rating】

○ The most important point in high rise building fire is that fire and smoke within thefire floor. Because if the fire or smoke spreads above the fire floor:
① Fire-fighters can't fight on floors above the fire floor.
② Fire-fighters have to extinguishthe fire floor by floor. If the fire or smoke spreads several floors,fire may continue so long a time that the fire building might collapse.

○ It should benecessary to pay attention to following routes that fire and smoke may develop through:

① Gaps between floor slabs and curtain wall panels.
② Vertical distance between floor windows.
③ Flammable exterior or insulator materials attached to exterior wall

① Gaps between floor slabs and curtain wall panels:

・Method ofcurtain wall construction often makes gaps at the connection parts.
→ a major cause of fire spread of Bashundhara-cityfire

→ Regulations to be made for covering in gaps at connection parts between floor and curtain wall.

② Vertical distance between floor windows:

・In case of a big fire, it's difficult to protect fire sprea through windows to upper floorby windowless wall about 1m.

・Balconies or eaves are necessary but such regulation is difficult because of necessity of building design.

→Regulation combined with sprinkler systems and reduction of fire load is a compromised solution in many countries.

③ Flammable exterior or insulator materials attached to exterior walls:

→This may be amajor cause that several East Asian high rise building fires spread recently:

・Central Broad Casting Building fire in Beijing in February 2009
・High rise apartment fire in Chóngqìng in August 2010
・High rise apartment fire in Pusan in October 2010
・High rise apartment fire in Shanghai in November 2010

→Sprinkler systems placed in this apartment worked normally but 53 deaths and over 50 missing were caused.

◎ Materials of exterior and insulator of exterior wall should be nonflammable.

Note:

- JBC : Japan Building Code
- JFC : Japan Fire Code
- BNBC : Bangladesh National Building Code

Annexure-A

General Comments

APPENDIX B: Fire Protection Considerations for Venting in Industrial and Storage Buildings (p4-69～p4-80)

B.1 SCOPE

B.1.1

Reference:In Japan, the Building Code governs"fire smoke venting" in industrial and storage buildings. The Fire Code also prescribes "fire smoke venting" mainly for rooms without openings, however industrial and storage occupancies are out of control. As explosion relief vents concerned, "the technical recommendation for explosion venting of revised edition", NIIS-TR-NO.38 (2005), published by the National Instituteof Occupational Safety and Health,is mainly refered as technical guideline.And this guide line was made referring to NFPA68 (2002). Whereas the building codes and Fire Code do not consider explosion venting.However, present fire vent system prescribed in those codes can cope with ordinary building fire and explosion in such occupancies.

B.2.1.5

Reference:150℃ seems to be adequate. However in Japan there is no specific limit temperature of smoke vent. Only melting temperature of fusible link for smoke exhaust is set to be 280 deg.C. For reference, melting temperature of normal vents is 72 deg.C and 120 deg. C for kitchen use in Japan.

B.2.1.8

Reference:The Building Code in Japan prescribes smoke area as 500 m^2 in ordinary buildings. Factories and Storages occupancies built with non combustible are exempt from fire vent. B.2.18 seems to be close to Japanese standard.

B.2.1.10

Reference:Ordinary smoke vent in Japan needs 1/50 vent area of each smoke floor area, which is divided into 500 m^2. It is preferable to specify minimum opening size of the ventilators.

B.2.1.12

Reference:It is not necessary to eliminate horizontal (roof type) vents when inlets are secured.

B.2.1.17

Reference:When vents are installed, the size, design, number and disposition and associated roof screen or curtain boards shall be carefully assessed. Each of specific design values are presented as followings. Those design values seem to be adequate empirically. However the design fire of each degree of hazardous occupancies is not disclosed. From a scientific view point, it is hard to guarantee its appropriateness.

B2.2.4

Reference:Japanese Building Code adopts 1/50 only. When the classification from Low to Hazardous is determined by fire severity(heat release rate), the above classification is correct. The design value given by "1:30 to 1:50" seems to be ambiguous. I wonder which authority has the discretion to determine under what conditions?

B2.3.7

Reference:Japanese Building Code allows a part of "exterior wall windows" (definition might be different from yours?) which locates within 80cm below the ceiling as natural fire vents.

B.2.5.4

Reference:Japanese Building Code specify the layout of vents by distance from smoke area planning. Each of the vents should be within 30 m from smoke area boundary in any occupancy buildings. Specific distance between vents is not prescribed.The design value given by "22.5 to 30m" seems to be ambiguous. I wonder which authority has the discretion to determine under what conditions?

B.2.6.4

Reference: As for one smoke area, 4500m^2 seems to be too large as for fire area. Whereas if the object of compartmentalization by screens is aimed for safe evacuation, 750 m^2 presented in B.2.6.5 in case of hazard occupation is not safe enough. Information associated with the objective should be disclosed.

Annexure-B

General Comments

Appendix D: Special Requirements of Buildings more than 20 Meter High (p4-87～p4-99)

Overall:

Appendix D is a very good regulation for high-rise buildings. And, as a whole, following comments are sincerely recommended.

- It is recommended to specify the situation when a certain building needs to be of 'fire-resistive construction', from the viewpoints of occupancy and scale of building.
  - In Japan for reference, when a certain building is 'fire-resistive construction', it shall maintain its own construction, in case of fire in the said building or fire from an adjacent building. After fire, it shall revive with minor renovation, instead of rebuilding from scratch. This is basic premise before entering the detailed regulations.
  - 'Fire-resistive construction' consists of three elements: Stability, Integrity, and Insulation.
  - For example, a special building with many visitors, shall be made of 'fire-resistive construction'.
- Fire-resistance ratings for walls described in hours, such as two hours or three hours etc., are incoherent from section to section. It is recommended to have identical fire-resistance rating, such as one hour, because it is enough for constituting a fire compartment within a building.
- Criteria in height of building are also incoherent from section to section. It is also recommended to have identical height criteria, such as 20 meters, except for unusual cases.
  - In Japan for reference, a building over 31 meters is considered to be high-rise, and emergency lift shall be installed.
- When any building condition shall be inspected by "authority", it is recommended to specify which authority shall check the condition, such as FSCD or PWD, etc. In short, information on fire authority and/or building authority, shall be specified.