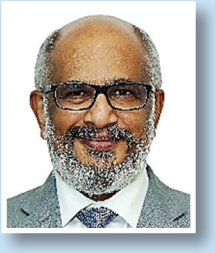
06

Elevatoring in a Taller India



TAK Mathews
Director
TAK Consulting Private Limited

Introduction

From one building of 45 floors at the turn of the last century to 45 floors no longer sounding tall, the Indian landscape has changed dramatically through the first two decades of this century. The Bureau of Indian Standards recognized the dramatic change and released the revised National Building Code of India (2016) [NBC 2016] in two volumes. The earlier NBC 2005 was just one volume.

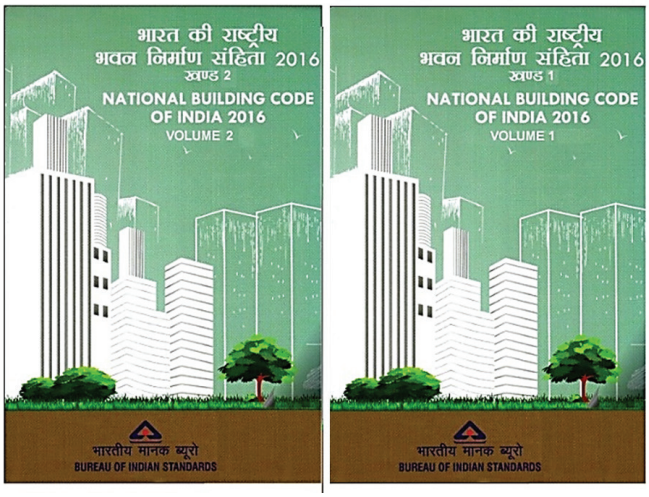


Figure-1: NBC 2016 (the majestic two volumes)

From the elevator and escalator perspective, the clear objective was to put together codes that facilitate going tall. The new codes for elevators and escalators were totally rewritten. The first differentiator from NBC 2005 was the separation of escalators and moving walks as a separate part (Part 8 Section 5B) from the elevators which is covered under Part 8 Section 5A.

NBC 2016 Part 8 Section 5A Codes for Lifts

The section on Lifts has been rewritten with a significant emphasis on taller buildings and the special require-

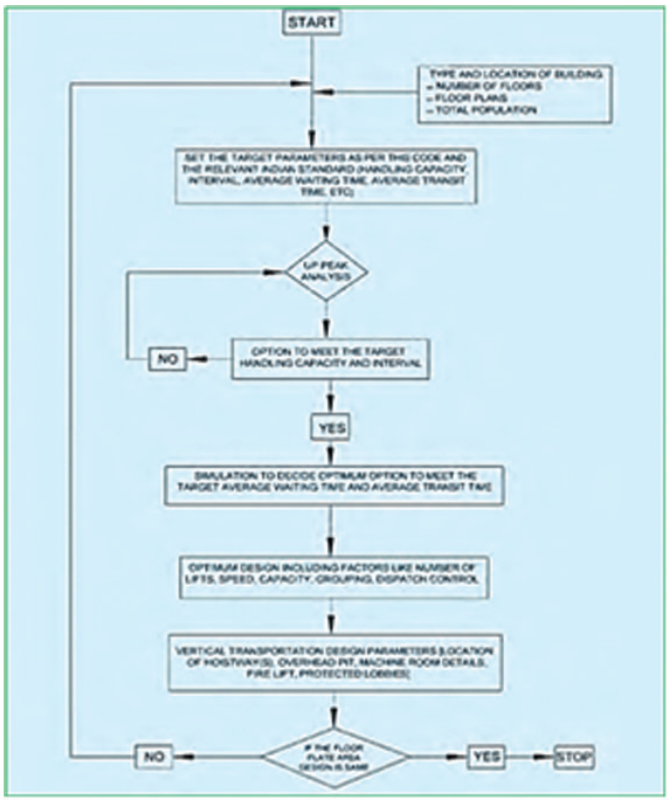


Figure 2: Typical Flowchart on Preliminary Design of Lifts (Ref NBC 2016, Part 8, Section 5A)

ments. The chapter on Planning and Design had more elaboration than NBC 2005 and provided a robust design process flow chart.

The recommended quantity of service and quality of service for residential buildings has been segregated to reflect the difference in requirements depending on the class of building. NBC 2005 had a flat 7.5% handling capacity for all class of buildings and an open-ended range for quality of service.

The planning dimensions were expanded to include for more capacities and for speeds up to 10m/s. They were also expanded to differentiate between machine room elevators and machine room less elevators, different door types as well as applications like hospital bed lifts and automobile lifts.

Chapter 7 was devoted to Fire Protection requirements with clear recognition that firefighters, in case of taller buildings, are dependent highly on elevators for firefighting and assisted evacuation. Accordingly, the minimum capacity of the fireman's lift buildings beyond 60m has been increased to 1000kgs (15 passengers) from the previous 544kgs (8 passengers). The new requirements also recognizes that for taller buildings, it might not be possible to have a single lift serving all the floors and has provided for zoning, which itself provides an additional level of safety for firemen.

Chapter 7.2 introduces a radical change to the *"Do not use Lifts in case to fire"*. The committee recognized that elevators could provide additional support for building evacuation to the time-tested evacuation via the staircase, particularly for the people with special needs and the elderly. Clear guidelines and standard operating process has been defined for evacuation lifts with two very clear riders – first, that *lifts may be planned only as a supplementary means to staircases* and second, that dependency on *lifts instead of staircases may increase the evacuation time*.

Chapter 9.5 of Part 8 Section 5A also considers impact of seismic forces and provides guidance how to provide the required protection for elevators and users.

Chapter 11.0 has been introduced in the lift section detailing the Special Technical Requirements for Super High-Rise Buildings. It brings to attention impact of piston effect on ride comfort and quality. It provides for the elimination of imperforate partition walls or provision of vents between hoistways to reduce the impact of piston effect. Impact of building sway is also covered.

The above effectively covers the best part of elevatoring in a taller India.

The rest of the paper looks at how India is approaching the two most critical prerequisites for tall buildings from a codal perspective – first, **Elevator Planning and Design** approach to establishing the required elevators and second, the issues related to **Fire and Elevators**

Note: Through the paper, the terms Elevators and Lifts are used interchangeably

Elevator - Planning and Design

Almost a decade back, the author's recommendation on elevators for a building were not considered. That was despite the whole project team's concurrence with the explanations and recommendations. The question was who would bell the cat and inform the owner and the architect that slabs had to be cut and elevator hoistways added. The project manager who saw the folly, in sheer frustration had predicted, "*only disasters and financial loss will make people learn"*. Sure enough, on commissioning the building had and continues to have major problems with inadequate elevatoring. However, it is doubtful whether the project manager's prediction has any chance of coming true.

So how is a taller India approaching the elevator planning and designing? The author's contention is that there are more under elevatored buildings coming up or being planned than before NBC 2016 was issued.

Matching the Building to proposed Elevators

Where a Design Basis Report (DBR) does exist for a building (which is not the case for many buildings), there is a high probability that the recommendations of NBC

2016 are being adequately achieved due to adoption of two techniques to achieve the results theoretically.

I. Averages, Creative Probability & Statistics

At a workshop on traffic analysis the trainer narrated a story – *A 6 feet tall man who did not know to swim drowned trying to cross a river that was on average 3 feet deep.* What the average and statistics did not reveal was that at the deepest point, the river was 20 feet deep.

In many ways that is how many approach elevatoring decisions. It is not uncommon for to consider that there is nothing wrong with a 45 second average waiting time for a commercial building without recognizing that averages do not tell the whole story or that lunch time peaks is a very different scenario. Incidentally, NBC 2016 recommends less than 25 seconds for a premium building and between 25 to 35 seconds for a regular commercial building.

Considering a single 5-minute period to establish averages without recognizing that the average of a single number is the number itself is a fallacy that needs to be set right.

II. Designing the Population to the Elevators

Calculating the Round-Trip Time (RTT) which forms the basis for the interval calculations and the *absolute* 5-minute handling capacity number does not have the building population as an input. Barring some tweaking of enhanced acceleration/ deceleration rates, faster door operation, and faster passenger ingress/ egress timings, the round-trip time would remain the same for most traffic analysts. Of course, sometimes the probable number of stops is not properly accounted for and that yields an erroneous improved RTT.

It is when the handling capacity is converted into percentage terms that the building population number first comes as the denominator into the traffic analysis equation. At this stage, often the elevator traffic population is not correctly considered and hence the result is again incorrect and the Handling Capacity percentage meets the set target or values prescribed by NBC 2016. Another common error is to consider elevator designs for office buildings based on absenteeism factors as high as 40% or even 50% - *effectively meaning the average elevator traffic is reduced to 50%.* Thus, when the building is finally occupied the morning peak would be very bad, while lunch time traffic would be a disaster.

Similar approaches are adopted for residential buildings on the plea that the building would never be fully occupied. That again is not the correct reasoning, as in time either the owners could have moved-in or investors could have leased out their apartments.

If the population to be considered for traffic analysis becomes a function of the available elevator capacity i.e., the *input becomes the output*, then that again is incorrect

With the above considerations the viability of the building is questionable!

High-Rise Committee, DCRs and Municipal Byelaw

Beyond the structure, what makes a high rise building viable are the elevators – the buildings life line, a fact which must be acknowledged.

However, there is no statutory compulsion to ensure the adequacy of elevators since no Development Control Rules (DCR) or Byelaw lays out the verifiable conditions for elevator adequacy. While Mumbai Metropolitan Region Development Authority (MMRDA) does ask for a validation, however it is more of a formality. The only reference to elevators is for Fireman's Lift and in recent times the Fire Evacuation Lift (which is a misnomer and discussed later); that too, driven by the Chief Fire Officer's (CFO's) office.

To the best of this author's understanding, the High-Rise Committee also does not have any requirement or check for the adequacy of the elevators.

Without a statutory compulsion or mandate for elevator adequacy, costs become the driving and deciding factor

for elevatoring. The provisions of NBC 2016 are taken as just a recommendation and are not correctly adhered to.

In one instance, while reviewing the elevatoring provisions for a tall commercial building, it was clear that the elevator provisions were without a DBR. The elevator provisions were established for other considerations. The Handling Capacity was less than 5% against the minimum of 10% called for by NBC 2016. With a metro at walking distance from the building, the morning average waiting times are expected to be close to 4 minutes.

2.0 Fire & Elevators

The author's involvement with fire and elevators started in 2009 after the tragic death of 6 firemen in an elevator at the Tarangan Housing Society. It was ironical that the incident happened on the eve of Diwali. As everybody was celebrating with firecrackers and diyas, 6 families lost their breadwinners and loved ones. Six brave men, who were colleagues and friends to many were lost.

Figure-3: Tarangan CHS Elevator (post incident)

On investigation of the incident, it was concluded that the elevators were installed prior to NBC 2005 and therefore were not expected to meet those norms. Some of the potential issues were that the elevators had multiple fireman's switches, the door opening wasn't as per phase 2 defined in NBC 2005 and NBC 2016 and the hall call buttons were not being deactivated. The investigations and studies were expanded to address the question, *"How could this tragedy been prevented?"*

The observations and conclusions gathered since 2009 are discussed below.

Collaboration between constituent stakeholders

The first issue identified was the very little collaboration and understanding between the various constituent stakeholders – the fire-fighting fraternity, fire experts, consultants, architects, developers, and the elevator industry.

Within months a workshop, a first of its kind, was organized with representatives from the fire fraternity from around the country and the others.

Since then, the author has been advocating the cause of proper planning and designing of elevators and has addressed audiences on numerous platforms around the country. Others from the elevator industry too have taken up this issue.

Awareness

A glaring and most dangerous issue is and continues to be, that many from the fire fraternity and most laymen carry the notion that "Fire Lifts" mean that these lifts are fireproof. It is essential that all concerned, recognize that the term *Firelift is* a short form for Fireman's Lift or Firefighter's Lift. The official statutory documents, including the Unified Development Control and Promotion Regulations of Maharashtra (UDCPR – 2020), use this short form. Therein chapter 9.28.8 is titled 'Fire Lift'. That needs to be corrected to convey the correct intent. Hence, it is recommended that, to avoid confusion or misunderstanding, the short form 'Fire Lift' whether verbal or written be removed from the vocabulary especially of codal and statutory documents.

Standard Operating Process (SOP)

Due to limited understanding and collaboration, the standard operating processes were varied and somewhat vague.

Figure-4 Recommended reading for PG course in Fire & Life Safety Audit

David M Mcgrail in his detailed book "Firefighting Operations in High-Rise and Standpipe-Equipped Buildings", PenWell Corporation, Oklahoma, USA has provided detailed and very clear SOP. Some of the points mentioned therein are:

- Never take an elevator below grade
- Never take an elevator directly to a reported fire floor
- Stop two floors below the reported fire floor

The book is part of the recommended reading list for the post graduate diploma in Fire & Life Safety Audit offered by the Guru Gobind Singh Indraprastha University. It is recommended that it should be made a compulsory reading material for all firemen and the other stakeholders.

Standards and Codes

While many issues and shortcomings came up during the February 2010 workshop, one particular issue was the discovery that the prevailing Indian standard for elevators (IS 14665) was silent on the requirements for fireman's lift, however, NBC 2005 (Part IV and Part VIII Section 5) had detailed requirement for fireman's lifts. BIS' ET 25 Committee immediately sprang into action and on priority issued an amendment to correct the anomaly.

During the drafting of NBC 2016, the CED 46: P16 Committee ensured that any section on Fire and Elevators would be based on collaboration with domain experts and the fire fraternity. Many including Mr. S K Dheri and Mr. Santosh Warrick extensively contributed their time and counsel to the committee.

However, the problem remains as many jurisdictions tend to issue their own adaptations, often with requirements which are technically impractical or in contradiction to the standards and codes and sometimes even dangerous. There has been very little appetite to study and understand the provisions and requirements for Evacuation Lifts, instead new provisions which are technically impossible or in violation of prevailing standards and codes are being introduced. Even the critical NBC 2016 provision where the Fireman's Lift for buildings above 60m should have a minimum capacity of 1000kgs (15 persons) is often not provided.

References to International Standards and Codes

Documents issued by statutory authorities sometimes refer to international standards and clauses. These references though based on inputs from experts, are not properly incorporated to convey the correct meaning or context as intended.

A few examples:

i. Some jurisdictions refer to paragraphs from Annexure B of National Fire Protection Association (NFPA) 101 as mandatory requirements. However, Annexure B starts with the statement, "*This annex is not part of the requirements of this NFPA document but is included for information only*".

The understanding is that devices mentioned in Annexure B could be considered as *supplemental* evacuation methods. Unfortunately, the emphasis laid out is on the supplemental methods and not the primary requirements.

ii. A CFO document mandates a controlled lowering device for evacuation as defined by NFPA 101 as approved by CFO. NFPA 101 in its *not mandatory* section defines a Controlled Descent Device as "*A system operating on the exterior of a building or structure that lowers one or two people per descent, each wearing a rescue harness, at a controlled rate from an upper level to the ground or other safe location."* Discussions with persons concerned revealed that they understood it to be something else.

iii. A recent circular has a requirement that Fire Evacuation Lifts should have a "Conformité Européenne" (CE) certification. There are three issues with this requirement.

First, the two standards defined for fireman's and evacuation lifts by the European Committee for Standardization CEN (Europe) are

- EN 81-72 (2015) Safety rules for the construction and installation of lifts – Particular applications for passenger and good passenger lifts – Part 72: Firefighters Lifts, European Committee for Standardization.
- EN 81 – 76 (2011) Safety rules for the construction and installation of lifts – Particular applications for passengers and goods passenger lifts – Part 76: Evacuation of disabled persons using lifts, European Committee for Standardization

There is nothing like a Fire Evacuation Lift either in Europe or anywhere else in the world.

Second, without a requirement for Fire Evacuation Lifts, Europe does not have a standard for Fire Evacuation Lifts and hence does not have a CE certification process for this newly created local requirement. The CE certificates that this author has seen as having been submitted for equipment supposedly complying to the Fire Evacuation Lifts requirement, refers to a Fire Evacuation System and not an elevator. The certificate also does not refer to any CEN requirement (EN81 – 20, 50, 58, 72 or 76) for elevators.

Third, CE certification indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area (EEA). India does not have a CE certification body and does not recognise a CE certificate

Conclusions

that the provisions of NBC 2016 for elevatoring must be correctly incorporated in the planning and design of buildings which embodies the collective wisdom of over 2 dozen experts with combined and varied experience of close to 1000 years. Trying to reinvent the wheel, has serious consequences from the perspective of safety, viability and sustainability of any building, let alone tall buildings. The sooner that is recognized and corrected the better it would be for all the stakeholders.

References

1. National Building Code of India 2005
2. National Building Code of India 2016
3. Unified Development Control and Promotion Regulations of Maharashtra– 2020
4. National Fire Protection Association 101
5. EN 81-72 (2015) Safety rules for the construction and installation of lifts – Particular applications for passenger and good passenger lifts – Part 72: Firefighters Lifts, European Committee for Standardization.
6. EN 81 – 76 (2011) Safety rules for the construction and installation of lifts – Particular applications for passengers and goods passenger lifts – Part 76: Evacuation of disabled persons using lifts, European Committee for Standardization