Vertical Transport in India

-An Analysis

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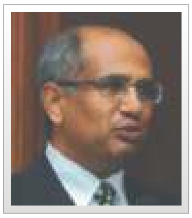

From two 40 storey buildings a decade back to 40+ storey buildings coming up all over the country, not to mention the 100+ storey buildings that have been announced, India is surely growing tall. However Pallabika Ganguly's commentary titled “Is kissing the sky the dream of most Mumbai residents?” raises some very valid concerns. She raises a serious question in asking whether these high-rises are safe and acceptable from the infrastructure and maintenance perspective. Probably the members of the various approving authorities like the “High Rise Committee” and other expert committees would be able to assure us of this aspect.

However the definition of high-rise itself raises a concern. For instance, the DC rules defines a multi storeyed building or a high-rise building as a building of height of 24 meters (about 8 storeys) or more above the average surrounding ground level. One could then infer that the scale of reference for what at best can be referred to, as a mid rise is the same as a “real” high rise. The difference in complexity between a 24 metre high building and a 200 metre high building is exponential.

The commentary by Ganguly continues to read “High-rise structures need special amenities like double-glazed windows to minimise the impact of sound and heat, special equipment such as hydro-pneumatic tank systems, building management systems (BMS), water pumps, common lighting and common hot water system to make the project viable for people to live there. In a high-rise, the complete tower will have to be electronically controlled, which should have efficient systems.” Though there is a subsequent reference to high-speed lifts, it is not surprising that the list of special amenities does not have vertical transportation system as the most significant aspect. This view just mirrors the current thought process of most developers and designers. In fact the current Indian Standards as well as the National Building Code (NBC 2005) does not envisage speeds beyond 2.5mps which at best would suit a mid rise building.

The skills and knowledge to build tall structures have been in existence from ancient times as is evident from the Great Pyramid which once towered at over 145 metres. Closer home, India too has had a number of tall structures. Brihadeeswarar Temple (66 metres) and the Qutab Minar (73 metres) are examples. In fact if Alau'd-

structures were not intended for supporting or sheltering any use or continuous occupancy. As per Wikipedia these structures at best could be called as non-building structures or simply structures.

Despite having the skills and knowledge from ancient times, the only reason why high-rise buildings couldn't find takers was that climbing stairs to occupy the upper levels on a daily basis would have been a practical impossibility. Lifting mechanisms that did exist were not considered safe. All this changed in 1853, when Elisha Greaves Otis invented a safety mechanism that could stop the free fall of a lift. With this invention, (all lifts to this day incorporate modified versions of Otis' original approach) the cityscape around the world started changing.

While there is no doubt that a safe and effective vertical transportation system is what made high-rise buildings a reality around the world, this fundamental reality appears to have been missed in India. The queues outside the Nariman Point / Cuffe Parade buildings could be rationalized as the result of inexperience. Yet when we consider that many of the newer and significantly taller buildings, if ever fully occupied, will not fare much better, one would need to conclude that the inexperience continues.

Din Khalji had been successful, the Ala'i Minar on which he had commenced work would have been twice the height of the Qutab Minar and taller than most 40 storey buildings.

Yet none of these historical landmarks would meet

While most Developers and Designers continue to think otherwise, there is a detailed scientific and mathematical approach to elevatoring. The science has been in existence for many decades and has continuously been refined by pundits like G C Barney, Richard Peters, M L Siikonen, J Schroeder, J Nahon, G T Kavounas, S M Santos, not to forget the original pundit G R Strakosch. With low appreciation of the required approach, lift requirements for most buildings have been designed and is being designed without a scientific backing. The theory behind the traffic analysis has been well elaborated by various pundits of the science. In particular Dr. Gina Barney's “Elevator Traffic Handbook Theory and Practice” is a good source. A word of caution, with the extensive detailing and statistics, this book also has a soporific effect.

The primary problem in the approach to elevatoring appears to be in the aesthetic priorities that a Developer sets out. An experienced architect acquaintance explained the different approaches in terms of “Outside-In Design” vis-à-vis “Inside-Out Design”. With the first approach Designers have to “fit” in the lifts within whatever core has been left. Therefore the lift provision becomes a function of what can be accommodated rather what should be provided.

Some designers have also considered thumb rules for establishing the lift requirements, for instance a few prominent designers consider one lift for every 2,500 square metres. This thumb rule might have served these experienced designers well in the past, but in all likelihood they were designing smaller buildings. What is ignored is that 2,500 square metres over 10 floors are not the same as 2,500 square metres over 40 floors. When confronted with this fact the normal explanation is that higher speeds will be considered to take care of the height difference. Even a basic examination of the theory of traffic analysis would lay bare the fallacy of this assumption.

Other designers probably consider the minimum requirements that have been set by the local statutory requirements or NBC2005 as the base for establishing the lift requirements. The 8 passenger capacity lifts that have been provided for a number of 40+ storey high rises would tend to indicate that the intention was to meet the minimum statutory fire lift requirements rather than the project's lift requirements. This approach in addition to leaving a building grossly under elevatored also does not take into account that as the building grows taller, construction inaccuracies will reduce the effective hoistway dimensions not to mention the impact of wind tunnel effects on lifts at higher speeds.

Some designers and consultants do carry out traffic analysis that is based on the methodology described by NBC2005. However the steps described by NBC2005 are at best just an attempt to give an overview of the approach and is not adequate for carrying out the detailed elevator system design for a building. Though commercial software is available to carry out the required traffic analysis very few have invested in it, not that investment on it's on would make a difference. After all the results of any analysis are only as good as the inputs and the understanding of the outputs. As Richard Peters frequently reminds lift designers, software won't make anybody an expert.

The other approach, which tends to give better results, is when the design comes from abroad. Experienced Designers from abroad invariably hire the services of an elevator consultant to set out the lift requirements. Yet this cannot be considered as absolute. While the consultant would have a good understanding of the traffic

TRAFFIC ANALYSIS PARAMETERS

The two parameters that are referred to world wide as well as in NBC2005 for lift design are Interval and Handling Capacity defined as follows

Interval (Quality of Service) is the average time in seconds between successive elevator cars arriving at the main entrance floor(s). Interval is also referred to as Average Interval or Waiting Interval.

5 min Handling Capacity (%) (Quantity of Service) is the percentage of the building population transported by the elevators in 5 minutes during a morning up peak. Quantity of service is defined as the measure of the passenger handling capacity of a vertical transportation system. It is measured in terms of the total number of passengers handled during each five minute peak period of the day.

Values, though with a few typographical errors, that have been recommended by NBC 2005 should be adequate to account for most buildings.

What the NBC 2005 does not cover are requirements for a typical BPO building, a hotel, hospitals, malls, theatre / sports facilities, educational institutions etc. The code is also vague on the recommended interval for residential apartments with the clause reading “for residential buildings longer waiting intervals should be permissible”.

It needs to be kept in mind that these values are based on the assumption of pure up peak traffic and a single entry level. It also needs to be known that Waiting Interval Average Waiting Time. Average waiting time is what users would be bothered about and realistically can be estimated only by simulation

analysis science he would have very little understanding or appreciation of the cultural nuances of the specific country. Interestingly this aspect has not been addressed by any of the traffic analysis pundits. Recently an elevator consultant friend based in New York, whilst providing inputs for two projects a hotel building and a residential building in India, both very tall, contacted me to review his design proposal. My friend, who has never experienced India, couldn't comprehend my criticism of the assumptions.

The result of these flawed approaches towards establishing the vertical transportation requirements is disastrous. Some of the results are

- Inadequate number of lifts.
- Incorrect hoistway sizes, whereby lifts of required capacities / speed cannot be accommodated. The error could also be that the hoistway width and depth requirements are interchanged as a result of which only inefficient deeper cars can be accommodated.
- While normally it is a case of inadequate pit depth preventing higher lift speeds, there have been unbelievable instances where buildings have been constructed where the requirement of a lift pit was overlooked as a result of which the lifts cannot service the lower terminal floor.
- Inadequate over head is also a case where low priority is allotted to the lift, where the building height restrictions are achieved by compromising the over head and / or machine room height requirements. The

result is that the required lift speeds can't be provided.

Incorrect positioning of hoistways is invariably due to lack of clarity of understanding that “X” number of individual lifts is not the same as “X” number of lifts in a single group. There are a number of high end buildings almost ready for occupation which will fail, not because of inadequate lifts, but just because the lifts have been located in such manner that they cannot be effectively grouped.

It is reality that in the design scheme of projects, discussions and decisions for bathroom fittings quite often receives higher priority than the lifeline of the building. It is no exaggeration that an uncomfortable number of the new high rise buildings will not even meet the minimum requirements set out by the NBC 2005 let alone the super facilities that are promised. Most developers and designers miss the fact that if they get lift core wrong the only available alternative is to bring the building down.

To conclude, the prevailing elevatoring approach will convert many of these new high rise buildings of the new India into non-building structures. How do we change the current mind set? Waiting for the numerous high rise buildings to fail on account of inadequate lifts and thereby set out learning experiences is just too expensive and surely a drain of our nation's resources. Probably we could consider the approach adopted by Leonardo DiCaprio in the latest blockbuster Inception and attempt manoeuvring the thoughts of Developers and Designers toward better elevatoring practices.

About the author:

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