

# Analysing our Vertical Transportation



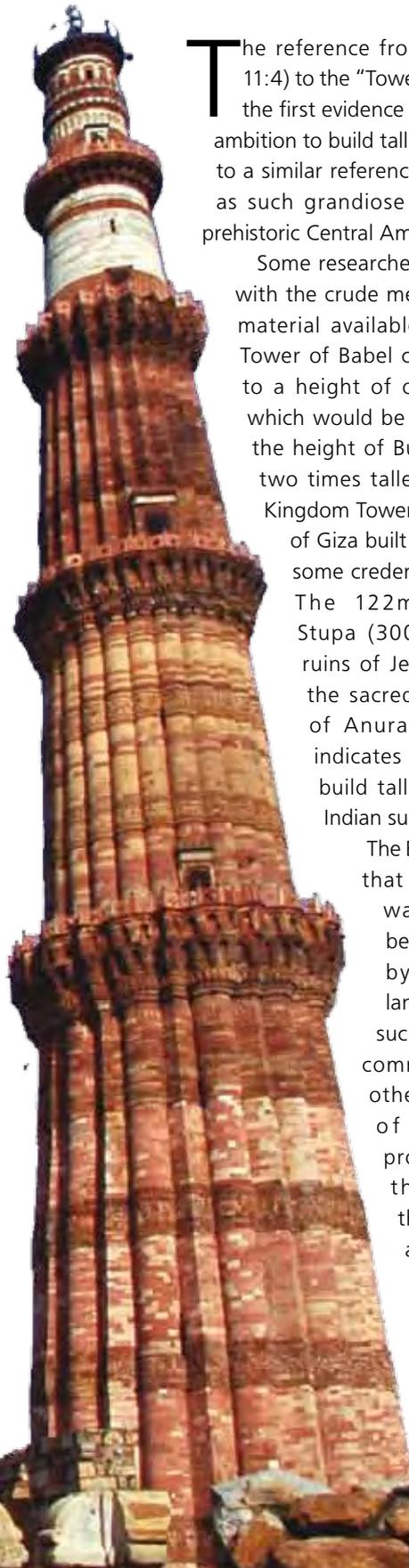


*India is surely growing tall with more than 40 storeys high building becoming a norm rather an exception. TAK Mathews, Chartered Engineer and Principal Consultant TAK Consulting examine the criticality of vertical transportation in building tall.*

The reference from the Bible (Genesis 11:4) to the "Tower of Babel" is probably the first evidence of man's never ending ambition to build tall. Wikipedia also points to a similar reference in the Koran as well as such grandiose plans originating in prehistoric Central America.

Some researchers conclude that even with the crude methods, resources and material available in those days, the Tower of Babel could have been built to a height of over two kilometres, which would be two and a half times the height of Burj Khalifa and about two times taller than the proposed Kingdom Tower. The 146.5m Pyramid of Giza built around 2500BC lends some credence to this contention. The 122m Jetavanaramaya Stupa (300AD) located in the ruins of Jetavana Monastery in the sacred world heritage city of Anuradhapura, Sri Lanka indicates that the expertise to build tall existed even on the Indian sub-continent.

The Bible goes on to explain that the Tower of Babel was never completed because God intervened by confounding the languages of the people such that they could not communicate with each other. The confounding of the languages probably explains why the Americans and the British still cannot agree whether it is an "elevator" or a "lift". »



## COVER STORY

But, suppose the Tower of Babel had been built, would the people have achieved their objective of staying together? Would the tower have ensured the close interaction between the people, which was the primary driver to the tower plan? How would they have ensured their livelihood and means of sustenance?

The answer would have to be a resounding NO. While the people might have had the methods, resources and material to build tall, it is fact that Elisha Graves Otis had not invented the safe elevator till 1853 and without the elevator, movement within the tower and daily sustenance would have been impractical. The Tower of Babel would then have failed in its objective of keeping all the people together and would have remained nothing more than a structure like the Pyramid and the Stupa.



In India, the earliest tall ambition was epitomized in the 73m Qutab Minar from the 13th century. The 85m Rajabhai Clock Tower constructed in

1878 surpassed the Qutab Minar, but then again remained a structure not meant for continuous occupancy. The first real habitable building to attempt reaching for the skies in India was the 86m high, 25 floors Usha Kiran building constructed in 1961. This building was Asia's tallest for some time.

Undoubtedly, Elisha Graves' demonstration of the safety elevator in 1853 has been the one single event that has enabled the transformation of the skylines of the world's cities. Today, it is possible to construct structures of great height. The conversion of these structures into a meaningful building is limited only by the technical limitations of elevators.



Elisha Graves Otis

## Understanding the Importance

While elevating is what converts something that would otherwise be nothing more than a monumental structure into a habitable meaningful building, its critical importance continues to be ignored. Most developers and designers are unaware of the detailed science involved in establishing the elevating in a building.

When the approach to the building design is driven by aesthetic priorities that the owner sets out, invariably elevators become a function of what can be accommodated rather than what should be provided. It is not uncommon to find developers and designers allot higher priority to toilet fittings and landscaping than to the lifeline of the building. After the aesthetic priorities are addressed the next bottleneck that sets in are economic priorities that look at elevators as a luxury that is best compromised if not avoided. ➤





The grand old Usha Kiran is a contrasting study. Equipped with three passenger elevators and two service elevators, this building even today stands out as a benchmark for the elevating that requires to be provided for an ultra-premium residential apartment. (A good 50 years later these elevators are being replaced today with the latest technology and faster elevators.) In contrast, many of the ultra-premium and bespoke buildings of today have elevating provisions that are not only inferior but also grossly inadequate. In fact, some of these newer buildings have elevating that make the serpentine elevator queues at the Nariman Point buildings look acceptable.

If the design is wrong, rarely is a corrective solution available. If the structure or the elevator core is inadequate, what solution do you have other than demolition? To quote a senior leader from the industry, "Change will happen only after developers and designers had repeatedly faced the consequences and costs of bad elevating". Definitely a very costly exercise!

## Indian Cultural Challenges

Along with the good traffic analysis, understanding of the cultural

nuances of the region is also critical. Interestingly, this aspect is often overlooked. The primary objective of elevating a building is to facilitate circulation and movement of people (and goods) within a building. To this end it is vital to understand why and how people need to move, which is largely dictated by their living habits. Living habits in turn are largely governed by the cultural background and societal influences.

When it comes to the low-income segment in India, which normally would be one room and kitchen units, the ratio would be a function of whether the apartment building is a rehabilitation building or an affordable housing project. The owner profile would impact the density from

4 to 5 people per unit for the former and 1 to 3 people per unit for the latter.

In the middle income apartment building, the service staff (maid, garbage collector, milkman, newspaper delivery, driver etc.) numbers add to the elevator population whereas, in luxury apartments, the service staff do not have access to the main elevators and elevating has to be planned accordingly.

In other building types like hospitality, many prominent hotels in India while great on providing adequate elevators for guests fall short on the adequacy of elevators for service. Likewise, in some office complexes, one elevator is reserved for the top management. Removing one of the lifts from general service invariably compounds the traffic analysis on which the project's vertical-transportation was based and thereby increasing average waiting time for the public.

These examples bring to the fore the importance of planning the elevator system at an early stage of the project with thorough understanding of the profile of the users, usage pattern as well as elevator grouping, placing and configuration.

## Avoiding Accidents

The numbers of accidents involving elevators and escalators around the country are on the rise, which cannot happen without errors and omissions on part of either the





buyer, supplier, maintainer or the user. Moreover, the third party inspections cannot be 100 per cent accurate, nor can it be done on a 24x7 basis.

Though elevators form the lifeline of the tall building, they are invariably at the bottom of the design priority of a building. Once the structure and the core comprising the hoist ways or shafts have been finalised, it is almost impossible to remedy the inadequacy of elevators.

The next compromise happens at the procurement stage. India has always been governed by the concept of the lowest bid, and this is even truer when it comes to elevators. The scrimping thought process continues to the maintenance stage. It is not uncommon for the owners to award the maintenance contract to the lowest bidder who would find it impossible to provide any level of service beyond basic breakdown maintenance.

In addition, elevator equipment age and require upgrading or replacing after a period. Most building owners will delay the investment to the point when something goes drastically wrong. An elevator, though the safest mode of transport, if not designed, installed, maintained and used in the right manner, has a high potential to become accident prone.

To sum up, India needs to wake up to the criticality of elevating. Otherwise, India would have to live through a very expensive learning curve.

### Traffic Analysis Components

The efficiency of a system is traditionally defined in terms of the quantity of service (handling capacity) and quality of service (passenger waiting time). The NBC 2005 also recommends the acceptable limits for these parameters.

**Peak Handling Capacity** is the total number of passengers that the system can transport during the peak traffic conditions with a specified average car loading.

**Interval (INT)** also referred to as Average Interval or Waiting Interval is the average time, in seconds, between successive lift car arrivals at the main terminal floor with cars loaded to any level. Average Waiting Time

(AWT) is the average period of time, in seconds that an average passenger waits for a lift, measured from the instant that the passenger registers a landing call (or arrives at a landing), until the instant the passenger can enter the lift. Typically, this would be the sum of the waiting times of all the passengers divided by the total number of passengers.

**Points of caution** – Firstly, it needs to be clearly recognized that Interval  $\neq$  Average Waiting Time. The Average Waiting Time can be realistically established only through a simulation. Secondly, the average car loading should never be expected to cross 80% of the rated car capacity.