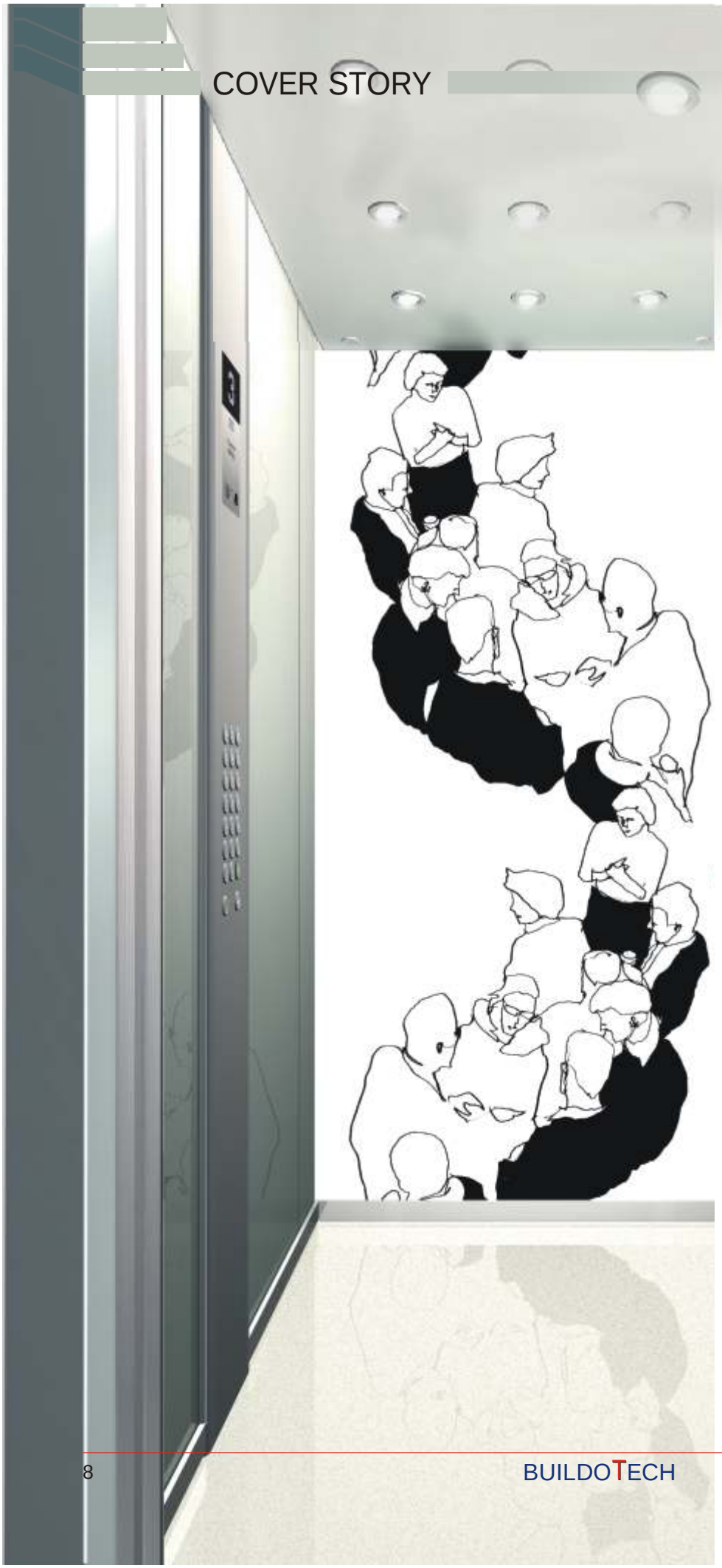


Vertical Transportation Life Cycle

t is imperative that the developer and the architect recognise that the vertical transportation system is the life line of a building, particularly, as the buildings grow taller and larger and the users become more demanding

A short while back a property developer approached me with his problem. The building was half-way up and there was a concern related to the inadequacy of the vertical transportation system. The developer wanted me to recommend solutions to resolve the potential crisis, particularly as a few multi-national tenants were looking at leasing space in the building. Making provisions to accommodate more lifts couldn't be done because of the advanced stage of the project. The other alternative of reducing the number of floors and thereby the population was not acceptable due to commercial considerations. The Developer was not too pleased when I expressed my inability to do magic. He was sure that I would bail out the project by incorporating technological advancements into the vertical transportation configuration.

I was prompted to fantasise that I could play tennis like Roger Federer – I would just need to procure the Wilson NCODE N6, the ranges of Apparel, Footwear and Accessories created specially by Nike and land up at the Wimbledon center court. Just like my client, could I expect

technology advancements to take care of the basic limitations, like the fact that I have never learnt to play tennis, am half a foot shorter than the champion, 20 kilograms heavier and just two decades older?

The reality is that I have very little chance of controlling my genetic design. On the other hand the developer could have followed a scientific and experienced approach to the whole project and specifically to the design stage of the vertical transportation system, and taken control of its genetic design. It is a different matter that he chose not to exercise control over the project at a time when he could have, similar to my choice to focus on cricket rather than tennis when the opportunity presented itself.

Any building is only as good as the access to each square foot. For instance what use is a grand building even with the best of facilities, if it is to be located on the moon? The pre-requisite to planning this lunar building would be by establishing a viable and convenient access infrastructure for every potential visitor – on date none exists.

Yet this is not an aspect recognised by the players involved in the development of the projects. A senior architect recently narrated an experience where he was sacked from a mall project – the mega mall was expected to attract 3,000 to 5,000 cars which the 40 feet access road obviously would not have been able to handle. The developer on the other hand was adamant that he would not consider the architects suggestion to scale down the size of the mall. With other architects willing to oblige, this architect was shown the door.

With access to the building itself being overlooked, access to the spaces within the building is of little priority.

I am often queried as to what is the appropriate point in the project to involve the services of a vertical transportation consultant. This question itself reveals the lack of understanding or the priority that has been set for the vertical transportation aspect of the project. The life-line has to be integrated into the project at the concept stage and not fitted in as an after thought.

Rising expectations, flawed approach


"All safe, Gentlemen"

Worldwide, demands and expectations from Vertical Transportation Systems have come a long way since Elisha Graves Otis demonstrated the “safe” elevator at New York's Crystal Palace in 1853 and pronounced the now famous industry slogan “All safe, Gentlemen”. Technology also has progressed to the extent, that Elisha's equipment would be considered almost primitive.

From an Indian perspective, while users have traditionally been more accommodating and willing to accept the transport system as long as they could get to their destination, the trend has started changing. With buildings getting taller and floor plates getting bigger, population numbers in individual buildings are getting larger. With global exposure and benchmarks, this

increased population has a higher expectation. Queues and waiting times, jerks and noises during travel are becoming unacceptable.

Potential owners and tenants have started putting the effectiveness of the vertical transportation system on their decision checklist. It is a different matter that the process is limited to a paper exercise mainly due to a lack of awareness of the technicalities and the science. Developers have also started including the vertical transportation system as part of their sales arguments, yet without really understanding the prerequisites.

Architects too struggle. Without adequate sources of information or guidance they are dependent upon their own understanding derived from supplier brochures or from a sales engineer who is further constrained with his main priority of fitting in his standard product.

Indian E&E Industry

The Elevator and Escalator (E&E) industry's response to this enhanced requirement and expectation has not maintained pace. With the presence of almost all the global E&E majors and another 150 local players, competitive options are available.

Yet, there is serious reason to be concerned as the available technical competency among the project, service and sales engineers has deteriorated. In earlier years an average project or service technician/engineer would have had undergone at least three to five years of hands-on training as a helper before taking on independent responsibility. This training period has been drastically reduced to some months of learning in class rooms.

"You're right, Joe, that counterweight should be behind the car!"

Courtesy: Elevator World

Many of the E&E sales engineers have limited their understanding of the overall requirements of a vertical transportation system. With no real motivating drive, their understanding of the nitty-gritty's involved in the design stage of an E&E project or the science of traffic analysis is minimal. Their approach is restricted to selling standardised products from their brochures rather selling solutions.

With the real estate industry growing at over 30% per annum, the E&E industry has also grown. Most elevator companies have doubled and trebled their annual sales and are booked beyond capacity. Why bother to sell solutions, when you can exceed your annual target selling boxes? The boom has ensured that the E&E companies are so caught up in trying to execute their order backlog, that they are left with almost no scope to set long term training priorities or implement them.

E&E Legislation

The Indian E&E is guided by the standards laid out by the Bureau of Indian Standards and the National Building Code. While there is a base to the argument that the standards are not up to the mark (for instance the prevailing escalator standard is of 1968), some direction would be better than nothing.

These standards and codes are only recommendatory unless enforced by individual states through legislation. With most states not having passed an act or legislation, the Indian codes and standards for E&E are not enforced in most of the states.

The states that have enforced legislation have more or less limited the legislation to just elevators, leaving escalators out of the purview. The enforcing duty is invariably an additional responsibility for the state's electrical or factory inspectors. These inspectors, in addition to not being hands-on experts in the E&E field, are already overloaded with their primary responsibility to be able to really be effective.

E&E Consultancy Expertise

In India, most of the available E&E consultancy expertise (when sought) is provided by services consultants with specialisation in other areas. This in itself points to the lack of priority being given to the life-line of a building. Without the required expertise and detailed understanding of the science of vertical transportation, these consultants struggle to establish an adequate system. Even when the consultant has some E&E background, it is often gleaned from books or restricted to a specific part of the E&E industry and not enough to establish and then implement a complete and optimum solution.

Without the know-how, the vertical transportation configuration and specification is then determined by one or varying combinations of suppliers' standards or past experience and compelled by architectural considerations. When there is over dependence on a particular supplier for

inputs, it is not uncommon to find specifications almost matching the supplier's brochure or parts list rather than the generic name for the equipment or component. In fact E&E sales engineers are known to label tenders as "X Supplier" specification or "Y Supplier" specification and use that measure to decide the level of seriousness to be attached to the bid.

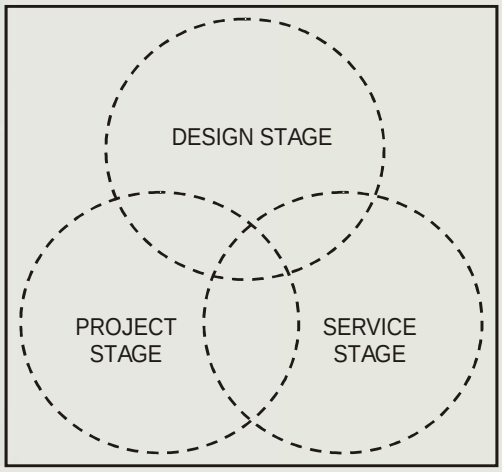
If the origin of the specification is from another project, the cut and paste errors are obvious – for instance a recent tender that I came across for a standard commercial building called for a "hospital service" provision. It took a smart sales engineer to remind the consultant and the client that the building was not a hospital!

This lack of understanding also leads to the inclusion of terms and conditions which are irrelevant to the specific project resulting in bids with multiple deviations. This is then followed by endless discussions stretching the whole bidding and negotiation process. Invariably, time constraint pressures creep in and the supplier manages to push in his own standard one-sided proposal.

Numerous buildings across India stand testimony to the flawed solutions that were recommended and then implemented.

Vertical transportation life cycle

The question that arises is what is the right approach to achieve an effective and efficient vertical transportation system.



The success of a vertical transportation system of any project is dependent on three distinct stages of the "Vertical Transportation System" life cycle – the design stage, the project stage and the service stage. (The three inter jointed circles in a square is the trade mark of TAK & Associates) These stages are interlinked inseparably.

A compromise at any stage can have disastrous and sometimes irremediable consequences on other stages of the vertical transportation project.

Design Stage – Vertical Transportation Design – The Effective System

The design and selection towards an "Effective Vertical Transportation System" should start with an early entry into the project. The start should preferably be at the concept stage itself. And then by achieving a configuration that balances between the traffic characteristics and handling requirements, building requirements, architectural compulsions and economics of the various technologies available. This stage is the most ignored aspect of the vertical transportation system, partially on account of ignorance and partially on account of reluctance to allot adequate priority to the life line of the project. Numerous prestigious and great projects stand testimony to this.

The first step in this stage is establishing the building definition and characteristics and estimating the traffic and circulation patterns. Invariably estimating the population is a basic play of ratios where the total area is divided by the expected area per person, with debates on whether the areas to consider are based on carpet or built-up area. This is too simplistic and can lead to a traffic estimate which is significantly higher than the actual figure, which when used as the design basis can lead to over-elevatoring. On realising this aspect, the tendency is to cut and chop the number of elevators without any basis.

The normal argument at this stage is that the building is still conceptual and therefore occupation patterns are not available. This is only partially true as the financial viability of the

project would have been based on a target clientele and possible occupation patterns can be derived from this.

Further the developer's marketing personnel are in a great position to provide this data. This source of data needs to be addressed with caution as the developer's marketing departments are normally motivated to provide very high floor efficiencies as part of their sales arguments with potential clients and tenants. Yet a frank discussion can lead to significantly accurate estimates.

It is to be recognised that floor plate shapes, column grids etc can impact the efficiency and therefore data from another building might not be comparable. It might also be necessary to carry out a realistic test fit to validate the data on the occupation ratios.

The next step is carrying out the traffic analysis which would reveal the number of elevators and escalators required, capacities and speeds. Once these are established, the arrangement and location of the equipment will need to be established. An issue that comes up at this stage is a conflict between the architect's compulsions, the circulation logic and the effectiveness of the E&E configuration. It has to be understood that certain arrangements and locations prove detrimental to the effectiveness of a system.

Traffic Analysis Components: It will be difficult to go through a detailed discussion of the science of traffic analysis or its components here.

A brief definition of the terms normally referred to is given below.

The efficiency of a system is traditionally defined in terms of the quantity of service (handling capacity) and quality of service (passenger waiting time)

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.

Two points of caution–

(i) It needs to be clearly recognised that Interval ≠ Average Waiting Time. Average Waiting Time can be realistically established only through a simulation.

(ii) The average car loading should never be expected to cross 80% of the rated car capacity.

Once the optimum configuration has been arrived at, detailed technical specifications need to be written out. To achieve a competitive bidding process it is imperative that the specifications are fairly generic. This will ensure a fair bidding opportunity for the pre-qualified vendors as well as ensure that they tender in a bid with minimal technical deviations, which in turn ensures an equitable comparison.

The general and commercial terms included in the tender documents would also need to be specific to the E&E aspect of the project. It is important that the supplier submits a bid with minimal deviations to the tender terms and conditions.

Project Stage – The Vertical Transportation Project – Ensuring Quality

There isn't much to differentiate between technology offerings from the major companies. In fact you might not even be able to differentiate between processes. Yet the final installed quality will vary depending upon the synchronicity between the process, people and performance.

Most experienced E&E industry

clients will always have numerous horror stories of their experience in getting E&E projects executed on time. The basic reason for most delays is the absence of transparent understanding and a common language between all the parties involved.

The ideal E&E project would be one where the entry of the E&E material and execution team into the site is delayed to the absolute last moment to achieve a just-in-time completion. The key to achieve this ideal situation is absolute trust and confidence between all the parties involved. However courtesy the history of bad experiences, it is a chicken and egg story – how do you break this vicious cycle? Clients will have numerous examples of delayed projects. Suppliers will have an equal number of stories of material lying at sites (or installed and not commissioned) for years together due to site delays.

The quality of an installation is dependent on the quality of equipment that has been supplied and the quality of the installation activity. The E&E contractor has the responsibility to supply and install equipment as has been contracted within the schedules and to the quality that has been assured. However the owner also has to be meaningfully engaged with the whole process. The key is "being meaningfully engaged", as engagement without understanding or for the sake of engagement is counter productive as is the other extreme of not being engaged at all.

Service Stage of the Vertical Transportation System extends to well over 25 years and includes preventive, break-down and repair maintenance and eventual modernisation or up gradation of the equipment.

Maintenance – The Vertical Transportation – Project Ensuring Safety & Reliability

A well designed and executed vertical transportation system, when badly maintained is a white elephant, or even worse, a dangerous white elephant. To ensure your investment performs reliably & safely through its life expectancy, the maintenance process, the people and the implementation will have to perfectly mesh together.

Maintenance is a continuous process. It is almost impossible to make up for a backlog and therefore it is imperative that cycle is not broken.

While the maintenance contractor is contracted to provide good maintenance that ensures the equipment is safe and reliable, the owner and users also have a responsibility to take care of their equipment. The owner has a responsibility to be meaningfully engaged and supportive of the maintenance activities.

Modernisation – The Vertical Transportation Project – Enhancing your investment

As the building ages, so does the vertical transportation system. It becomes necessary to consider the modernisation /replacement of the equipment. This stage is the trickiest aspect of the vertical transportation life cycle requiring the greatest degree of hands-on experience, understanding of equipment and technologies and ability to anticipate potential problems. A compromise at any of the steps of status assessment, deriving and comparing alternative approaches, preparation, planning, execution and monitoring will leave the building crippled.

The developer and the architect have to recognise that the vertical transportation system is the life-line of a building, particularly as the buildings grow taller and larger and the users become more demanding. It has to be recognised that the right time and more often than not the only opportunity to ensure that the system is effective is at the concept stage.

Or alternatively, we could look at it from the perspective that "Climbing Steps is good for Health" and drive the thriving health club industry out of business.


Zigzag elevator, Japan

Eon Free Zone, Pune

The project located in Kharadi, Pune will provide over four million sq. ft of integrated workspace dedicated for IT and ITES over a 40 acre land.

With an expected population of around 40,000, the developer recognised that an effective vertical transportation system would be very crucial to the success of the project. The vertical transportation consultant was appointed at the concept stage of the project.

A well defined step by step and iterative process was followed to define the optimal vertical transportation configuration.

Extensive discussions took place between all the parties to arrive at the realistic population estimate and then derive the average daily traffic and the possible circulation patterns. Feedback was constantly sought from the developer's marketing department. The estimates were also compared with buildings that had similar occupation patterns. As the building floor plates had a unique shape, the estimates were validated through test fits.

With the building at the concept stage, intermittent changes to the building and floor plans were normal and for each variation, population estimates were re-established. With each revised population estimate, the corresponding traffic analysis and simulations were conducted to define the required vertical transportation configuration. All in all, over 20 sets of calculations and simulations were conducted before the vertical transportation configuration was frozen.

The constant involvement of the vertical transportation consultant ensured that the arrangement and location of the elevators were optimised without compromising any of the architectural requirements. From a commercial perspective, the involvement of the vertical transportation consultant also ensured the rationalisation of the elevator lobbies and location of the common facilities. This in turn released significant space for beneficial use.

Kensington, Mumbai

This project located in Powai, Mumbai, is developed by Hiranandani Group and designed by Hafeez Contractor would have 1.4 million sq. ft of prime commercial spread over two wings and 19 floors. The project would be targeted at premium multi-national clients.

The vertical transportation consultant was appointed at the initial stages of the project.

An extensive exercise was carried out to establish the realistic traffic estimate. The well experienced marketing department of the Developer was involved in the discussions. Physical population counts were also obtained from similar buildings to validate the assumptions. With the possibility of IT / ITES clients occupying a sizeable part of the building, the Consultant carried out studies to establish circulation and traffic patterns that apply to a typical IT / ITES set-up.

The final vertical transportation configuration required the addition of four elevators. However with rationalisation of the elevators and their operation, over 7000 sq. ft was released for beneficial use, more than mitigating the costs of accommodating and installing the four additional elevators.

TAK Mathews is a Chartered Engineer, a member of the International Association of Elevator Engineers, of the National Association of Vertical Transportation Professionals (USA) and of the National Association of Elevator Safety Authorities International. He is also certified as a Qualified Elevator Inspector in conformance with the requirements of the American Society of Mechanical Engineers. He is an Associate at TAK & Associates. www.takassociates.net