

AN OVERVIEW OF THE NEW ELEVATORING SYSTEMS FOR BUILDINGS



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1 INTRODUCTION

As the proverb goes, “necessity is the mother of invention”, every few years with the increased space crunch, especially in the cities, there are inventions in every field including the E&E (Elevator & Escalator) industry. This article is written to highlight the latest or the new technologies available in the E&E industry, their advantages and disadvantages.

In the past few decades many new technologies have been invented and are a boon to the rapidly growing urban infrastructure. Few of the technologies are double-deck elevators, TWIN elevators, MULTI elevator system, jump elevators, IoT (Internet of Things) and AI (Artificial Intelligence) for elevators & escalators and high speed elevators.

These technologies are elaborated in the paragraphs below.

2 DOUBLE-DECK ELEVATORS

Though the technology of Double-deck Elevator was invented way back in 1931, the reason this technology is detailed here is because till date there is not a single Double-deck installation in India. A few technical details of a Double-deck Elevator are:

- Double-deck Elevator is an elevator with two cabs attached together, one on top of the other,
- This allows the passengers on 2 consecutive floors to be able to use the elevator simultaneously,
- By virtue of the design of this Elevator, passenger capacity per hoistway increases significantly,
- For conventional Double-deck Elevators, the floor rise of each floor has to be equal

Customized option of Elevator serving unequal floor rise is available at an additional cost.



Figure 1: Double-deck Elevators at Midland Square, Nagoya, Japan (figure shown just to indicate the Double-deck design)

Some of the advantages are:

- If the building/ structure is designed well, the number of hoistways could reduce considerably which would reduce the core space requirement,
- During peak period, when both the decks are fully loaded, energy is saved,
- In many scenarios the upper deck is used as passenger elevator and during non-peak hours the lower deck is doubled up as service/ goods Elevator, hence saving up on providing separate service/ goods Elevator.

It has a few disadvantages are given below:

- During non-peak hours, even though the traffic is less both the decks will operate,
- Few designers may find the equal floor rise a constraint,
- For efficient usage of the double-deck system, even number of floors is preferred, and
- There is no standard/ code in India as of now

3 TWIN ELEVATORS

TWIN Elevator system is a proprietary product invented by ThyssenKrupp in 2003. TWIN is the system in which 2 Elevator cabs run independently in 1 hoistway. The ideal scenario is where the upper cab serves the upper half of the building and the lower cab is serves the lower half of the building (number of floors served is a function of the traffic analysis results).

Some technical details of TWIN elevator system are:-

- TWIN Elevator system if designed efficiently could result in saving of around 25% space,
- TWIN is designed on a TÜV-tested safety concept to satisfy even the most stringent requirements, and
- This system is suitable specially for hotel, office, mixed-use buildings where 2 separate entities operate in a single building

Some of the advantages are:

- If the building/ structure is designed well, the number of hoistways could reduce considerably which would reduce the core space requirement,
- Both the cabs use the same single hoistway, same set of landing doors and guide rails,
- Unlike in a Double-deck Elevator where even during non-peak hours, both the decks are run, in the TWIN system, one of the cabs could be parked and only 1 cab could be utilized,



Figure 2: Indicative TWIN Elevator system (Figure credit ThyssenKrupp)

- Upper cab could be made to serve the lowest landing (with proper pit design)

A few disadvantages are:

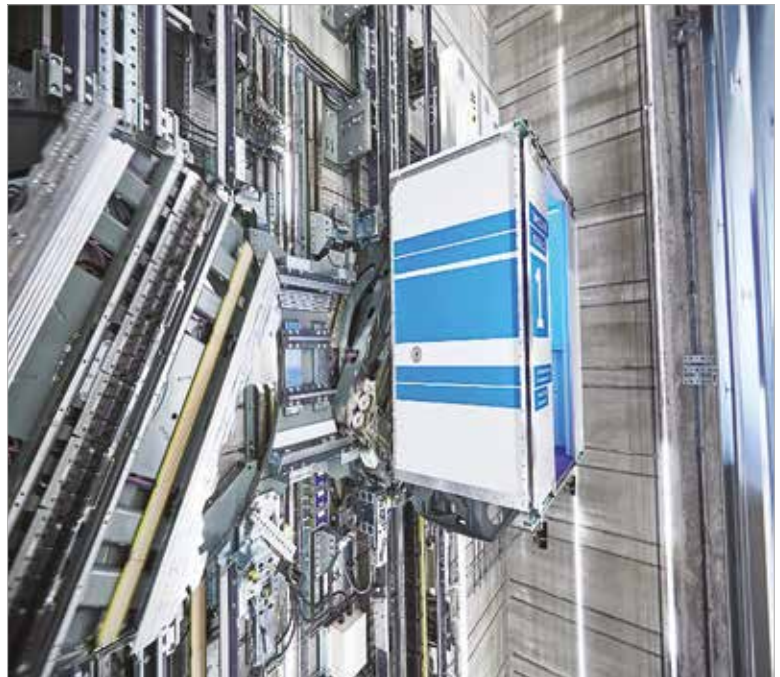
- Standalone TWIN system is not completely efficient unless there is a supporting Elevator/s transferring passengers to the upper cab/ upper entry level,
- Ideal for buildings with 2 entry levels/ zones,
- There is no standard/ code in India as of now

4 MULTI SYSTEM

MULTI system was announced in 2017 and is a proprietary product of ThyssenKrupp. This system is the world's first rope-free Elevator system, in which multiple cars move in a single hoistway horizontally as well as vertically.

Some technical details of MULTI system are:

- Through the use of magnetized cabins, which operate in the same shaft on an electromagnetic track, enables the cabs to travel sideways as well as up and down,
- Leveraging the linear motor technology developed for the magnetic levitation trans-rapid train, the cabins move up one shaft, travel horizontally, and then come down another in a continuous loop,
- Exchanger mechanisms like railway switches help to guide the cars, which are mounted with carbon-fiber bearings called slings that allow them to change direction,
- Since this system runs on magnets and motors, fewer and smaller hoistways are required in comparison to conventional cable operated Elevators
- Not having cables might seem that the system is less safe but that's not the case. The linear motors are safe because they need to be energized before they move. That means that without energy, the cabins can't move. That's why the cabins are equipped with batteries in case of energy breakdown. In addition, a multi-step braking system is designed that doesn't allow cabins to move freely.



Some of the advantages are:

- Endless possibilities with the architectural design as the building can be served both horizontally and vertically for passenger/ goods movement,

Figure 3: Indicative MULTI system (Figure credit ThyssenKrupp)

- If the building/ structure is designed well, the number of hoistways could reduce considerably which would reduce the core space requirement

A few disadvantages are:

- Not suitable for low rise/ mid-rise buildings where the footprint is small,
- Cost effectiveness compared to the conventional Elevating system for a particular project needs to be evaluated, and
- There is no standard/ code in India as of now

5 JUMP ELEVATORS

Jump Elevators/ Lifts were developed by Kone Elevators in 2001. It is a self-climbing Elevator system that is installed as soon as the first levels of completed floors are constructed. It allows hoistway construction and Elevator installations to continue at higher floors while the Elevator is operating in the same hoistway at lower floors, below a protection deck. The permanent Elevator cabin is used in this system which is equipped with temporary fixtures and protective materials so they can be used during construction time. With proper planning and execution, Jump Elevators can be a good solution to improve construction efficiency and speed. They are a good alternative to external hoists.

Some technical details of Jump Elevators are given below:

- Jump Elevators/ Lifts use the permanent hoistway,
- Jump Elevators/ Lifts are fitted with automated doors as any other regular Elevator/ Lift, making the usage safer,
- The mobile machine room contains the hoisting machine and the Elevator controls. It moves upwards as the building progresses,
- The double protection deck is used to protect against any possible falling of objects & is locked to pockets in the hoistway walls,
- The deflection deck is attached to the slip form very close to the formwork position, deflecting any objects or possible wet concrete that may fall to the shaft,
- The installation platform is used to install the guide rails and other elevator components, and
- The separation deck isolates the working area from the operating elevator below it. It prevents any objects from falling into the operational section of the elevator shaft. The deck is integrated with the lifting beams, which are used to pull the heavy mobile machine room up with the aid of a rope hoist. The whole process is self-powered and does not require a site crane.

Some of the advantages are:

- With proper planning, construction process could be faster,
- Labour, material & tools reach their destination floor faster,
- As against an external hoist used during construction, jump Elevator/ Lift has an all-weather operation, and
- Façade can be completed faster than when external hoist is used

A few disadvantages are:

- Needs proper planning during the construction phase, and
- This product is limited to few suppliers only.

6 IOT & AI FOR ELEVATORS AND ESCALATORS

Elevators and Escalators have become an inevitable part of most of the tier 1 and 2 cities across the globe. And with increased number of installations, managing the service, operation and maintenance is a big task for the suppliers. IoT and AI enabled Elevators and Escalators help in many of those tasks such as:

- IoT enabled Elevators / Escalators can gather data related to electrical circuits, load weighing, number of trips, number of door cycles, wait times, traffic trends, ride analysis, harmonic analysis, etc.,
- Data collected by IoT aids in improving the preventive maintenance schedule,
- The systems help in keeping track of wear and tear, is another useful way to predict when and where maintenance would soon become necessary,
- IoT devices enable real-time data transmission to the designated mechanic which can allow the mechanic to proactively attend to the problems,
- IoT devices monitor the equipment 24/7 and serve as the eyes and ears of whoever is responsible for maintaining a building's vertical transportation systems,
- IoT data can help improve the innovation/ research process of the manufacturers,
- Monitoring the equipment often and avoiding breakdowns can also lead to increased life cycle,
- AI is helping anticipate the problems and manage the traffic flow better in the Elevators & Escalators

7 HIGH SPEED ELEVATORS

There are many articles and design guidelines about high speed Elevators. The design details are mentioned in NBC 2016 as well. But the reason this topic is included here is to highlight that the fastest Elevator in the world which is running at 21.0mps (meter per second) and was installed by Hitachi Building Systems Co. Ltd. at Rosewood Guangzhou, China in 2019. Till date, the speed of the highest Elevators installed in India is 6.0mps. They are installed at The Imperial, Mumbai, Omkar 1973, Mumbai and World One, Mumbai.

8 CONCLUSIONS

To conclude let's recall the caution by the World Health Organization (WHO) on the current pandemic situation that the world is grappling with.

As per WHO, the COVID-19 would be here for a very long time, rather forever. There definitely is a risk in using Elevators and Escalators but that risk is significantly lower than all the other activities one would be involved with before and after getting to the Elevator or Escalator. Hence, few precautions which could help prevent the spread of a virus, from an E&E industry perspective are:

- Passengers to make use of sanitizer before entering an Elevator/ Escalator and before touching the call button/ COP

- Wear a mask
- The car to be loaded up to 50% only, so as to maintain ‘social distancing’
- Do not lean on the walls inside an Elevator,
- Avoid overcrowding an Escalator

There are few non-touch applications for call entering like QR Code, Apps, WhatsApp, pedal controlled, voice controlled and Hologram, but using these could only add to the waiting times. Imagine every passenger spending more than 10 seconds (minimum) to register their call using these applications, which will only increase the waiting times.

Pedal operator are now being advertised. The picture below is from a newspaper clipping. Imagine a passenger stepping on the footmark (in front of the pedal operator) to register the call and other passengers waiting at the floor or inside the car. As mentioned above, minimum time to register a call by this pedal operator would be 10 seconds and then the next passenger will register the call, by which the waiting times have already gone for a toss. The question that arises is how by installing the pedal operator, is one going to maintain social-distancing inside a car when a car is occupied with more than 2 or 3 passengers especially for cars of higher capacity (6 passenger, 8 passenger or 10 passenger)? In such a small area if the pedal operator is installed, maybe only 2 or 3 passengers can travel during 1 trip. Hence, one needs to understand the total implications of installing any new technology.



Figure 4: Picture showing pedal operator being installed inside an Elevator/ Lift car (source: local newspaper)

And more than ever the design of the Vertical Transportation System is critical so that the cars could be loaded to only 50% capacity but still the waiting times are not too high. The under elevated buildings will definitely face some challenges which need to be dealt on a case by case basis.

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