Unravelling Destination Control Systems – a Practical Perspective

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Abstract. Destination control systems (DCS) were conceptualized over half a century back. However, it was not till Schindler introduced the Miconic 10 in the 90's, that DCS made entry as a viable lift control and grouping solution. Since then, all major Original Equipment Manufacturers have developed their own proprietary solutions. Credible non-proprietary solutions too are available. This paper will explore the author's working experience with destination control systems which began in 1998. The paper will address the validity of some of the claims of manufacturers, common implementation errors as well as benefits and issues related to DCS.

1 ADVENT OF DCS LIFTS IN INDIA

Hiranandani Gardens township is located at Powai in the erstwhile Bombay. The township has the premier Indian Institute of Technology campus to the Northeast, the technology conglomerate Larsen & Toubro (L&T) to the West and the Powai Lake to the North. The township is being developed by the well-travelled and progressive Hiranandani brothers. The brothers have always been trendsetters through every aspect of the realty business and responsible for setting benchmarks and pioneering new technologies in India.

With their trendsetting approach extending to their elevator specifications, they were more than willing to experiment with Schindler's destination control system (Miconic 10). Glen Heights, the 28 floors residential building completed in 1999 and located at Hiranandani Gardens became the first DCS installation in India. They then added two more residential projects to the list of DCS projects. The initial decision in favour of the Miconic 10 was driven more by the novelty of a new concept than full appreciation of the derived benefits.

Figure 1 Hiranandani Gardens, Mumbai – Some of the earliest DCS projects

With the early positive feedback from users and a better understanding of the advantages of DCS, the Hiranandani Group adopted DCS at a number of their subsequent projects. Proctor & Gamble decided DCS would be the best option for their corporate headquarters in Mumbai. L&T chose DCS for their

IT buildings in Hyderabad followed by the Bombay Stock Exchange and the 45 floors Shreepati Arcade which was then the tallest building in India. By mid 2004, India had over 75 DCS lifts.

After the initial rapid growth in India, the DCS adoption in India slowed to a snail's pace. First, an uncertainty whether DCS was truly an effective solution had fewer sales engineers pushing the concept. Second, with competitors either not having a competitive solution or no solution at all, lift design and specifications were tuned towards generalisation to facilitate more competitive bids.

The author's interaction with international consultants during the first decade of this century indicated that they too were reluctant to pursue DCS as a viable solution even for commercial buildings with large lift groups.

2 THE PIONEERING JOURNEY

The introduction of DCS was perhaps the first ever lift industry change that directly impacted the way passengers interfaced with lifts. All other technological advancements were tucked away from the sight of the passengers. It was but natural that passengers would have to go through a learning curve and that there would be resistance. However, the industry too had to go through (and is still going through) a learning curve that went beyond just technology. Some of the problems were anticipated while some were not. Some examples of the problems are

Adapting new concepts: The obvious first concern was whether users would adapt to the new technology and how they would accept the shift from the conventional up & down call buttons that they had always been used to. Contrary to expectation the acceptance was not too much of a barrier. Some of the initial reluctance that did come was surprisingly from tech savvy passengers.

Even when DCS was blamed for problems including waiting times the real root cause mostly was elsewhere and listed below.

a) **Space reservation**:

That each user had to register their destination and be allotted a lift was a new concept. Tailgating became the norm with two possible consequences. First, the lift would fill up leaving no space for other passengers who had been allotted the particular lift. The second was that passengers would enter a lift which necessarily did not have their destination as a stop. They would then need to get off at the next stop and call for a lift to their destination.

b) **Cheating the system**:

Users accustomed to meaninglessly pushing the hall call button multiple times figured out that the same practice with DCS input terminals did have an impact, that they would get priority. The artificial demand led to the lifts reaching saturation even without perceptible traffic.

c) **The disability button**:

Some users figured out the disability button would allot priority and reserve additional space in the lift.

d) **Hall position indicators**:

A general trend in India has been the provision of hall indicators on all floors. Passengers observing the car movements derived comfort that a car would soon reach them. A certain level of extended waiting time was acceptable.

Without an idea where the car was the perception of waiting times went up exponentially. Passengers waiting for a DCS lift when shown video recordings with time stamps were taken aback that often their perception was over a 100% off. At a particular building users complained that they were average waiting time was in minutes. The subsequent video recording at the main lobby proved the maximum waiting time did not exceed a minute.

e) **Next lift is not my lift:**

Passengers were also irked that sometimes the next available lift was not the one that they had been allotted.

f) **DCS for shorter buildings**:

The original Miconic 10 telephone keypad had digits 0 to 9. If the building was shorter than 10 floors, some buttons became redundant. Owners were not too happy with this inability to customise.

Figure 2 Original Miconic 10 Key pad

g) **Non-numeric floor identification**:

The original Miconic 10 keypad also limited the use of non-numeric floor identifications. This too was a matter of annoyance for building owners used to customisation.

h) **Power outage**:

Power outages have been a common occurrence at many cities in India and provision of automatic rescue devices or generator sets is mandatory. That passengers had to exit the car and re-enter their destination and wait for another lift was another trigger for annoyance.

As problems and issues presented themselves, field engineers and mechanics came up with quick fixes. Learning on the go was the norm. With the limited experience, the quick fixes were aimed at resolving the symptoms. For instance, to take care of the system cheaters and saturation issues, engineers increased the capacity of each car virtually. More often than not, the disability wheelchair button was disconnected. For the users used to position indicators, group indicators were provided.

While these quick fixes solved one problem, they led to others. For instance, with the group position indicators, passengers used to the collective system would make their own analysis as to which lift should be serving them and be perturbed when they had another lift allotted to them.

The issues related to power outage still remain unresolved.

3 PLACEMENT OF INPUT TERMINALS

Sometimes an unrelated requirement led to learnings that led to major improvements in the DCS operation. One such key learning came from the L&T IT Buildings at Hyderabad where occupant entry was highly restricted.

At the L&T IT buildings, the building administration was clear that the DCS input terminals would be located at the turnstiles (at the time integration with turnstiles was not an option). This had an immediate effect in resolving the problems 2 a) to 2 b) listed above.

It became obvious that positioning of the input terminals outside the lift lobby and away from the conventional hall button locations is a key requirement to an effective DCS operation. The walking time from the input terminal to the allotted lift was not perceived as part of the waiting time giving passengers a sense that they boarded the lift much earlier, which too gives an added advantage.

Unfortunately, even today this requirement is given a go by to accommodate the architect's sense of symmetry and lobby design. Lift salespersons, installation engineers and even consultants give in to the architect's and developer's whims without recognising that the location of the input terminal is prerequisite to a successful DCS operation. This is not limited to India.

Over the years it became possible to interface access control (and lobby turnstiles) with the DCS input terminals. This eliminated the problems 2 a) to 2 e) almost completely while also improving the efficacy of the DCS system. T

4 OTHER SOLUTIONS & ISSUES

Today's average lift passenger is pre-occupied and more often than not on their phones. And therefore, it is even more critical that the lift interface must be simple and easy to use. There also must be commonality in usage interfaces virtually making the whole travel a *no brainer* exercise irrespective of the supplier or building.

a) Scrolling Input Terminals & Touchpads

To tackle the problem of limitations of a telephone keypad input interface, scrolling screens were introduced. This also brought about a higher aesthetic and space age offering that the architects loved.

However, these input terminals increase the time required to input the floor number and receive the car allotment. The time requirement increases exponentially when the input is being provided by passengers with special needs.

Unlike the conventional up down hall call buttons or even the telephone keypad input terminals, the replacement / repair costs of these scrolling and touch pads are very high adding to the maintenance costs.

b) Alpha Numeric floors and lifts designation

To accommodate the architect's / building developer's requirements, alpha numeric floor numbers and lift designations are now being provided. With scrolling input terminals alpha numeric floor numbering is possible.

However, this combination creates other problems. Some examples -

a) When lifts are identified by numerals, there is a possibility of conflict between the floor number and lift identification.
b) Lifts being identified as P1, P2 also creates problems when the building has podium floors identified as P1, P2.
c) When the ground floor is identified as G, it creates conflict with the G lift. The following will be a nightmare for the visually challenged.

Figure 3 Confusing Nomenclature Signage – one G pertains to the floor number while the other pertains to the lift identification

c) DCS with hall position indicators

DCS with hall position indicators are now available. However, passengers try to second guess which lift should serve them thereby creating dissonance when the lift allotted to them is not what they perceive as being the ideal lift.

d) Fireman's Lifts

DCS lifts when a fireman's lift requires a car operating panel (COP) within the car. Some companies have a hidden COP in a cabinet which automatically opens up on the fireman operation while others require a separate key to open the cabinet. Some others provide a regular COP (operatable under fireman operation). Passengers end up trying to register calls on this COP.

The ideal approach is the hidden COP. Standardisation must be brought about so that firemen do not need to second guess what to expect.

e) Walking Time

When the input terminals are placed away from the conventional locations, a walking time has to be to be factored in while allotting a lift such that the passenger does not the miss the lift.

Companies follow varied approaches to address this requirement, from programming each individual input terminal depending on the distance to the allotted lift to setting a common average for all terminals on a floor and all lifts. There are also variances in when and how different companies apply the walk time.

While walking time can be built in, the input terminals should not be that remotely located, that the passenger could miss their lift.

f) Hybrid Solutions

Hybrid solutions that involve a combination of DCS input terminals as well as conventional up down call buttons and car call buttons resolve some of the problems associated with the DCS down peak and inter-floor traffic handling.

Yet, it creates other complications. For instance, to ensure the DCS discipline passengers need to be aware at which level they are boarding and therefore the required action. On the other hand, it condones breaking the discipline of boarding only the allotted lift, a prerequisite to make DCS effective.

5 DCS MYTHS

a) DCS and Traffic Analysis

Peters[1] demonstrates that in comparison to conventional systems, DCS lifts improves up peak performance with exactly the same parameters other than the dispatching system. A further dive into the field settings indicate that there is a difference between both systems.

For a conventional system, the up-peak calculations are based on an average car loading of 80%. Effectively the car can be loaded till the load weighing device sets in. Or practically till the perceived personal space is encroached upon. In a building with inadequate elevatoring, the possibility is high that the personal space preferences will be given a go by and that the load weighing decides.

On the other hand, for a destination control system by virtue of its functioning the system requires to factor in tailgating and individual body weights that may be in excess of the lift design car capacity or standard. To this end, the number of passengers allotted to a particular lift during on field commissioning is normally set at a maximum car loading of 60% to 70%. In some cases, the maximum loading is set to as low as 50%. This brings the average car loading well below the average car loading of 80% assumed for the up-peak calculations for conventional lifts.

It is seen that designers use the same average car loading for conventional and destination control simulations. Depending on the tipping point where increased capacity for a conventional system overrides the benefits of the reduced number of stops for a DCS, the results could lead to a skewed picture. Designers are known to recommend reduction of the required number of lifts based on these skewed calculations. Even with the same parameters Peters[1] discourages under elevating a building let alone varied car loading assumptions.

While DCS provides handling capacity advantage over a conventional system this advantage normally kicks in only when the overall number of lifts, capacity and speed is just short of adequate. If the elevatoring is bad, DCS could make the overall efficacy of the elevatoring even worse.

b) Number of lifts in a group and positioning

With conventional grouping, the largest lift group was determined by the practical walking distance and line of sight and would not exceed eight, with four lifts facing four lifts. With DCS, increasing the size of the lift group is a possibility. The positioning of the lifts still has to consider practical walking distances and line of sight.

However, designers have pushed the envelope to have a single lobby with sixteen lifts in a single group with eight lifts facing eight lifts. It is anticipated that the occupants at these buildings will struggle to access their lifts. This could also turn to be a safety risk when there is two traffic and rush to get to the allotted lift.

6 CONCLUSIONS

In the last 2 decades, DCS has evolved from a solution from an individual company to a solution available with every major. The ready availability of non-proprietary solutions has ensured that the DCS offerings are not just from the majors. In this period dispatching algorithms too have evolved and have become more intuitive and efficient.

After the slow down for a few years, the spread of DCS in India has been very rapid and is no longer a novelty.

Undoubtedly DCS will become the norm across the board and the minimum expected by passengers. However, a significant level of passenger interface standardisation will be required between the various solution providers to make it truly a *no brainer* operation for the passengers. Architectural priorities are important but must concede to the primary function of facilitating the lift efficacy and making the building viable.

Lift companies and designers must also be realistic about what DCS can achieve.

REFERENCES

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BIOGRAPHICAL DETAILS

TAK Mathews has close to four decades experience in the construction and vertical transportation industry and is the principal consultant at TAK Consulting. He is a representative on the lifts and escalators standard committee of the Bureau of Indian Standards and of the chairman for the lifts and escalator section of the National Building Codes of India. Mathews is the founder of the Elevator & Escalator Safety Trust (EEST), India set up in 2008.