

### **Introduction**

Man's freedom to design buildings of ever increasing height has often been attributed to Elisha Otis' invention of the lift safety gear and the consequential rapid adoption of the lift as a safe way of moving people around tall buildings.

To this day lifts remain integral to a building's design and its ability to function efficiently and effectively. In spite of the world's mounting concerns over security, our desire to build ever taller appears to continue unabated.

Last year the 509m (1671ft) Taipei 101 building opened, taking the title of tallest building in the world and, in the UAE recently ground was broken for the Burj Dubai tower, a building that redefines 'tall' with a design height of around 700m (the exact height remains a guarded secret).

The role of the lift in making these and other buildings viable remains as pivotal as always.

Lifts however take up significant amounts of core space and in buildings, space is money.

This article sets out to provide a little background information on some of the new technology which, when used appropriately, can reduce the space occupied by lift cores.

### **The Design Balance**

Reducing the number of lifts frees up space that can be 'returned' to usable area of value. In high-rise developments in particular this 'return' can sometimes be the deciding factor in overall economic viability as the net:gross ratio improves with smaller lift cores.

Capital and lifetime costs should of course also form part of a lift designer's considerations however, in large commercial developments in particular, it is the value of the space take itself rather than the cost of the equipment that is often a key factor in the selection of lifting systems.

Good lift system design however is not just about space take and cost though: any lift system should also be capable of meeting the demands placed upon it by users.

Analysis of people movement within a building over a typical day shows clear peaks in demand in the morning, lunchtime and evening. Cutting things too fine in the pursuit of nett lettable or lower cost runs a very real risk of having a building with lifts that cannot meet these peak demands. The consequence of this can be people queuing in the lift lobbies during peak periods and a quickly gained reputation for a building that doesn't 'work'.

Conversely, too conservative an approach in design may result in a lifting system with inherent performance that is never fully utilised. Such a system is a particular luxury if one considers the value of the lost space.

This process of balancing the design goals of minimal space take, compliant performance, lowest capital and lifetime cost is a complex task and one that requires the skills of specialist, creative lift design engineers.

### **Space Take**

The drive to reduce the space occupied by lift cores has resulted in some innovative new products, applications and technology coming to the lift market, particularly in the last ten years.

Perhaps the biggest recent change has been the introduction of the machine-roomless {MRL} lift. MRL lifts came suddenly to the market back in 1996 and like most good design the concept was simple.

For years previously the machinery that drives lifts was housed in a separate machine room space, located either above or below the lift shaft. The MRL lift concept moves all this machinery within the lift shaft itself thereby freeing up the space previously taken by the machine room.

In a single design step the lift machine room was consigned to history. Almost.

MRL lifts were originally designed as a commodity product, commonly known in the industry as a 'model' lift, and were limited in both duty range and application.

Whilst these limits have been pushed back considerably since launch, some continue to remain. In order to retain commercial flexibility (i.e. 3 or more manufacturers able to bid at time of tender) MRL lifts currently should be considered to have the following limits:

- speed up to 2m/s;
- travel up to 75m;
- car size up to 26 person / 2000kg;
- up to 5 car group;
- passenger lift or light goods applications;

Architecturally, whilst a certain amount of bespoke design may be applied to MRL lifts, e.g. special architectural finishes, extended door and car heights, non-standard car sizes, the limitations again are much tighter than those associated with traditional machine roomed lifts where pretty much any vision may be achieved provided it's safe and supported by the budget.

Like many of today's in demand products these limits continue to be pushed back making MRL technology the future of lift design. In 2004 Kone launched the MaxiSpace™ MRL lift which removes the need for a counterweight. This offers smaller lift shafts for a given lift capacity, freeing up more space.

A leading global manufacturer recently stated they believe 90% of the world's new lift deliveries will be MRL by the year 2020.<sup>(1)</sup> So until that time how can space be minimised on schemes where MRL lift technology is not appropriate?

The conventional design approach to 'lifting' a building sees all lifts serving all floors direct from the main entrance lobby. As a building's height and population increases, the guideline limit of a group of eight lifts operating together cannot meet the demand and additional groups of lifts are required. Typically each group of lifts will be assigned a zone of floors creating low-rise, mid-rise and high-rise lift groups.

In these applications the required speed, group size and travel are often outside the limits of current MRL lift technology and conventional machine roomed lift solutions must be found. Here also though are opportunities for reducing space take.

Further advances in the cause of minimising space came about with the adoption of shuttle lifts, double-deck lifts and more recently with the launch of products such as ThyssenKrupp's TWIN® lift system.

When large groups of lifts are required to serve defined zones within a building the conventional solution as outlined earlier is to serve the zones direct from the ground floor. Whilst this provides

a one-trip service to any floor in the building the lifts serving the higher zones have to pass through the lower floorplates taking up valuable space. This problem is addressed with the adoption of a Sky Lobby shuttle lift system. Here a secondary lobby is created within the building at an upper level. A set of dedicated shuttle lifts move those people who are resident in the upper parts of the building direct from the ground to the Sky Lobby. From the Sky Lobby they then take their local lift groups to their desired floor. The advantage of this arrangement is the number of shuttle lifts required (and hence the space they occupy) is much less than the 'direct from ground' lifts they replace.

Back in the 1930s, as skyscrapers started rising up in many major US cities, the quest for space began heating up and the double-deck lift was born. Again a simple idea the double-deck lift comprises two conventional lift cars fixed together that travel in the same lift shaft. This arrangement significantly reduces the number of lift shafts required to serve a particular passenger demand.

ThyssenKrupp's new TWIN<sup>®</sup> lift system may be viewed as an evolution of the double-deck lift concept. Here two lift cars run within one lift shaft as with the double-deck, but the lift cars are free to move independently of each other. Robust electrical and mechanical safety measures are incorporated into the equipment design to ensure the lift cars can never meet. Each car is assigned an upper and lower zone to serve within the building and destination based control technology ensures efficient levels of service.

All of the above offer significant opportunities for returning space back to lettable but their assessment and selection should always be done with care and specialist advice. Each of them may have some associated disadvantages such as additional capital cost, lifetime cost, double trip journeys, dual access/egress floors, etc.

A complete assessment of the 'design balance' should always be carried out to identify the most appropriate solution for the building in question.

## **Summary**

The last ten years has seen more significant changes in the world of lift design than most decades prior, however the appropriate selection of available technology and the optimising of people movement within buildings continues to demand expert knowledge and specialist engineering skills.

The wrong solution will be costly in both the short and the long terms, undermining the owner's investment and becoming a constant drag on the occupant's use and enjoyment of the premises.

The right solution will improve overall functionality and add significantly to the value of a building both as an investment and an effective base for an occupier's operation.

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*(1) Source [www.OTIS.com](http://www.OTIS.com) news archive June 9<sup>th</sup> 2005*