3D – Destination Double Deck
The Next Generation of Double Deck Applications

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ABSTRACT

This paper explores the work done in the past six years on identifying the inherent and perceived problems with double deck lifts in general and when used with "conventional" two button collective traffic control systems in particular which include:

(a) Large number of occurrences of the "other deck loading" stops frustrating passengers.
(b) Inability of the lower deck to serve the top floor of the zone and user frustrations.
(c) Poor arrangement, signage and circulation within the dual main floor lobby of the building.
(d) "Forcing" of 50% of building users always to use escalators at the main lobby of the building

and how they are being addressed using "3D" i.e. Destination Double Deck control systems to solve these problems and improve the users experience and perception of lift service within a new building. As well as identifying the problems and the solutions this paper indicates the extent to which the next generation of high-rise buildings, particularly those presently in design and construction in the City of London where the author is the principal consultant, are adopting the solutions proffered.

1. INTRODUCTION

The City of London, unlike London's rival financial centre Canary Wharf, has far more limited opportunities to build large floor plate buildings within its densely developed confines, its random historical street patterns, conservation areas and listed buildings. Much like other city centres around the world, such as Singapore, where land costs are at a huge premium, there is now an intense need to provide more large-scale buildings that can provide headquarters accommodation for large financial institutions etc. if its rival is not to win all the major financial institutions into its neighbourhood. Given the limited development sites and opportunities for large scale low rise office buildings the planning authorities have accepted and now encourage the development of a cluster of high rise buildings in the heart of the City of London and also at designated transportation interchanges such as London Bridge station. The

concept being not to further overburden the public transportation within the city centre by allowing tall large scale buildings to be built directly on or adjacent to these major commuter transportation interchanges.

Since 1999 the author has been involved in the planning of several new landmark towers for London. Three of these are as follows:

Figure 1. From left to right: Heron Bishopsgate Tower (46 floors), London Bridge Tower (68 floors), Broadgate Tower (36 floors)

From the outset of the design of all of these towers the quest for efficiency was paramount. If the buildings were to be commercially viable then maximum handling capacity per unit of shaft area was critical. The author persuaded all three developers and their architects that not only was the use of double deck lifts the most efficient means of "elevatoring" these buildings but that, within the extended timescales of planning approval and construction I was confident that the next generation of double deck traffic control systems would be available i.e. "Destination Double Deck" – 3D if you like!?

Why was this an important aspect of the decision to employ double deck lifts? The answer lay in the apparent negativity of real estate agents in cities such as New York where double deck lifts, it appeared, had got themselves some bad press. Their owners, real estate agents and tenants viewed the few buildings employing double deck lifts negatively. The developers of the new buildings in London were very guarded and conservative and my task was to convince them that all the "negatives" I had managed to uncover could be addressed with good building planning with the architects and the promise that 3D held out to address the remaining known deficiencies, These deficiencies included the following:

(a) Large number of occurrences of the "other deck loading" stops frustrating passengers.

(b) Inability of the lower deck to serve the top floor of the zone and user frustrations.
(c) Poor arrangement, signage and circulation within the dual main floor lobby of the building.
(d) "Forcing" of 50% of building users always to use escalators at the main lobby of the building.

In 1999 the author presented all these perceived negatives of double deck lifts to Heron Corporation and the solutions and this was the basis of their decision to go ahead with double deck lifts for their new tower. This paper addresses all of these points and indeed makes some further observations on the potential advantages of 3-D "Destination Double Deck" over 3-C "Conventional Collective Control".

2. ADDRESSING THE PERCEIVED NEGATIVES

2.1 Main Lobby Design

With the adoption of double deck lifts within a building the design of the main entrance circulation and access to the dual main floor lobbies is critical to user acceptance. Users will tire quickly of long circuitous circulation routes, unclear signage or lack of "democratic" experience. By this I mean why should half the building population be forced to take an escalator and an extra 20m walk perhaps compared to the other half of the building population.

Circulation of building users needs to be as direct and obvious as possible containing the minimum walking distances possible. The main lobby of the Heron Bishopsgate Tower is shown below diagrammatically (see Figure 2). Points to notice are as follows:

(a) Turnstiles are placed as near to escalators as possible. The escalators themselves are placed as near as possible to the upper main floor lobby.
(b) The route to both the lower and upper lobbies can be determined visually by the user and is reinforced by simple signage!
(c) NOTE: Signage has been radically changed from the conventional "odd/even demarcation" to signage indicating only where identified cars can be found.
(d) NOTE: With destination control every car has to be individually identified and the car reference identity as between groups has to be "non standard" i.e. continuous between groups forming part of the same lower or upper main floor lobby. See Figure 2. In the low rise upper cars serving the upper main floor lobby A through E combine with the high-rise cars F through K (deleting the letter "I"). So that the upper lobby simply becomes signed for cars "A through K". There is a question mark over the operational viability of then labelling the lower deck cars L through V (deleting the letter "O") as dummy identifiers used only at the main lobby as users at the upper floors will only ever be assigned a car A through E or F through K depending on which floor they are on. Watch this space!
(e) Normal booking of user's destinations takes place at the security turnstile by abstracting the encoded normal floor of work from the user's card.

NOTE: This is normally best achieved by a separate reader and output string to the elevator control system rather then be reliant upon the potentially spurious timings of a third party security system and database which can become a source of delay to car assignments to users. In this way the security system and the elevator car assignment process run in parallel.

(f) NOTE: It is now accepted that walking distances of up to 40m can generally be successfully achieved between a call booking point and an assigned lift entrance with a well designed algorithm capable of differentiating individual booking points from their installed locations and the average walking time to that lift entrance.

2.2 Escalator Usage

From the negative comments received from existing double deck buildings it is clear that the use of an escalator at the main lobby often accompanied by a resulting longer walking distance and the fact that it is only half the building population (always the same half!) that needs to make this extra journey is viewed in some buildings as a big negative.

There is, however, little doubt that escalators will continue to be a necessary part of the design of the main building lobby in order to accommodate double deck lifts.

The solution here can be two fold. Firstly if site conditions dictate or the lobby design affords the opportunity it is always a good idea to try to make all users make an escalator journey.

At the Broadgate Tower due to its construction over railways lines it was necessary to elevate the dual main lobby to a higher than normal elevation. In this building users are segregated into those going to an odd or even floor at the main entrance and both groups make one escalator journey up to the appropriate main floor lobby.

At the Heron Bishopsgate Tower however the principle of rigid odd and even floor demarcation has been dispensed with entirely.

The 3-D control algorithm has the opportunity to book users to cars entirely flexibly. It can also mix odd and even floor intending passengers within the same cab if there is an advantage to doing so e.g. predominant short peak flow of passengers to even floors the system can put some users for higher even floors in the alternative deck and whilst stopping perhaps at consecutive odd/even, odd/even, odd/even floors initially on travelling up from the main lobby could skip a floor and serve even/odd floors thereafter. By switching alternately cabs to serve first odd floors from the upper main lobby and then even floors it means users assigned car and main floor lobby will almost certainly change each time they enter the lobby. This process then appears democratic to all users.

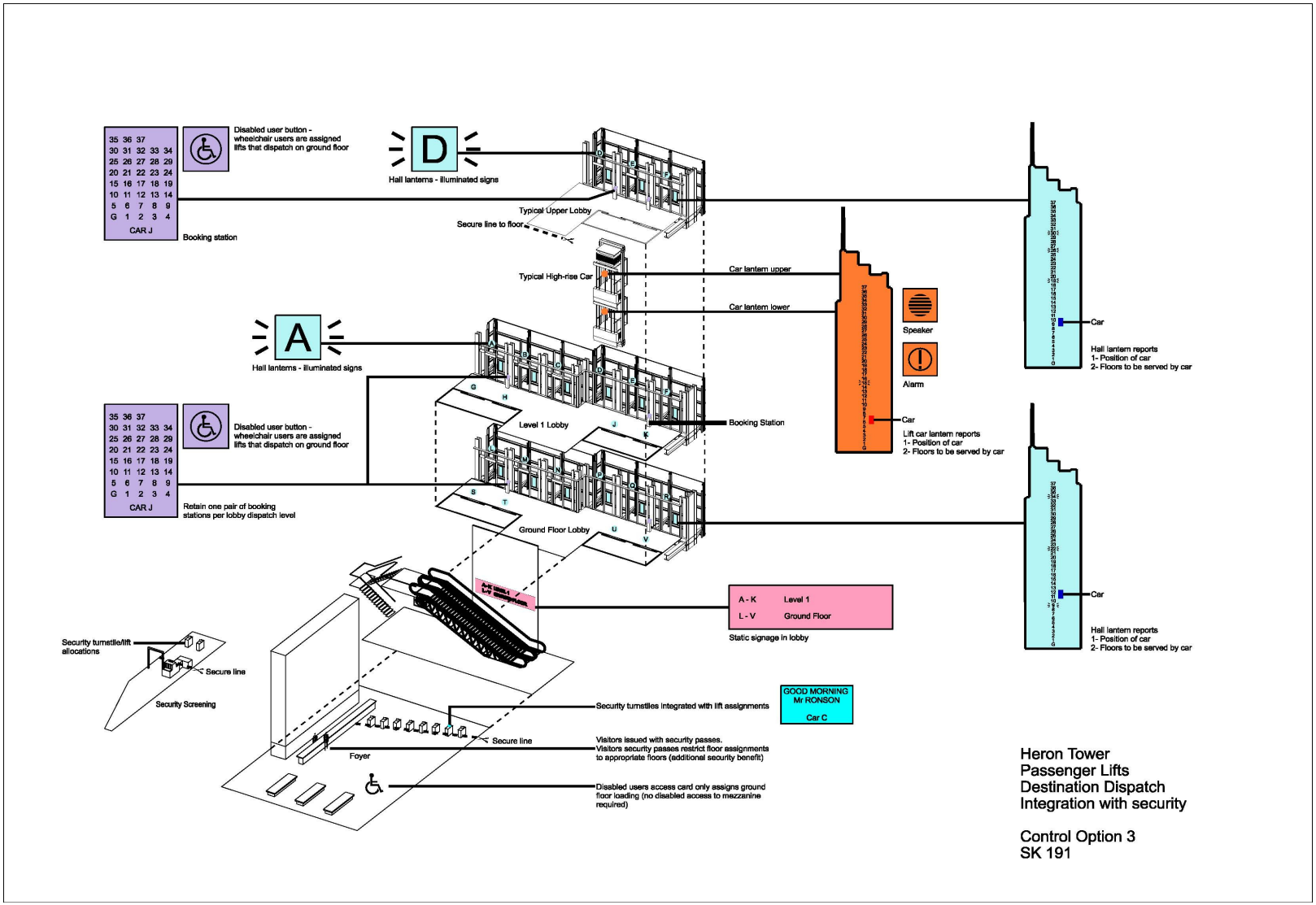

Figure 2. Heron Bishopsgate Tower – Diagrammatic Overview (courtesy Kohn Pedersen Fox Architects)

This flexibility it is believed will also boost potential handling capacity. Very preliminary simulations using "Elevate" with the assistance of Dr Peters has indicated that Destination Double Deck control can certainly boost "up peak" handling capacity, typically by at least 10% with no corresponding degradation in "quality" of service. In addition the resilience of the system to deal with very large handling capacity requirements and, indeed, to cope with one car being "out of service" for example is becoming ever more apparent the more simulations that are run. Figures 3 and 4 show saturation is hit much later with 3-D than 3-C.

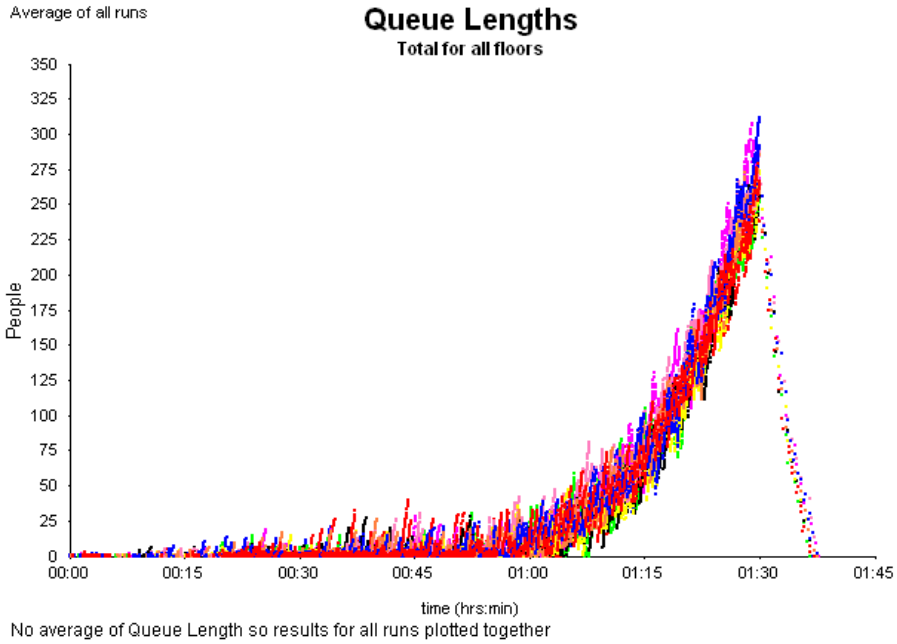

Figure 3. Heron Bishopsgate Tower – Queue Length as Demand Increases with 3-C Conventional Collective Control

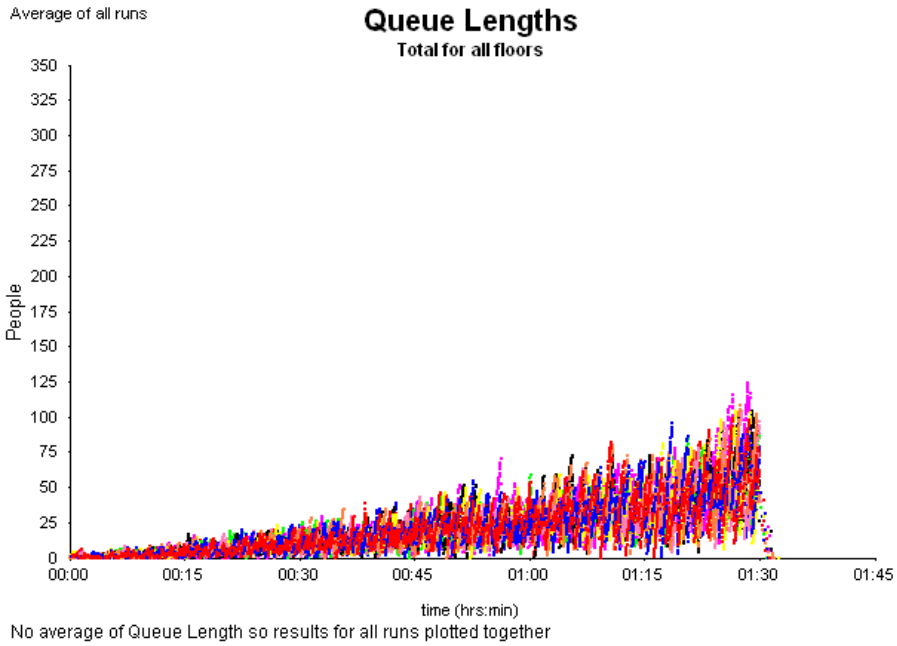

Figure 4. Heron Bishopsgate Tower – Queue Length as Demand Increases with 3-D Destination Double Deck

2.3 Access to Top Floor of a Given Zone

Allowing the lower deck of a double deck lift to serve the top floor of any given zone or, indeed, the top floor of a building requires additional space take and is the reason why many double deck installations don't offer this facility. This is perfectly acceptable for users entering the building with a conventional odd/even deck demarcation and travelling to this uppermost floor from the main lobby. However, for users travelling to and from this floor in interfloor traffic it can be a nuisance. With no way of indicating their destination users had a 50% chance of getting into a car that could not serve their floor. They would have to exit at the penultimate floor and re-register a call for the top floor when they could be certain to get the right deck assigned. Alternatively a third button could be installed in every lobby for the top floor but as with all collective control systems it is easy to abuse and did not properly solve the problem.

Needless to say the adoption of a full 3-D control system with booking terminals in every upper lobby enables the control system to send a suitable car and, indeed, although only half the cars may be able to serve this floor due to overhead limitations the control system can compensate for this, by prioritisation, so that users do not wait longer than the average prevailing waiting time.

2.4 The "Other Deck Loading" Phenomenon

Very simply when a double deck lift makes a stop and there is not demand for passengers to board or alight from both decks then inside the appropriate car a message is given announcing "Other Deck Loading". Dependent upon the tenancy of the building, the relative amount of interfloor traffic and other operational conditions the frequency of users experiencing these events, which appears to be more frustrating than a stop made in a regular single deck lift during its travel, will be greater or lesser. The biggest reason for this is, of course, because the users are driving the lift to make stops rather than the control system planning which lift can best handle the hall call. With 3-D there is the opportunity to plan ahead committed stops and either attempt to use both decks efficiently to serve calls on adjacent floors or even switch off one deck as soon as traffic levels allow.

Initial work in this area indicates that it might be possible to reduce these events by some 70% but this is an area of continuing research and the author is challenging manufacturers to spend more time addressing this final piece of the jigsaw!

3.0 CONCLUSIONS

Within the coming 24 months the first of the next generation of 3-D systems will go live! In the author's view there can be no reason to go with the old-fashioned 3-C systems as 3-D is now feasible and this paper has attempted to outline some of the many benefits of utilising this next generation of double deck control systems.