British Council for Offices (BCO) Guide to Specification 2014 Vertical Transportation

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Abstract. The British Council for Offices (BCO) has established over the years a well respected, referenced and utilised guide to best practice in the specification of commercial offices. Whilst the guide's usage is particularly prevalent in the London market, its relevance and value spans the United Kingdom and further afield.

September sees the publication of the sixth edition of the guide. Calling on the expertise of more than 100 leading industry professionals, all experts in their field, the guide establishes recommended benchmarks for all aspects of commercial property design.

A growing section of the guide deals specifically with vertical transportation and this addition sees the advice move another step towards closer alignment with other established guidance, particularly the Chartered Institution of Building Services Engineers (CIBSE) Guide D [1]. There are revised demand templates proposed that are based upon real world survey data. Car loadings have been reviewed and revised, again towards more realistic, observed levels. Guidance on goods lifts has been expanded along with additional comments on issues relating to fire-fighting lifts.

This paper provides an overview of the key technical elements of the guide, the thinking behind the advice, and trends for the future.

1 BACKGROUND

Whether one considers the design of effective vertical transportation strategies as an art, or a science, or simply a mystery, there should be no doubt as to the vital contribution lifts and escalators provide in making buildings work.

The *raison d'être* of most buildings is to provide a comfortable, safe environment within which people may live and work. People move around these buildings as blood flows around bodies; lifts are to a building as hearts are to bodies; a vital organ.

Buildings with insufficient lift and escalator provision quickly gain a reputation and lose tenants. Buildings with an overprovision cost their owners significant sums in the lower rent revenues generated by the smaller lettable area.

Much guidance has been published over the years to assist designers in developing appropriate vertical transportation systems to meet the predicted demands. From the seminal guides of Strakosch [2] and Barney [3], through to the foundation document of the CIBSE Guide D. The BCO guide has never purported to provide such detailed guidance as any of these three, but rather to provide the layperson reader with a key set of benchmark measures by which they may assess any design and challenge its provisions intelligently. The challenge therefore when drafting such a guide is to resist the temptation that is so commonly attractive to engineers to delve into the detail, and, with one's intended audience in mind, ensure the retention of appropriate simplicity at all times.

Luckily in this endeavour the review committee comprised the services of an able team of experienced peers in Mr. Simon Russett (Hoare Lea), Mr. Julian Olley (Arup), Mr. John Stopes (ex

WSP now The Vertical Transportation Studio) and Mr. Bill Evans (D2E International), with Mr. Neil Pennell (Land Securities) providing a technical chairmanship. The review process commenced in the summer of 2013 and concluded a few months ago.

2 THE NEW GUIDE

The last guide, published in 2009, provided the reader with significantly more information on vertical transportation than its predecessor, and this trend continues. Key considerations in drafting the new guide included:

1. Recognising the continuing trend towards increased occupancy densities
2. Adopting demand patterns based on actual building survey data
3. Aligning the advice with other established benchmarks, (e.g. CIBSE Guide D)
4. Recognising the prevalence of destination control (DC)
5. Taking another step away from the "interval"

2.1 DC or not DC

The previous guide recommended a different set of performance criteria for conventional control and destination control, which appeared in distinct, separate sections. The new guide recognises the increasing demand for destination control within the commercial office sector (particularly in London) and now proposes a single set of recommended performance criteria applicable to both destination and conventional control.

2.2 Waiting time vs. interval

Whilst the use of interval as a key performance criterion is well established, and indeed well justified by the historical complexity of mathematically calculating waiting time, its relevance in a "simple" guide such as the BCO is questionable. Users of lifts (and therefore layperson readers of the guide) intuitively understand the concept of waiting time better than interval and it has therefore been the goal of the guide to progressively move towards waiting time as a referenced criterion and away from the more complex measure of interval.

With destination control becoming the norm, the typical approach to lift traffic analysis now moves towards simulation and with simulation comes the ability to assess accurately and quickly the superior waiting time criterion.

The new guide therefore makes no recommendations as to appropriate interval times, instead noting the interval's demotion in favour of waiting time.

2.3 Population

It has long been recognised that the challenge for effective lift traffic design is not just in simulating the performance of the lift system itself but often more in accurately predicting the population of the building and the resulting demand patterns on the lifts.

As for previous issues of the guide, the BCO commissioned an extensive survey of building occupancy densities [4] which covered more than 380 properties all around the country.The survey concluded that, whilst there was some evidence to support the general feeling that densities were increasing significantly, this was not entirely supported by the findings. The overall mean density of surveyed properties was 1 workplace per 10.9 m^2 net internal area (NIA). Of the sample properties 38% fell within the range 8-10 m^2 (NIA), with 58% falling within the wider range of 8-12 m^2 (NIA).

Table 1 below shows that the highest densities are in the Corporate sector at 13.1 m^2 NIA per person and the lowest in the Financial & Insurance sectors at 9.7 m^2 NIA per peron. London and the South East have lower densities than may be expected which is thought to be due to the greater proportion of space allocated to lower density uses such as client entertaining and meeting room space.

Table 1 Breakdown of Results by Sector and Region

Sector	Density (m^2 NIA)	Region	Density (m^2 NIA)
Corporate	13.1	South East	12.7
Financial & Insurance	9.7	Wales	11.4
Professional Services	12.3	London	11.3
Public Sector	12.1	Midlands	10.2
Technology, Media & Telecoms (TMT)	10.5	North	10.1
		Scotland	9.7
		East	9.4
		South & South West	8.6

The BCO also undertook an analysis of data held by IPD[(1)] covering over 4 million m^2 in 823 properties from the private sector and over 4 million m^2 from the central government sector.

The trend from the whole data set during the relatively brief period of time from 2008 to 2012 showed very little change (Fig.1).

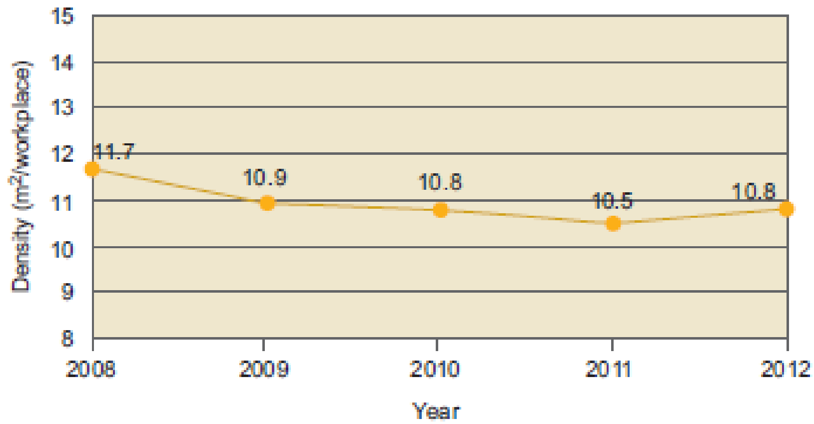

Figure 1 IPD data: overall mean density over time

However when those buildings that appeared in all five data points were analysed (some 0.3 million m^2) a clearer trend of increasing density is observed (Fig.2). The BCO draw an implication from this trend that occupation densities may be slowing as they tend to a "level" beyond which perhaps the benefits of increased efficiency diminish.

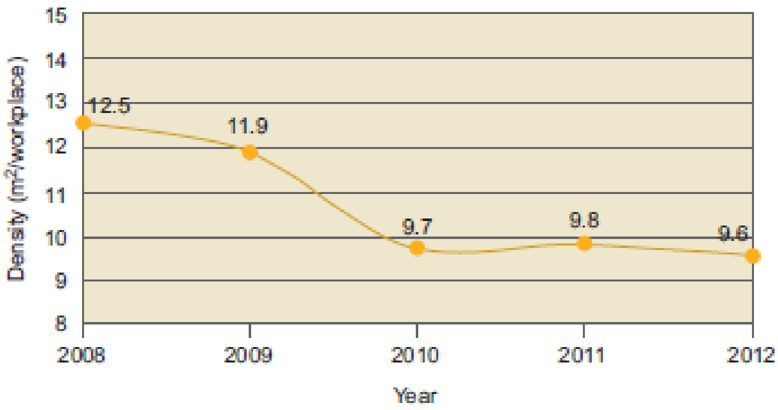

Figure 2 IPD data: overall mean density for the same buildings over time

The findings of the survey presented sufficient evidence to expand the range of recommended occupancy densities for lift traffic design. Previously the guide recommended designing to an occupancy of 1 person per 12 m^2 (NIA) and noted that this reflected a workplace density of 1 person per 10 m^2 (NIA) with a utilisation factor of just over 80%. The new guide retains this previous advice but now goes on to propose alternative criteria for high density offices, suggesting an effective density of 1 person per 10 m^2 (NIA), reflecting a workplace density of 1 person per 8 m^2 (NIA) with a utilisation factor of 80%.

It should be noted that, in the author's experience, clients or their advisors will often provide the occupancy density criteria that they wish the building and lifts to be designed to meet, as this often forms a key part of the marketing strategy and differentiates the building from its competition in the marketplace.

2.4 Demand profiles

As previously noted it was a key consideration of the BCO technical committee to align, where appropriate, the BCO advice with other established guidance, such as CIBSE Guide D.

In terms of demand on lifts, the previous guide had proposed designing to a morning uppeak of at least 15% of the design population in a five minute period, comprised of pure 100% up traffic. The recommended lunchtime profile was 12% of design population with mixed traffic components (i.e. up, down and interfloor).

Informal observation of lift traffic in buildings has suggested, for quite some time, that such a demand does not exist in reality. In 1996, Peters, Mehta & Haddon presented a paper [5] on lift passenger traffic patterns noting that morning traffic peaks were less marked than traditionally assumed and that lunchtime was becoming the busiest period for lift traffic. A Stanhope paper published in 2004 [6] also concluded, albeit based upon small sample sets and a methodology that was challenged at the time, that the demand proposed by the design criteria of the time was not observed in the real world.

Working patterns have evolved and eroded the rigid start and finish times of the past. Peak demand is rarely at such high levels and traffic never purely in the up direction. Lunchtime demand is normally greater than the morning demand, and the classic downpeak is now rarely observed.

Between 2007 and 2009 Peters Research Ltd undertook case studies of lift demand in a number of buildings. The result of their work is published within Chapter 4 of the CIBSE Guide D which proposes a set of modern office uppeak and lunchtime demand templates which correlate with observed reality. The new BCO guide adopts the principles of these templates as revised recommendations and the changes are as tabulated in Table 2 below.

Table 2 Demand Profile Comparisons

Demand Criterion		BCO 2014	BCO 2009
Morning Uppeak	5-Minute Handling Capacity	12%	15%
	Traffic Mix	85% (UP) / 10% (DOWN) / 5% (IF)	100 (UP)
Lunchtime Peak	5-Minute Handling Capacity	13%	12%
	Traffic Mix	45% (UP) / 45% (DOWN) / 10% (IF)	42% (UP) / 42% (DOWN) / 16% (IF)[1]

The guide retains its previous advice to use multiple simulation runs to assess theoretical performance, and to utilise typical demand profiles that rise and fall around the specified peak handling capacity. Results as before should present the average values, as measured across the multiple runs, for the most intense five minute period.

The new guide now also recommends that performance should be tested with one lift out of service to understand the sensitivity of the system to failure and to indicate what level of reduced service would be provided in those circumstances.

2.5 Car loading

As many readers know, robust lift traffic analysis requires multiple data inputs and considerations. Moving the passenger demand profiles towards more realistic patterns could in itself be misleading unless other design parameters are also moved towards reality.

A point of some debate for some time has been the subject of car loading and whether its basis for calculation should be one of rated load or actual capacity. Again, informal evidence and possibly personal experience suggests that one rarely, if ever, finds oneself in, for example, a 13 person car with twelve other people.

CIBSE Guide D Table 3.1 proposes a set of rated vs. actual capacity numbers which are based on the premise that a human feels comfortable within an elliptical space of around 0.21 m^2. BS EN81-20 Table 6 defines the maximum available floor area for passenger lift cars of varying rated load and therefore one may quickly deduce a set of values that represent “full” cars, e.g. a 21 person car will be “full” when there are sixteen people within it.

However, whilst people may on occasion feel comfortable squeezing into a “full” lift car, this behaviour is not typically observed in the more gentile environment of an office. Here typical behaviour suggests a value of 80% of actual capacity to be more appropriate.

Consequentially the new BCO guide adopts this more realistic viewpoint and recommends that lift cars are not loaded to more than 80% of actual rather than rated capacity, assuming 0.21 m^2 per person.

2.6 Performance values

There are no proposed changes to the recommended performance times in terms of average waiting time and average time to destination, which remain as summarised below:

- Lifts should target an up-peak average waiting time across all floors served of no more than 25 seconds (s). Average waiting times of up to 30 s may be acceptable in cases where the average time to destination is 80 s or less.

- Lifts should target an up-peak average time to destination across all floors served of no more than 90 s. Average time to destination of up to 110 s may be acceptable where the morning up-peak average waiting time is less than 25 s.

- Lifts should target a two-way lunchtime average waiting time across all floors served of no more than 40 s.

2.7 All lifts to all floors

Another established principle of good lift system design, that of all lifts in a group serving all floors in the zone, has become justifiably challenged by the prevalence of destination control. Indeed, one of the attractions of destination control is it grants the designer the freedom to configure certain lifts in a group not to serve upper floors (thereby improving the net:gross floor area ratio) in a manner that is invisible to the user.

However, this approach should be used with care. It is intuitive that the fewer lifts one has serving certain floors, the poorer the performance may become. With current performance metrics being based on averages across *all* served floors it is possible for this measure to be compliant whilst average values to and from upper floors served by restricted numbers of lifts to be significantly outside the target.

The new guide draws the reader's attention to this and recommends that where all lifts do not serve all floors within a zone, the performance to and from those floors with reduced service is checked.

2.8 Destination control panels

The guide now contains some additional advice with regard to the number of destination input panels required. Whilst this should ultimately be established with the specialist lift designer, one panel per 60 passengers arriving in a 5 minute period provides a good starting point for design.

In all cases at least two panels should be provided in each lobby to provide a level of resilience in use should one fail.

2.9 Goods & fire-fighting lifts

The guide provides some new guidance on goods lifts noting that they are an important part of any commercial building and should be quantified, sized and located carefully. There is also a recommendation that dedicated goods lifts should be capable of travelling from the main access level to the highest floor served in around 50 - 60 s.

Additional general guidance is now offered on the appropriate use of fire-fighting lifts and evacuation lifts.

2.10 Additional content

The guide now contains new high level advice on other elements of vertical transportation design, such as:

- In-car multimedia screens
- Continuous operation of mobile telecoms and Wi-Fi connection
- Lift and escalator management and performance monitoring systems
- Car park shuttle lifts
- Vehicle, motorbike and bicycle lifts
- Lifting platforms
- Maintenance contracts and beneficial use

3 CONCLUSIONS

The 2014 guide takes another useful step towards better understanding of the key issues influencing vertical transportation planning. The fact that its updated advice on some of the fundamental issues is now starting to align well with other publications is encouraging and to be welcomed for this and future issues.

REFERENCES

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BIOGRAPHICAL DETAILS

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Adam started his career in the lift industry 23 years ago with Otis in London, UK. After twelve years working in construction, service, modernisation and new equipment sales, he moved into the world of consultancy with Grontmij (formerly Roger Preston & Partners) and has subsequently worked on the design of vertical transportation systems for many landmark buildings around the world.

Adam is a past Chairman of the CIBSE Lifts Group and of the CIBSE Guide D Executive Committee. He is the current codes and standards representative for the CIBSE Lifts Groups and sits on the British Standards Institute MHE4 technical committee. He is also a member of the BCO vertical transportation technical review committee. Adam is currently the UK nominated expert for WG7 working on the revision of EN81-70.