Addendum No. 2 to Guidelines on Energy Efficiency of Lift & Escalator Installations

Following the Review in end 2004/05, there are the following amendments:

Delete the original contents of sections 2.3 & 2.4, and change the sections nos. of 2.5 & 2.6 to 2.3 & 2.4 respectively.

Insert sections 5.6 & 5.7 as follows:

5.6 Lift Traffic Design

5.6.1 For any passenger lift system which forms the main mode of vertical transportation and fulfilling all of the following conditions, a lift traffic analysis shall preferably be carried out to optimise lift traffic flow:

(i) the rated speed of any lift car in a lift bank exceeds 1.5 m/s

(ii) a building that requires lift service and has at least 10 storey

(iii) the building usage shall be of the zone type as indicated in Table 5.6.1

5.6.2 In the traffic analysis, the Maximum Interval (INT) at up-peak at the terminal floor of a lift bank serving a zone of a particular building usage shall preferably not exceed the maximum values in Table 5.6.1.

Zone Type	Maximum Interval of a Lift Bank (s)
Office Zone	**30**
Hotels	**40**
Institutional Zone	**45**
Commercial Zone (Shopping Complex)	**30**
Industrial Zone	**55**
Composite Zone	**the smallest value of various *Maximum Intervals* that apply to different zone types of a composite zone *(see note 1)***

Table 5.6.1 : Maximum Intervals of Lift Banks for Various Zone Types

note 1: premises in a composite zone which do not occupy more than 1.5 percentage of the gross floor area (e.g. estate management office, mutual-aid office within a domestic block) of the zone may be considered not constitute an independent zone type.

The maximum interval requirement does not apply to a lift system that is not

the main mode of vertical transportation. An example of this is in a shopping complex with both escalators and lift system, the main mode of vertical transportation is usually by escalators and not by lift system, and the lift system does not have to follow the handling capacity requirement.

5.6.3 The Maximum Interval at up-peak of a lift bank is equal to the Round Trip Time (in sec) at the Up Peak traffic condition divided by the quantity of lifts in the lift bank. The Round Trip Time of a lift car refers to a value calculated by Up Peak Model. The Round Trip Time (RTT) could be obtained from the following equation:

$$RTT = 2Ht_v + (S+1)t_s + 2Pt_p$$

where RTT = Round Trip Time (in seconds)

t_v = time to transit two adjacent floors at rated speed (in seconds)

t_s = time consumed when making a stop (in seconds)

t_p = passenger transfer time for entering *or* exiting the lift car (in seconds)

P = 0.8 x contract capacity of lift car (in person)

The time consumed when making a stop is obtained from the equation:

$$t_s = t_{f1} - t_v + t_o + t_c$$

where t_{f1} = Single floor jump time (in seconds)

t_o = Door opening time (in seconds)

t_c = Door closing time (in seconds)

5.6.4 Unless there are sufficient technical information on the door opening and closing times for the lift equipment, the figures in Tables 5.6.2 and 5.6.3 shall be adopted in the lift traffic analysis.

Panel arrangement	Door Size *(note 2)*			
	0.8 m		1.1 m	
	Ordinary	Pre-Open *(note 3)*	Ordinary	Pre-Open *(note 3)*
Side opening	2.5s	1.0s	3.0s	1.5s
Centre opening	2.0s	0.5s	2.5s	0.8s

Table 5.6.2 : Minimum Door Opening Times To Be Used For Lift Traffic Analysis

Panel arrangement	Door Size *(note 2)*	
	0.8 m	**1.1 m**
Side opening	**3.0s**	**4.0s**
Centre opening	**2.0s**	**3.0s**

Table 5.6.3 : Minimum Door Closing Times To Be Used For Lift Traffic Analysis

note 2: For door size other than 0.8m and 1.1m, the operating time shall be calculated by interpolation.

note 3: Also known as Advanced Door Opening. The door panels of the lift car start to open when the car has entered the door zone e.g. say some 0.2m from a landing level. The time is taken from the first application of the brake to doors 90% open.

5.6.5 When a lift traffic analysis is carried out, the highest call reversal floor (H) and the average number of stops (S) could be obtained from the following equations, with the passenger transfer time assumed to be 1.0 second:

$$H = N - \sum_{j=1}^{N-1} \left(\sum_{i=1}^{j} \frac{U_i}{U} \right)^p \qquad S = N - \sum_{i=1}^{N} \left(1 - \frac{U_i}{U} \right)^p$$

where N = Number of floors above main terminal floor
U = Total population of zone above main terminal floor
U_i = Population at the *i* th floor
terminal floor = the principal floor in a building zone from which lift cars can load and unload passengers.

5.6.6 A complication for the requirement in table 5.6.1 lies with the composition zone (i.e. there are more than one single type of floor usage for the zone). In this case, the smallest value of the required maximum interval for the various floor usage types within the zone will be taken as the control value. However, if a certain type of floor usage within the zone does not occupy more than 1.5% of the gross floor area of the zone, the designer can discard this type of usage from the composite zone. This is to avoid unnecessary stringent requirement being imposed on the zone having an insignificant portion of other usage (such as a management office within a residential block).

An example of the calculation based on up-peak is included in Appendix I.

5.7 Handling Capacity of Lift System

5.7.1 The following handling capacity shall preferably be followed:

(i) a lift bank serving a *sky lobby* shall have a passenger handling capacity not less than 20 %, and

(ii) a lift bank serving *zones* shall have a passenger handling capacity not less than 10 %.

where sky lobby means a terminal floor at the highest floor served by a low-zone group of lifts, where passengers can wait for service by high-zone lifts.

The Passenger Handling Capacity for a lift bank is defined as :

$$\frac{5\,\text{min} \times 60 \times 0.8 \times \text{Lift Car Contract Capacity (no. of persons)}}{\text{Up Peak Interval} \times \text{Population Above Terminal Floor of Zone}} \times 100\%$$

The handling capacity is based on a 5 minutes interval and assuming that the lift cars are filled to 80% of the rated load (in number of persons). The reasons for assuming this 80% are:

- **The passenger transfer times are longer for a crowded lift car. For example, the last person usually takes a longer time to enter a fully loaded lift car. Researches have shown that an 80% filled up car has the best performance in terms of round trip times.**

- **Quantitatively, there are simulation studies, which indicated the up peak performance figure deteriorates drastically for lift cars filling up to 80% and above. The performance figure is obtained by dividing the Average Waiting Time by the Interval. It is a figure indicating the deviation of the actual waiting time from the ideal interval of the system.**

5.7.2 However, the following lift systems do not have to follow the handling capacity requirement:

- **lift system serving domestic buildings including those on top of podium or commercial centres (shopping complex).**

- **lift system is not the main mode of vertical transport.**
- **disable platform.**

5.7.3 The Handling Capacity requirement provides a counter balance figure for the Lift Traffic Design requirement in 5.6, as using smaller size cars could achieve the Maximum Interval requirement but not the handling capacity requirement that demands a larger no. of lift cars or larger size cars.

Addendum No. 1 to Guidelines on Energy Efficiency of Lift & Escalator Installations

Following the Review in end 2002, there are the following amendments:

<u>Addition as last paragraph of **clause 2.1**</u>

In order to meet the allowable electrical power, some good engineering practices for suspension lift are:

- Lift machine to locate directly above the lift shaft to avoid losses through additional pulley mechanism;
- Maximum rise (m) to limit to 50 (s) x Speed (m/s) to minimize the travel distance and thus the energy consumption;
- Maximum rise (m) to limit to 40m for under slung type roping arrangement with basement/side type traction, so as to minimize the travel distance and thus the energy consumption; and
- Avoid blind hoist way above the top most landing to minimize the dead weight of ropes.

<u>Addition as last paragraph of **clause 2.4**</u>

To encourage energy efficiency of Domestic lifts, the lift traffic calculation requirement for Domestic premises is uplifted to suit the local trade practice, which does not normally specify a minimum INT based on full calculation, with the capacity and number of lifts being determined by general rule of thumb. However, designers should try their best to achieve a minimal INT in the lift traffic design.