

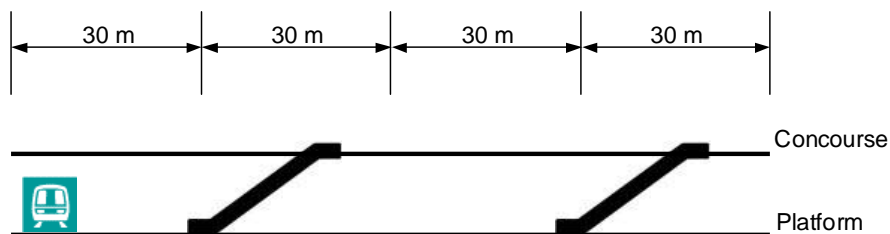
Exercise 03 -- Lift and Escalators

1. A proposed office building has 10 floors above ground and will require a lift system with an appropriate performance. Given the following data, calculate the round trip time (RTT), select a suitable lift car capacity and numbers, and determine the up-peak interval (UPPINT), up peak handling capacity (UPPHC) and percentage of total daily population that can be served (%POP).

Given data:

Number of floors to be served	= 10
Interfloor distance	= 3.4 m
Gross floor area per floor	= 1,200 m ²
Floor density	= one person per 10 m ²
Gross to usable (floor area) ratio	= 80%
Attendance ratio (of occupants)	= 90%
Rated speed of lift	= 1.6 m/s
Lift car capacity factor	= 80%
Performance (floor-to-floor cycle) time	= 8.0 s
Passenger transfer time	= 1.2 s
Desirable lift performance:-	Interval less than 30 s and peak arrival rate = 12%

2. The design engineer of a mass transit railway company are asked to check the proposed transportation system for a new terminal subway station as described below.



Building type:	Terminal MTR (mass transit railway) station
Occupant:	Passengers
Population:	800 passengers per train
Number of floors:	Two (one platform and one concourse)
Length of the train:	120 m (= length of the platform)
Train interval:	Design for a 2.5 minute headway during peak hours
Lift:	1 no. passenger (disabled access)
Escalators:	8 no. total in two sets:- 2 no. up, 2 no. down at the one quarter point of the platform 2 no. up, 2 no. down at the three quarter point of the platform

Identical equipment for all the escalators:-

- rated speed = 0.5 m/s
- escalator width = 1000 mm

- step width = 400 mm

Escalator handling capacity:-

- theoretical handling capacity, C_e , in persons/minute is:

$$C_e = 150 \times V \times k$$

where V = speed along the incline (m/s)

k = average people per escalator step

($k = 2.0$ for escalator width 1000 mm)

- assume the actual handling capacity is only half of the theoretical handling capacity

Passenger walk: Assume an average speed of 1.5 m/s (for working persons)

For the following two operation modes of the escalators, perform evaluation and suitable calculations to determine if the platform will be clear by the time the next train arrives and the likely condition of passengers queuing.

- i) Normal mode: 2 no. up, 2 no. down (for both sets of escalators)
- ii) Tidal flow mode: 3 no. up, 1 no. down (for both sets of escalators)

Comment on the ideal strategy for operating and maintaining the escalators.

3. Lifts and escalators are mechanical devices for enhancing circulation in buildings. Besides them, suggest four other circulation elements which are important for the planning and design of tall buildings. Briefly describe each of them.
4. When planning and designing the vertical transportation for very tall commercial buildings (say, over 60 floors), the following three approaches are often used. Briefly explain each of them and illustrate with sketch diagrams.
 - (a) Sky lobby concept
 - (b) Double-deck lifts
 - (c) Top-down approach
5. Draw a layout diagram to show the typical arrangement of a protected firefighting lift lobby with three lifts and one staircase. Label clearly the elements.
6. Imagine you are the Building Services Engineer designing the lift and escalator systems for a large commercial shopping complex. Discuss the important issues and criteria that you will consider when selecting and designing the systems.