

## Self-Evaluation Exercise on Lifts and Escalators

### Q.1 Solution:

$$\text{Up-peak interval} = \text{RTT} / L = 200 / 4 = 50 \text{ s}$$

$$\text{UPPHC} = (300 / 50) \times 0.8 \times 10 = 48 \text{ persons/ 5 minutes}$$

$$\% \text{POP} = 48 / 400 = 12\%$$

### Q.2 Solution:

For lift speed 1.6 m/s:

$$\text{Single floor transit time, } t_v = 3.5/1.6 = 2.19 \text{ s}$$

$$\text{Stopping time, } t_s = 3.0 + 4.0 + 4.5 - 2.19 = 9.31 \text{ s}$$

$$\text{Passenger transfer time, } t_p = 1.2 \text{ s (given)}$$

$$\begin{aligned} \text{Therefore, RTT} &= 2 \times 10 \times 2.19 + (9+1) 9.31 + 2 \times 10 \times 0.8 \times 1.2 \\ &= 43.8 + 93.1 + 19.2 = 156.1 \text{ s} \end{aligned}$$

When lift speed is increased to 2.5 m/s:

$$\text{Single floor transit time, } t_v = 3.5/2.5 = 1.4 \text{ s}$$

$$\text{Stopping time, } t_s = 3.0 + 4.0 + 4.5 - 1.4 = 10.1 \text{ s}$$

$$\text{Passenger transfer time, } t_p = 1.2 \text{ s (given)}$$

$$\begin{aligned} \text{Therefore, RTT} &= 2 \times 10 \times 1.4 + (9+1) 10.1 + 2 \times 10 \times 0.8 \times 1.2 \\ &= 28 + 101 + 19.2 = 148.2 \text{ s} \end{aligned}$$

The first term gets smaller and the middle term gets larger. The RTT is 5% smaller.

### Q.3 Solution:

For a rated car capacity of 10 persons and  $N = 11$ , the values of  $H$  and  $S$  can be obtained from the given table:  $H = 10.2$  and  $S = 5.9$ . Also,  $P =$  average number of passengers  $= 10 \times 0.8 = 8$  nos.

$$t_v = \text{single floor transit time} = d_f / v = 3.4 / 2.5 = 1.36 \text{ s}$$

$$t_s = \text{stopping time} = T - t_v = t_f(1) + t_c + t_o - t_v = 4 + 2.5 + 3.0 - 1.36 = 8.14 \text{ s}$$

$$t_p = \text{passenger transfer time} = 1.2 \text{ s (given)}$$

$$\text{RTT} = 2 \times 10.2 \times 1.36 + (5.9 + 1) \times 8.14 + 2 \times 8 \times 1.2 = 27.7 + 56.2 + 19.2 = 103.1 \text{ s}$$

$$\text{UPPINT} = \text{RTT} / \text{number of lifts} = 103.1 / 4 = 25.8 \text{ s}$$

$$\text{UPPHC} = (300 \times P) / \text{UPPINT} = (300 \times 8) / 25.8 = 93.1 \text{ persons}$$

Comments on the quality of lift service:

- As the UPPINT is 25.8 seconds, the lift service is considered good.
- For handling capacity, the total population is needed for calculating the percentage of population handled. If this percentage is larger than 15%, then the capacity is good.

Q.4 Solution:

For the stationary passengers on the right hand side, the passenger flow rate is:

$$60 \times 0.8 \times 1 \times 2.5 = 120 \text{ persons/minute}$$

For the walking column of passengers on the left hand side, the passenger flow rate is:

$$60 \times (0.8+0.7) \times 1/3 \times 2.5 = 75 \text{ persons/minute}$$

Therefore, the total passenger flow rate =  $120 + 75 = 195$  persons/minute