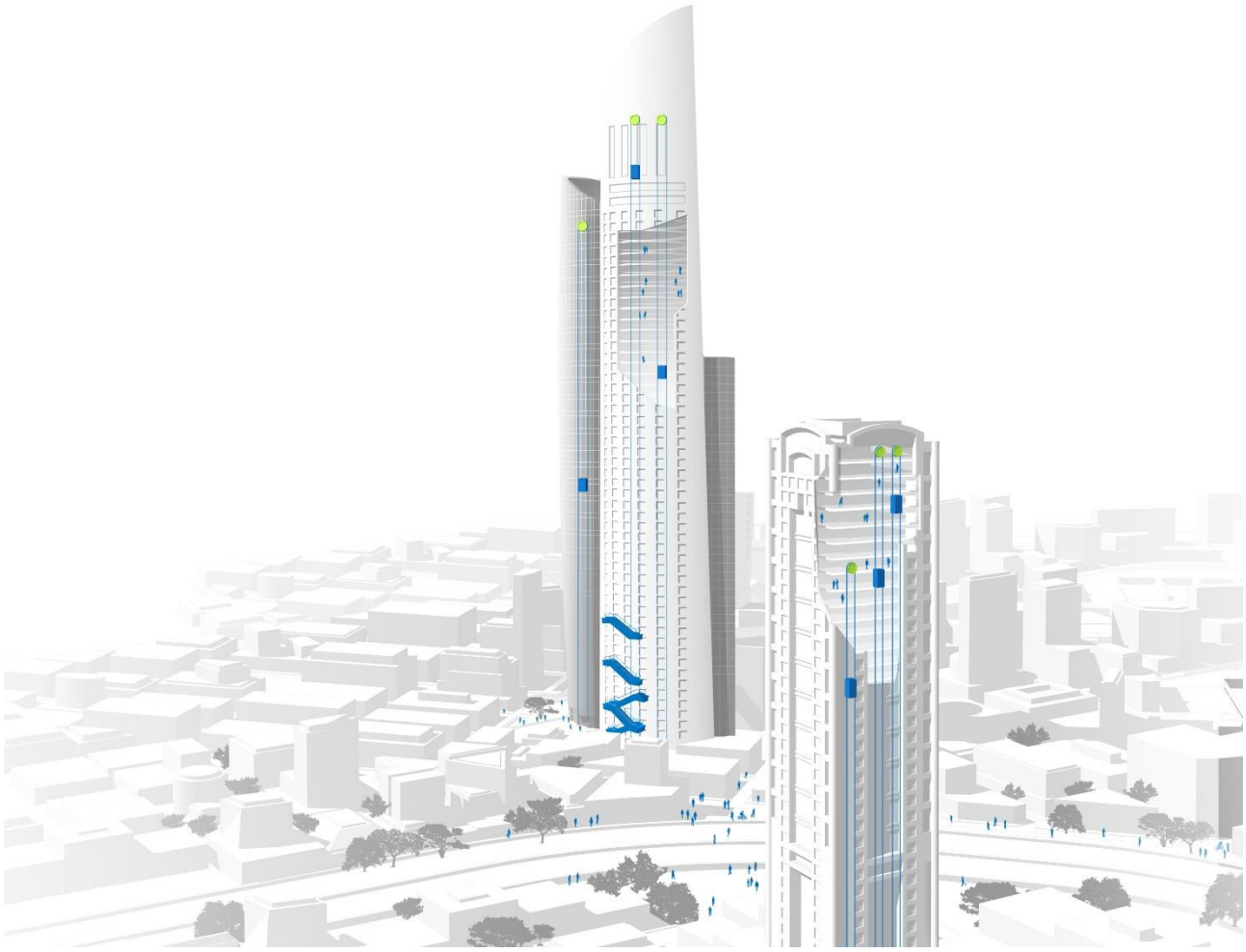
Dedicated to People Flow™



TRAFFIC ANALYSIS FOR

ARNCLIFFE, 26-42 EDEN ST (BUILDING B - 3 LIFTS)

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VERSION HISTORY

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Issue	Date	Description of change	Author	BTS version
-	2020-11-02	First issue.	JBB	1.7.7

1 Summary

People flow in Arncliffe, 26-42 Eden St (Building B) is analyzed. The building has 27 floors and the travel height is 83.5 meters. The assumed population is 585 persons.

Table 1. Simulation results.

Elevator Group: *1600kg @ 2.0mps (3 Lifts)* **Group Control**: GA (Conventional)

No of Elevators 3 **Floors/Stops** B4-B1,G-21 / 26 **Load (kg / persons)** 1600 / 21 **Speed (m / s)** 2 **NTT (s)** 41.7

Traffic type	Arrival rate (%/5 min)	CLF (% of rated load)	WT (s)	TTD (s)	IS	Rating
Up-peak (100%, 0%, 0%)						
Two way (50%, 50%, 0%)	7.5	18	28	69	1.4	★★★★

Elevator Group: **Group Control**: DCS

No of Elevators 2 **Floors/Stops** 1, 20-40 / 21 **Load (kg / persons)** 1600 / 21 **Speed (m / s)** 5 **NTT (s)** 30.0

Traffic type	Arrival rate (%/5 min)	CLF (% of rated load)	WT (s)	TTD (s)	IS	Rating
Up-peak (100%, 0%, 0%)						
Lunch (45%, 45%, 10%)						

2 Building Analysis

2.1 Building Data

Building population was estimated from the net usable area (NUA) assuming NNN per person.

Table 2. Building and population definitions, 1600kg @ 2.0mps (3 Lifts).

Floor	Height (m)	Travel h. (m)	Population	Entry %	1	2	3
21	3.1	90.5	26	-	S	S	S
20	3.1	87.4	26	-	S	S	S
19	3.1	84.3	26	-	S	S	S
18	3.1	81.2	26	-	S	S	S
17	3.1	78.1	26	-	S	S	S
16	3.1	75	26	-	S	S	S
15	3.1	71.9	26	-	S	S	S
14	3.1	68.8	26	-	S	S	S
13	3.1	65.7	26	-	S	S	S
12	3.1	62.6	26	-	S	S	S
11	3.1	59.5	26	-	S	S	S
10	3.1	56.4	26	-	S	S	S
9	3.1	53.3	26	-	S	S	S
8	3.1	50.2	26	-	S	S	S
7	3.1	47.1	26	-	S	S	S
6	3.1	44	26	-	S	S	S
5	3.1	40.9	35	-	S	S	S
4	3.1	37.8	35	-	S	S	S
3	3.1	34.7	33	-	S	S	S
2	3.1	31.6	33	-	S	S	S
1	3.1	28.5	33	-	S	S	S
G	4	24.5	0	96	MS	MS	MS
LG	5.5	19	0	-			
B1	3	16	0	1	ES	ES	ES
B2	3	13	0	1	ES	ES	ES
B3	3	10	0	1	ES	ES	ES
B4	3	7	0	1	ES	ES	ES

M = main entrance, E = entrance, | = express zone, S = served floor, D = destination control served floor

Table 3. Floor summary, 1600kg @ 2.0mps (3 Lifts).

Building type:	Residential	
Populated floors:	Populated floors	1-21
	Number of populated floors	21
	Total population	585
Entrance floors:	Entrance floors	B4-B1,G
	Number of entrance floors	5
Totals:	Number of floors	27
	Total travel (m)	83.5
	Typical floor height (m)	3.1

2.2 Selecting Elevator Speed

Nominal Travel Time is obtained by dividing the travel height by the elevator rated speed. It gives a rough estimation of the maximum time it takes to ride inside the car from the bottom floor to the top floor.

Group	No of Elevators	Floors / Stops	Load (kg/persons)	Speed (m/s)	NTT (s)	Travel Height (m)	Speed rating
1600kg @ 2.0mps (3 Lifts)	3	B4-B1,G-21 / 26	1600 / 21	2	41.7	83.5	★★★

2.3 Elevator Data

Table 4. Elevator parameters.

Elevator group	1600kg @ 2.0mps (3 Lifts)
No. of elevators	3
Rated speed (m/s)	2
Acceleration (m/s^2)	0.8
Jerk (m/s^3)	1.2
Start delay (s)	0.7
Adv. opening distance (m)	0.15
Adv. opening speed (m/s)	0.3
Rated capacity	21
Bypass load	17
Door opening time (s)	1.5
Door closing time (s)	2.8
Photocell delay (s)	0.9
Transfer times (s)	1.6

3 Results

3.1 Stepwise Serial Simulation

Passenger arrival rate is increased in stepwise manner in serial simulation model. For each arrival rate at least one hour simulation is performed to get enough accuracy.

Average Waiting Time and Average Time to Destination can be compared against KONE has quality of service criteria (see KONE recommendations). Values of Average Car Load Factor are shown beside the curves. The values can be used to determine Handling Capacity.

Table 5. Simulation settings.

Name	Morning Building B - 3 Lifts - 1600kg -
Excluded from begin (s)	300
Included from end (s)	86400
Traffic start time	12:00:00 AM
Traffic end time	2:00:00 AM
Number of simulation steps	3
First arrival (% of base level)	7
Last arrival (% of base level)	9
Step arrival (% of base level)	1
Arrival intensities (% of population/300s)	7, 8, 9
Arrival intensities (persons/300s)	41, 47, 53

3.1.1 Two way Results for 1600kg @ 2.0mps (3 Lifts), GA (Conventional)

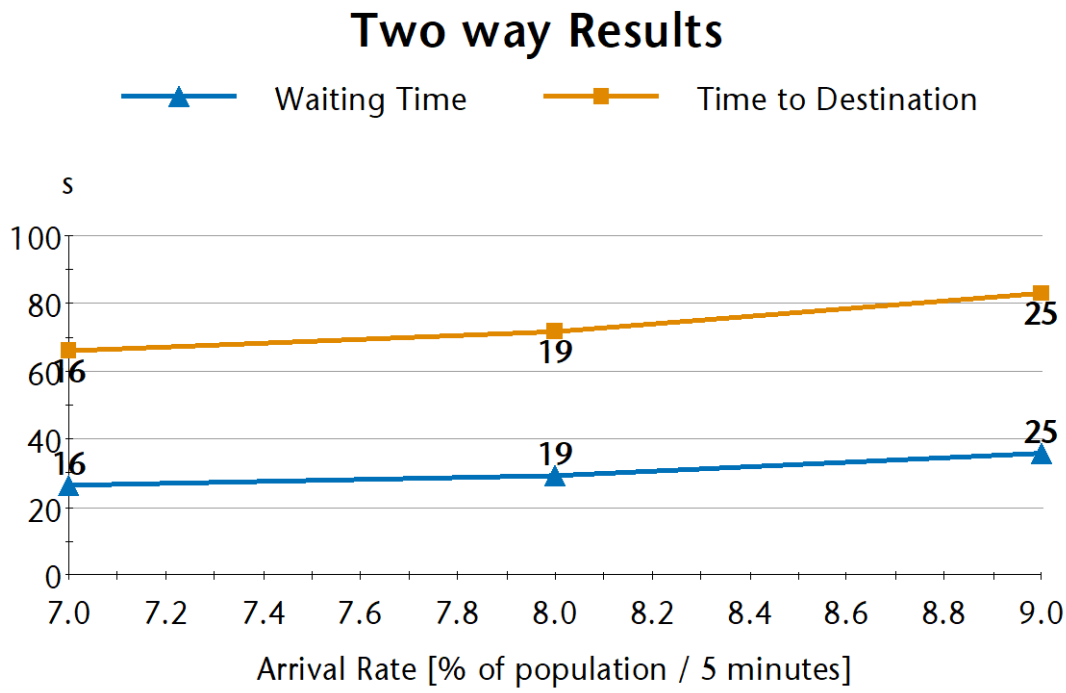

Figure 1. Two way (50%, 50%, 0%) Results for 1600kg @ 2.0mps (3 Lifts).

Table 6. Two way (50%, 50%, 0%) Results for 1600kg @ 2.0mps (3 Lifts).

Arrival Rate	Waiting Time	Time to Destination
% of population / 5 minutes	s	s
7	26.5	66.3
8	29.3	71.6
9	35.7	82.8

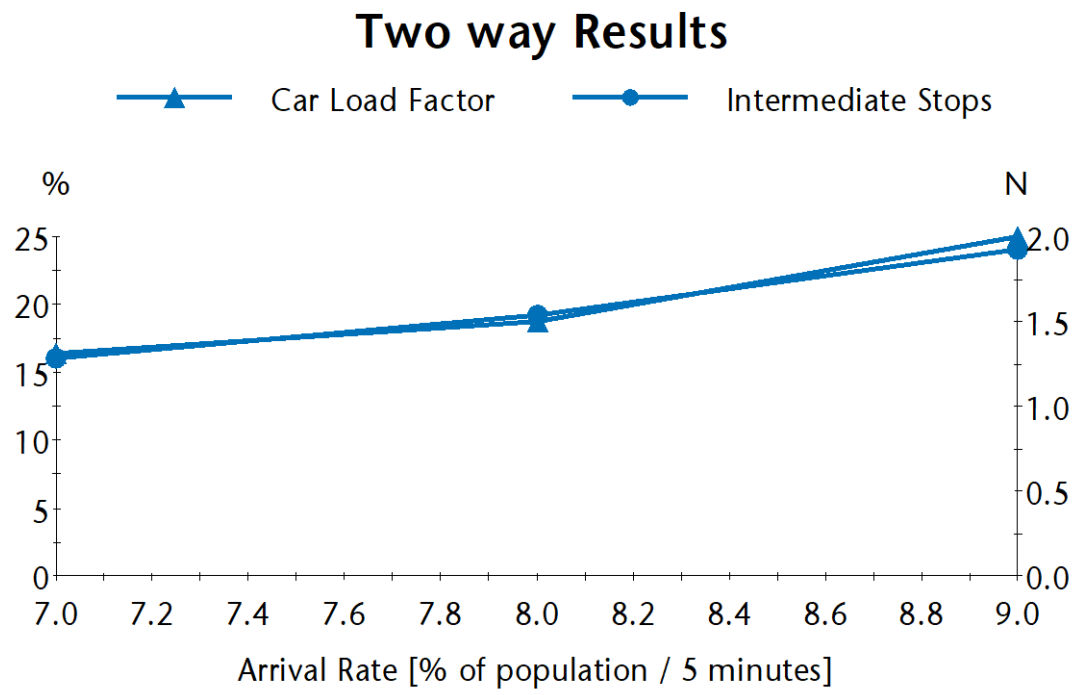

Figure 2. Two way (50%, 50%, 0%) Results for 1600kg @ 2.0mps (3 Lifts).

Table 7. Two way (50%, 50%, 0%) Results for 1600kg @ 2.0mps (3 Lifts).

Arrival Rate	Car Load Factor	Intermediate Stops
% of population / 5 minutes	%	N
7	16.4	1.28
8	18.7	1.54
9	25.0	1.92

3.1.2 Two way Results for 1600kg @ 2.0mps (3 Lifts), GA (Conventional)

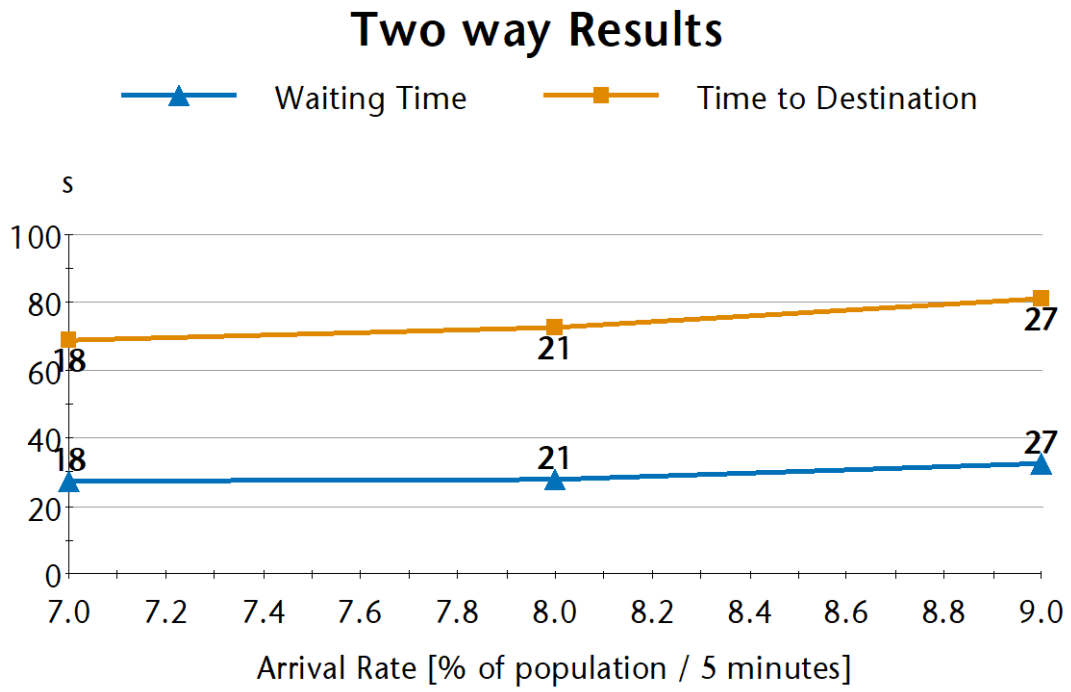

Figure 3. Two way (15%, 85%, 0%) Results for 1600kg @ 2.0mps (3 Lifts).

Table 8. Two way (15%, 85%, 0%) Results for 1600kg @ 2.0mps (3 Lifts).

Arrival Rate	Waiting Time	Time to Destination
% of population / 5 minutes	s	s
7	27.6	68.9
8	28.0	72.7
9	32.5	81.4

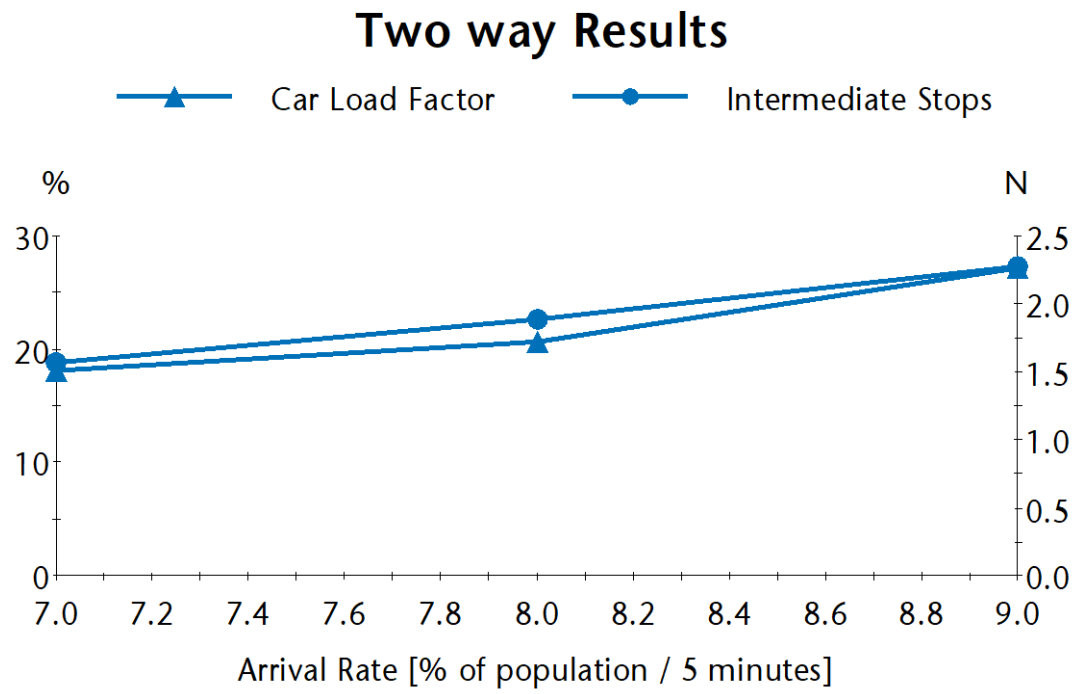

Figure 4. Two way (15%, 85%, 0%) Results for 1600kg @ 2.0mps (3 Lifts).

Table 9. Two way (15%, 85%, 0%) Results for 1600kg @ 2.0mps (3 Lifts).

Arrival Rate	Car Load Factor	Intermediate Stops
% of population / 5 minutes	%	N
7	18.1	1.57
8	20.6	1.88
9	27.1	2.27

4 Elevator Planning Guidelines

4.1 KONE Recommendations

Quality of service is rated as 3-5 stars in single tenant offices, multi tenant offices, hotels and residential buildings.

Elevator group gets the rating, if Average Waiting Time and Average Time to Destination are below the given limits at the given arrival rates (% of population in 5 min) in both traffic situations. Two traffic situations, defined by percentages of incoming, outgoing and inter-floor passengers, are given for each building type. Interval criteria can be applied to analytical up-peak calculations.

Table 10. KONE ratings for Handling Capacity and Quality of Service

Building type	Traffic type	★★★				★★★★				★★★★★			
	(in – out – interfloor)	5HC	INT	WT	TTD	5HC	INT	WT	TTD	5HC	INT	WT	TTD
Single Tenant Office	(100%, 0%, 0%)	13%	40s	40s	120s	15%	32s	30s	100s	17%	25s	25s	80s
	(40%, 40%, 20%)	11%	–	40s	120s	12%	–	30s	100s	15%	–	25s	80s
Multi Tenant Office	(100%, 0%, 0%)	11%	40s	40s	120s	12%	32s	30s	100s	15%	25s	25s	80s
	(45%, 45%, 10%)	10%	–	40s	120s	11%	–	30s	100s	12%	–	25s	80s
Hotel	(100%, 0%, 0%), (50%, 50%, 0%)	10%	40s	40s	120s	12%	32s	30s	100s	15%	25s	25s	80s
Residential	(100%, 0%, 0%), (50%, 50%, 0%)	5%	100s	60s	150s	7.5%	80s	40s	120s	9%	60s	30s	90s

Nominal travel time recommendations are used as guideline for selecting rated speed of elevator.

Table 11. KONE ratings for Nominal Travel Time

Building type	★★★	★★★★	★★★★★
Office or hotel up to 224 m	25 – 32s	20 – 25s	12 – 20s
Office or hotel over 224 m	32 – 40s	25 – 32s	20 – 25s
Residential up to 350 m	32 – 50s	25 – 32s	20 – 25s
Residential over 350 m	40 – 63s	32 – 40s	25 – 32s

4.2 Basic Planning Parameters

Cycle time is the time for an elevator to move from one floor to the next adjacent floor, measured from the instant that the doors start to close at the departure floor to the instant the doors start to close at the arrival floor (provided that no passengers have entered or left the car).

Door-to-door time (or **performance time**) is the time for an elevator to move from one floor to the next adjacent floor, measured from the instant that the doors start to close at the departure floor to the instant the doors are open 800 mm at the arrival floor.

Advance door opening is the initiation of door opening whilst a car is slowing into a floor, under normal operating conditions, usually when the car is in a door zone of plus or minus 150 mm of floor level and such that the car is substantially level at the floor before passengers can attempt to exit.

Door opening time is the period of time measured from the instant of the elevator car being at a floor and when the doors are open 800 mm.

Door closing time is the period of time measured from the instant that the elevator door close push button is pressed (or the first visible door movement) until the door interlocks are made up.

Basic door time (or **Door Dwell 1**) is the time, in seconds, that the doors will wait until closing if the passenger detection beam across the door entrance is not broken.

Photocell delay (or **Door Dwell 2**) is the time, in seconds, that the doors will wait until closing after the broken passenger detection beams are cleared.

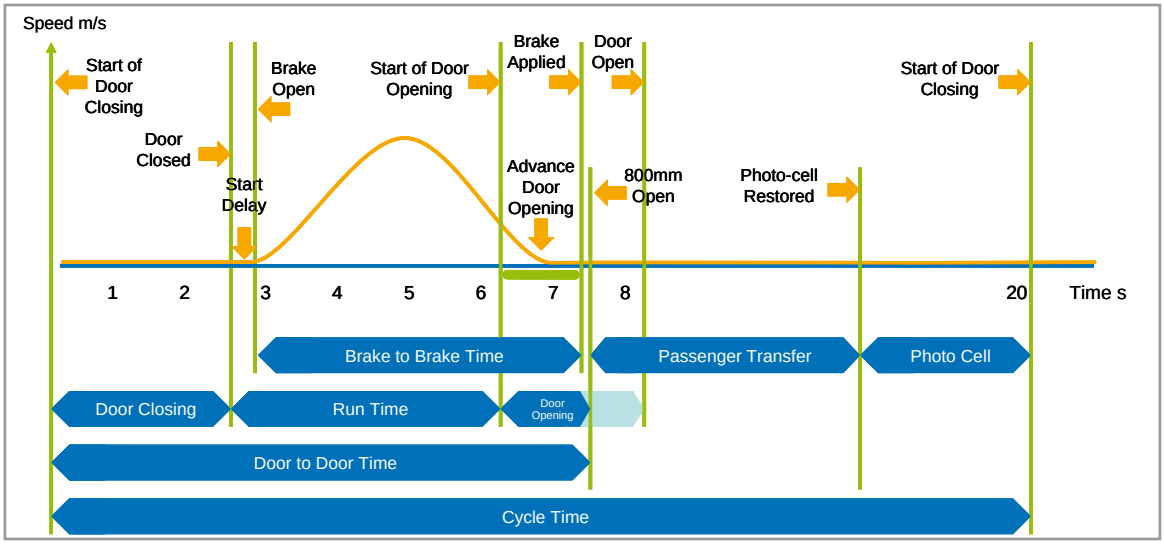

Figure 5. Elevator cycle time parameters

Handling Capacity (HC5) shows how many passengers the elevator system can transport in five minutes, normally in up-peak with 80% load factor. Usually Handling Capacity is given in relative units, percent of population in 5 minutes. Relative value of Handling Capacity is obtained by dividing the absolute value (persons/5 minutes) by the total population at the served floors (%HC5).

Car Load Factor (CLF) is maximum load during the round trip of elevator divided by the rated load (usually the maximum occurs at the main floor). CLF is averaged over round trips.

Interval (INT) shows the average frequency how often an elevator leaves the lobby during up-peak. It is obtained by dividing the round trip time by the number of elevators in group. (Not recommended to be used as performance criteria with up-peak boosters)

Nominal Travel Time (NTT) is obtained by dividing the travel height by the elevator rated speed. It gives a rough estimation of the maximum time it takes to ride inside the car from the bottom floor to the top floor.

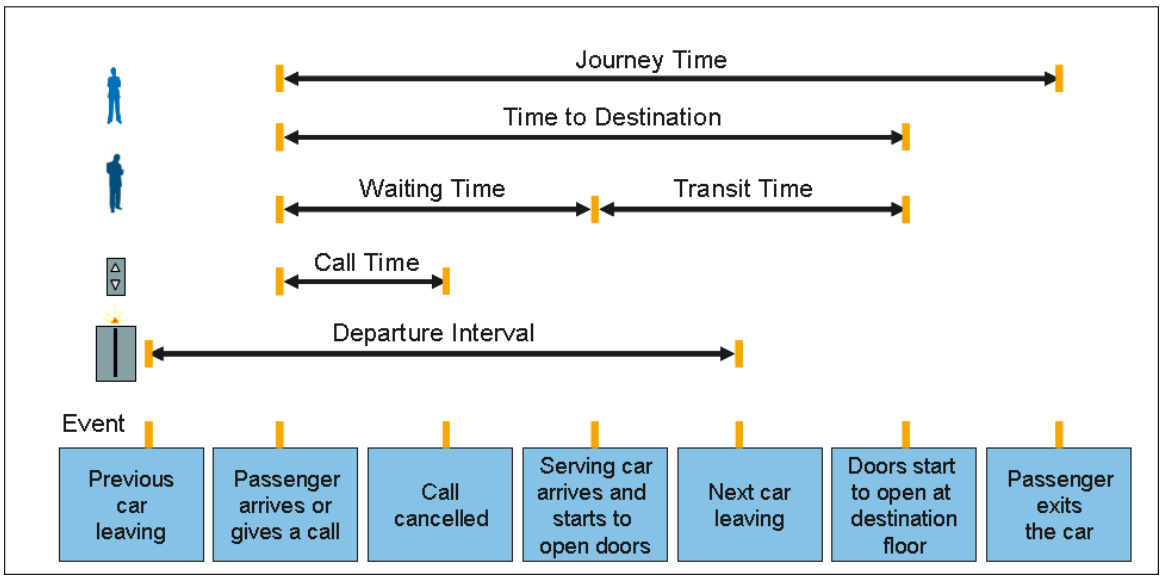

Figure 6. Service Quality Parameters

Each parameter definition below considers an individual passenger. Average value of parameter is usually used as service quality criterion.

Call Time (CT): Time from when a passenger registers a landing call until the responding elevator cancels the call at the deceleration point.

Waiting Time (WT): Time from when a passenger either registers a landing call, or joins a queue, until the responding elevator begins to open its doors at the boarding floor

Time to Destination (TTD): Time from when a passenger either registers a landing call, or joins a queue, until the responding elevator begins to open its doors at the destination floor

Journey Time (JT): Time from when a passenger either registers a landing call or joins a queue until the passenger alights at the destination floor

Intermediate Stops (IS): The number of stops elevator makes between the boarding and destination floor of a passenger.

Intermediate Load (IL): Maximum number of passengers inside the car during passenger journey.