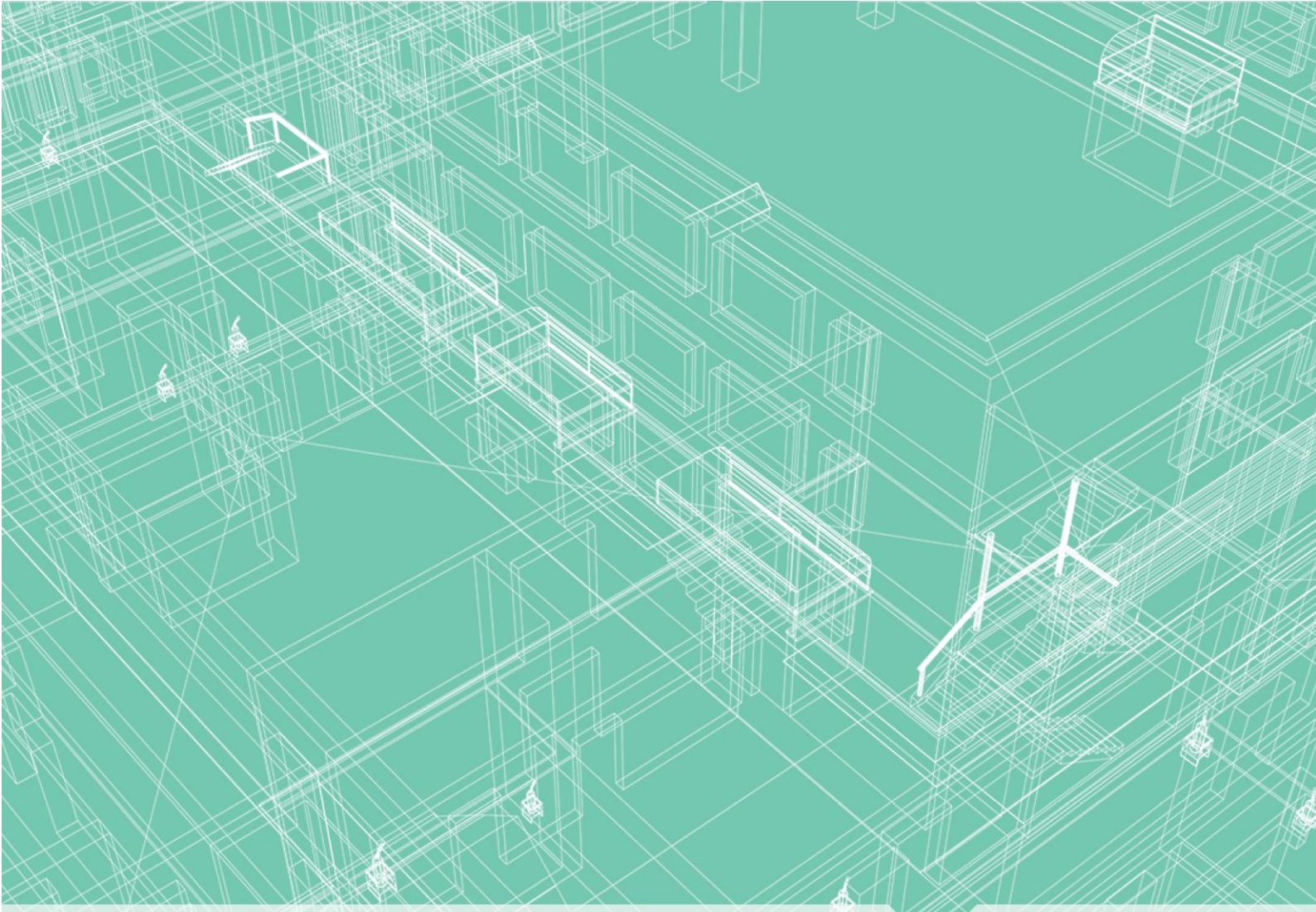

LIFT TRAFFIC STUDY

DORAN DRIVE PRECINCT 2 RESIDENTIAL TOWERS

VERTICAL TRANSPORTATION SERVICES

JHA

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DOCUMENT CONTROL SHEET

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CONTENTS

1 EXECUTIVE SUMMARY

1.1 EXECUTIVE SUMMAY

Our review of the Vertical Transportation (VT) systems currently designed for the residential buildings located at Dorian Drive Precinct 2, is that, based on the information provided, as outlined within the documents detailed below the system will generally meet the guidelines of CIBSE Guide D 2020 for residential buildings, see table below with results.

Table 1–Traffic study results

	Morning (two-way)		Evening (two-way)	
	Recommended	Simulated	Recommended	Simulated
Building A	< 60 s	55 s ✓	< 60 s	55 s ✓
Building B	< 60 s	42 s ✓	< 60 s	42 s ✓
Building C	< 60 s	55 s ✓	< 60 s	53 s ✓
Building D	< 60 s	43 s ✓	< 60 s	35 s ✓

There is some scope for minor fluctuations in the building population without significantly impacting the level of service to be provided to the development.

1.2 DOCUMENTS PROVIDED AND REFERENCED

The traffic report has been based on the following documents:

- Turner's architectural drawings received 08/07/2021,
- Turner's yield mix received 13/05/2021,
- CIBSE Guide D, The Charted Institution of Building Services Engineers

Any changes to the above will require re-assessment to determine the VT system meets the guidelines.

1.3 EXTENT OF WOKS

The vertical transportation scope of works to be carried through to design development include but are not limited to:

- Building A two (2) resident lifts
- Building B two (2) resident lifts
- Building C two (2) resident lifts
- Building D two (2) resident lifts

Figure 1–Location of lifts

2 PROCESS

In determining the efficiency of the proposed VT system, we have drawn the following key data from the information provided

- Lift travels
- Entrance openings
- Number of units on each level

The key data is then used to determine the building population which is based on the number of bedrooms in each apartment on each floor. CIBSE Guide D provides recommendations on occupancy factors.

Figure 2–Extract from CIBSE Guide D, Table 3.12 Occupancy factors

Table 3.12 Occupancy factors (persons) for residential buildings

Type	Luxury	Normal	Low income
Studio	1.0	1.5	2.0
1 bedroom	1.5	1.8	2.0
2 bedroom	2.0	3.0	4.0
3 bedroom	3.0	4.0	6.0

This information is then entered into Elevate™, lift traffic simulation software, for analysis. The results are compared to the recommend levels specified in CIBSE Guide D, refer to table below.

Figure 3–Extract from CIBSE Guide D, Table 4.3 recommended performance criteria

Table 4.3 Draft ISO recommendations for use with provisional ISO simulation method (ISO, 2015)

Building type and typical traffic mix	Typical range of required handling capacity (HC5) (%)	Typical range of required average waiting time (s)
Residential:		
— morning two-way (15 % incoming, 85 % outgoing)	6–8	30–65
— evening two-way (50 % incoming, 50 % outgoing)	6–8	30–65

The results and key data are displayed in each building's summary below.

3 TRAFFIC SIMULATIONS

3.1 GENERAL

3.1.1 TRAFFIC SIMULATION SOFTWARE

Lift traffic analysis software used is Elevate™, Version 8.25, Dr Richard Peters, Peters Research. For each analysis, Elevate™ runs 10 simulations with the same configuration; the results of each simulation are then averaged to produce the final results. Also, for each simulation, Elevate™ generates a random number seed to make a list of people and their arrival time based on the building and passenger data. By changing the random number seed, the simulation will have the same number of people generated but they will arrive at different times.

3.1.2 DEFINITIONS

Table 2–List of terms and their definitions

Two-way traffic	is a traffic condition which exists when the dominant traffic flow is to and from the main floor
Incoming traffic	the part of the total demand that corresponds to passenger arriving at the entrance floor
Outgoing traffic	the part of the total demand that corresponds to passenger arriving the other floors, and travelling to the entrance floor—exit traffic
Handling Capacity	defined as the percentage of the building population transported by the lift system in a five-minute period
Average Waiting Time	defined as the average period of time in seconds from when a passenger either registers a landing call, or joins a queue, until the responding lift begins to open its doors at the boarding floor
Capacity Factor	allows for passengers not loading the elevators to their rated capacity
Loading Time	The time taken, in seconds, for a single passenger to load the car
Unloading Time	The time taken, in seconds, for a single passenger to unload from the car

3.1.3 LEGEND FOR DISTRIBUTION OF PASSENGER WAITING TIMES CHART

Green line: plots against the right-hand side y axis, a graph showing what percentage of passengers have waiting times less than or equal to the value on the x axis, dotted red line identifies the 90-percentile.
Blue line: plotted against the y1 axis, identifies the number of passengers who have waited in each of the specified time ranges.

3.1.4 NOTE

Note: Lift simulations are based on theoretical models that are used to assist with system selection for performance, differences between this report and the actual service provided by the indicated equipment may be encountered due to variations in user behaviour or building design which were not anticipated when this report was prepared. Results can also differ between suppliers.

3.2 REQUIREMENTS

As outlined in Section 2 above, Figure 3 Table 4., we need to complete two separate traffic pattern calculations with the following parameters:

1. Morning (two-way comprising of incoming 15% and outgoing 85%)
2. Evening (two-way comprising of incoming 50% and outgoing 50%)
3. Average Waiting Time: < 60s
4. Handling capacity: 7%

3.3 BUILDING A

3.3.1 BUILDING PARAMETERS

Traffic simulations have been run using an expected population of 369 people.

ANALYSIS DATA

Analysis Type	Simulation
Measurement system	Metric
Dispatcher Algorithm	Group Collective Traffic mode: Normal
Time slice between simulation calculations (s)	0.10
No of time slices between screen updates	10
No of simulations to run for each configuration	10
No of learning runs	0
Random number seed for passenger generator	1
Energy Model	Off

BUILDING DATA

Floor	Marking	FFL	FTF	S	F	R	Use	BR-1	BR-2	BR-3	T U	1B	2B	3B	T P	CP	CP	
			-								-	-	-	-	-			
			-								-	-	-	-	-			
			-								-	-	-	-	-			
27	19	156,250	3,200	X		R	Residential	-	2	3	5	-	6	12	18			
26	18	153,050	3,100	X		R	Residential	-	2	3	5	-	6	12	18			
25	17	149,950	3,100	X		R	Residential	-	2	3	5	-	6	12	18			
24	16	146,850	3,200	X		R	Residential	-	2	3	5	-	6	12	18			
23	15	143,650	3,100	X		R	Residential	1	4	1	6	2	12	4	18			
22	14	140,550	3,100	X		R	Residential	1	4	1	6	2	12	4	18			
21	13	137,450	3,100	X		R	Residential	1	4	1	6	2	12	4	18			
20	12	134,350	3,100	X		R	Residential	1	4	1	6	2	12	4	18			
19	11	131,250	3,200	X		R	Residential	1	4	1	6	2	12	4	18			
18	10	128,050	3,100	X		R	Residential	1	4	1	6	2	12	4	18			
17	9	124,950	3,200	X		R	Residential	1	4	1	6	2	12	4	18			
16	8	121,750	3,200	X		R	Residential	4	3	-	7	7	9	-	16			
15	7	118,550	3,100	X		R	Residential	3	7	-	10	5	21	-	26			
14	6	115,450	3,100	X		R	Residential	3	7	-	10	5	21	-	26			
13	5	112,350	3,100	X		R	Residential	3	7	-	10	5	21	-	26			
12	4	109,250	3,100	X		R	Residential	3	7	-	10	5	21	-	26			
11	3	106,150	3,200	X		R	Residential	3	7	-	10	5	21	-	26			
10	2	102,950	4,800	X		R	Residential	2	7	-	9	4	21	-	25			
9	1	98,150	5,950				Retail				-	-	-	-	-			
8	UG	92,200	2,300	X	F		Main Entry				-	-	-	-	-			30%
7	G	89,900	4,700				Ground				-	-	-	-	-			
6	B1	85,200	3,000				Basement				-	-	-	-	-			
5	B2	82,200	3,000				Basement				-	-	-	-	-			
4	B3	79,200	3,000				Basement				-	-	-	-	-			
3	B4	76,200	3,000	X		R	Basement				-	-	-	-	-	40	80	22%
2	B5	73,200	3,000	X		R	Basement				-		-			49	98	27%
1	B6	70,200		X		R	Basement									38	76	21%
			86,050	22	1	21		28	81	19	128	50	243	76	369	127	254	

ELEVATOR DATA

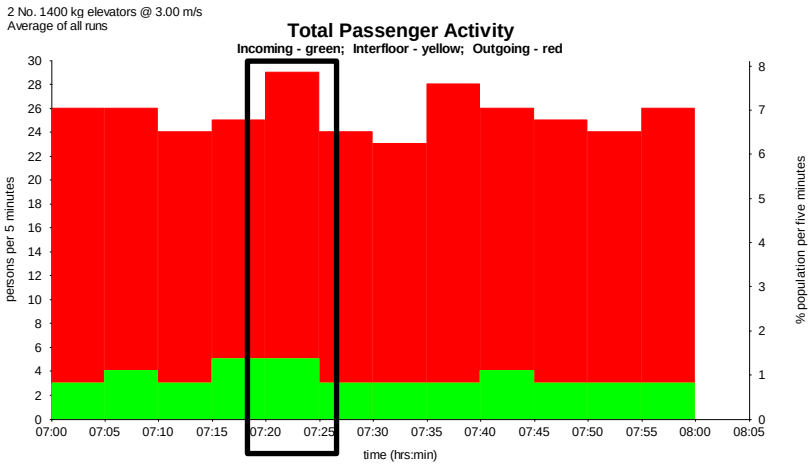
No of Elevators	2
Type	Single Deck
Capacity (kg)	1400
Car area (m^2)	3.11
Door Pre-opening Time (s)	0.50
Door Open Time (s)	1.70
Door Close Time (s)	2.40
Door Dwell 1 (s)	3.00
Door Dwell 2 (s)	1.00
Speed (m/s)	3.00
Acceleration (m/s^2)	1.00
Jerk (m/s^3)	1.00
Start Delay (s)	0.50
Levelling Delay (s)	0.00
Home Floor	UG

3.3.2 MORNING TWO-WAY

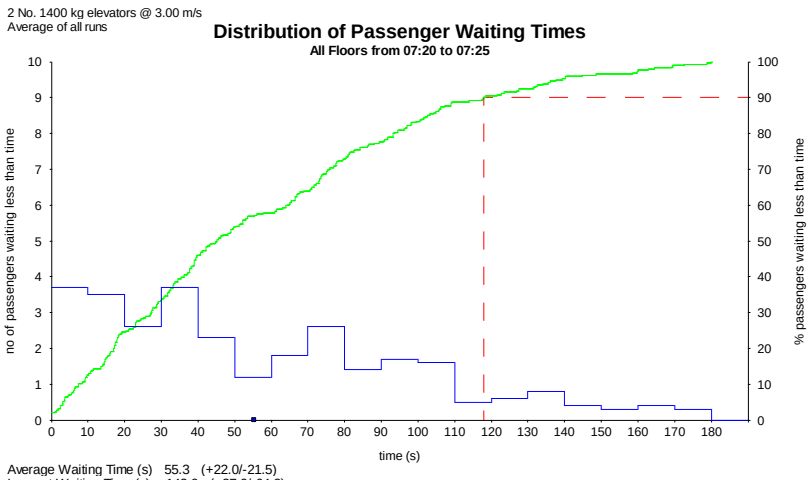
PASSENGER DATA	
Arrangement	Conventional for Single Deck elevators
Template	Constant traffic (% building pop per 5 mins)
Demand (% pop per 5 mins)	7.00
Incoming (%)	15.00
Outgoing (%)	85.00
Interfloor (%)	0.00
Start Time (hrs:mins)	07:00
End Time (hrs:mins)	08:00
Passenger Mass (kg)	75
Passenger Area (m^2)	0.00
Loading Time (s)	1.00
Unloading Time (s)	1.00
Stair Factor (%)	0.00
Capacity Factor by Mass (%)	80.00
Capacity Factor by Area (%)	100.00

Floor Name	*Entrance Bias*
B6	21.00
B5	27.00
B4	22.00
UG	30.00

The simulation was run for the period 07:00-08:00 and the peak 5-minute period was determined to be 07:20-07:25.



Based on the peak 5-minute period, the average waiting time is 55s and 90% of calls were answered within 115s. The average longest waiting time is 142s.



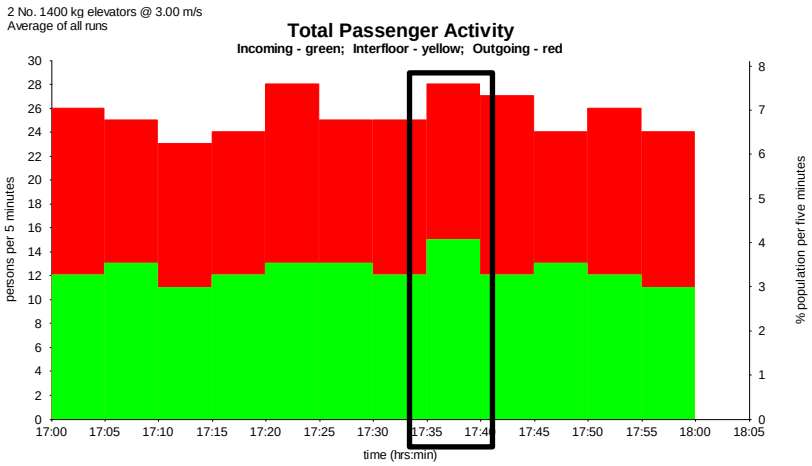
With an average waiting time of 55s, the current design will meet the criteria for the morning two-way pattern.

3.3.3 EVENING TWO-WAY

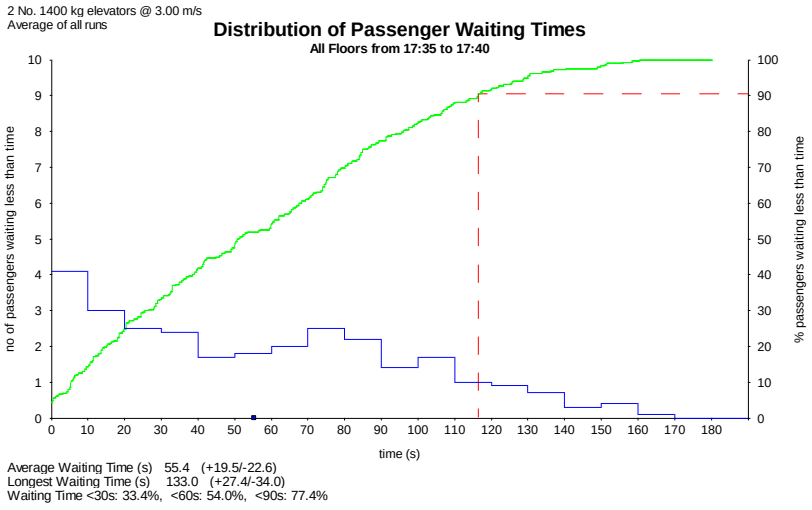
PASSENGER DATA	
Arrangement	Conventional for Single Deck elevators
Template	Constant traffic (% building pop per 5 mins)
Demand (% pop per 5 mins)	7.00
Incoming (%)	50.00
Outgoing (%)	50.00
Interfloor (%)	0.00
Start Time (hrs:mins)	17:00
End Time (hrs:mins)	18:00
Passenger Mass (kg)	75
Passenger Area (m^2)	0.00
Loading Time (s)	1.00
Unloading Time (s)	1.00
Stair Factor (%)	0.00
Capacity Factor by Mass (%)	80.00
Capacity Factor by Area (%)	100.00

Floor Name	*Entrance Bias*
B6	17.00
B5	27.00
B4	25.00
UG	31.00

The simulation was run for the period 17:00-18:00 and the peak 5-minute period was determined to be 17:35-17:40.



Based on the peak 5-minute period, the average waiting time is 55s and 90% of calls were answered within 115s. The average longest waiting time is 133s.



With an average waiting time of 55s, the current design meets the criteria for the evening two-way pattern.

3.4 BUILDING B

3.4.1 BUILDING PARAMETERS

Traffic simulations have been run using an expected population of 270 people.

ANALYSIS DATA

Analysis Type	Simulation
Measurement system	Metric
Dispatcher Algorithm	Group Collective Traffic mode: Normal
Time slice between simulation calculations (s)	0.10
No of time slices between screen updates	10
No of simulations to run for each configuration	10
No of learning runs	0
Random number seed for passenger generator	1
Energy Model	Off

BUILDING DATA

Floor	Marking	FFL	FTF	S	F	R	Use	BR-1	BR-2	BR-3	T U	1B	2B	3B	T P	CP	CP	
			-								-	-	-	-	-			
			-								-	-	-	-	-			
			-								-	-	-	-	-			
			-								-	-	-	-	-			
26	18	153,050	3,100	X	F		Residential	-	5	-	5	-	15	-	15			
25	17	149,950	3,100	X	F		Residential	-	5	-	5	-	15	-	15			
24	16	146,850	3,200	X	F		Residential	-	5	-	5	-	15	-	15			
23	15	143,650	3,100	X	F		Residential	-	5	-	5	-	15	-	15			
22	14	140,550	3,100	X	F		Residential	-	5	-	5	-	15	-	15			
21	13	137,450	3,100	X	F		Residential	-	5	-	5	-	15	-	15			
20	12	134,350	3,100	X	F		Residential	-	5	-	5	-	15	-	15			
19	11	131,250	3,200	X	F		Residential	-	5	-	5	-	15	-	15			
18	10	128,050	3,100	X	F		Residential	1	5	-	6	2	15	-	17			
17	9	124,950	3,200	X	F		Residential	1	5	-	6	2	15	-	17			
16	8	121,750	3,200	X	F		Residential	1	5	-	6	2	15	-	17			
15	7	118,550	3,100	X	F		Residential	4	3	-	7	7	9	-	16			
14	6	115,450	3,100	X	F		Residential	3	4	-	7	5	12	-	17			
13	5	112,350	3,100	X	F		Residential	3	4	-	7	5	12	-	17			
12	4	109,250	3,100	X	F		Residential	3	4	-	7	5	12	-	17			
11	3	106,150	3,200	X	F		Residential	3	4	-	7	5	12	-	17			
10	2	102,950	4,800	X	F		Residential	3	2	1	6	5	6	4	15			
9	1	98,150	3,900				Retail				-	-	-	-	-			
8	UG	94,250	4,275				Retail				-	-	-	-	-			
7	G	89,975	4,775	X	F		Main Entry				-	-	-	-	-			28%
6	B1	85,200	3,000				Basement				-	-	-	-	-			
5	B2	82,200	3,000				Basement				-	-	-	-	-			
4	B3	79,200	3,000				Basement				-	-	-	-	-			
3	B4	76,200	3,000	X	F		Basement				-	-	-	-	-	31	62	23%
2	B5	73,200	3,000	X	F		Basement				-		-			38	76	28%
1	B6	70,200		X	F		Basement									29	58	21%
			82,850	21	21	0		22	76	1	99	40	228	4	270	98	196	

ELEVATOR DATA

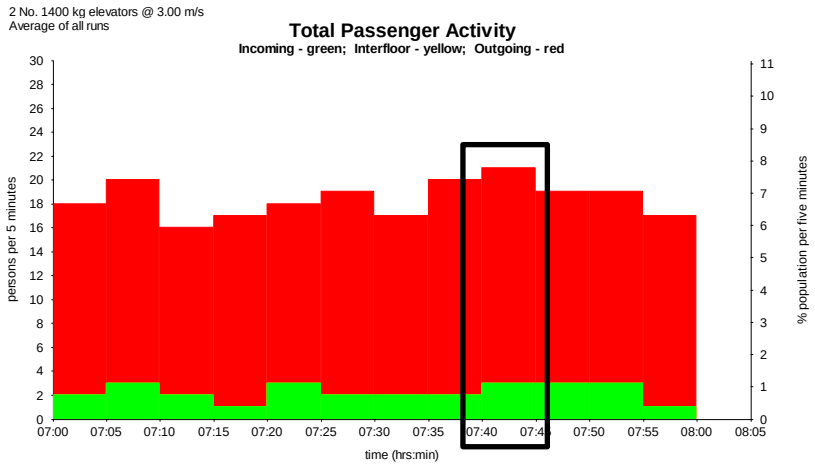
No of Elevators	2
Type	Single Deck
Capacity (kg)	1400
Car area (m^2)	3.11
Door Pre-opening Time (s)	0.50
Door Open Time (s)	1.70
Door Close Time (s)	2.40
Door Dwell 1 (s)	3.00
Door Dwell 2 (s)	1.00
Speed (m/s)	3.00
Acceleration (m/s^2)	1.00
Jerk (m/s^3)	1.00
Start Delay (s)	0.50
Levelling Delay (s)	0.00
Home Floor	G

3.4.2 MORNING TWO-WAY

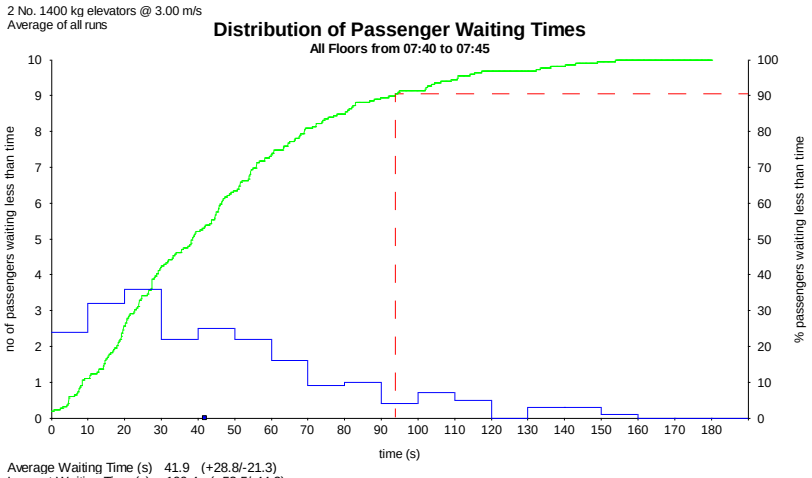
PASSENGER DATA	
Arrangement	Conventional for Single Deck elevators
Template	Constant traffic (% building pop per 5 mins)
Demand (% pop per 5 mins)	7.00
Incoming (%)	15.00
Outgoing (%)	85.00
Interfloor (%)	0.00
Start Time (hrs:mins)	07:00
End Time (hrs:mins)	08:00
Passenger Mass (kg)	75
Passenger Area (m^2)	0.00
Loading Time (s)	1.00
Unloading Time (s)	1.00
Stair Factor (%)	0.00
Capacity Factor by Mass (%)	80.00
Capacity Factor by Area (%)	100.00

Floor Name	*Entrance Bias*
B6	21.00
B5	28.00
B4	23.00
G	28.00

The simulation was run for the period 07:00-08:00 and the peak 5-minute period was determined to be 07:40-07:45.



Based on the peak 5-minute period, the average waiting time is 42s and 90% of calls were answered within 95s. The average longest waiting time is 100s.



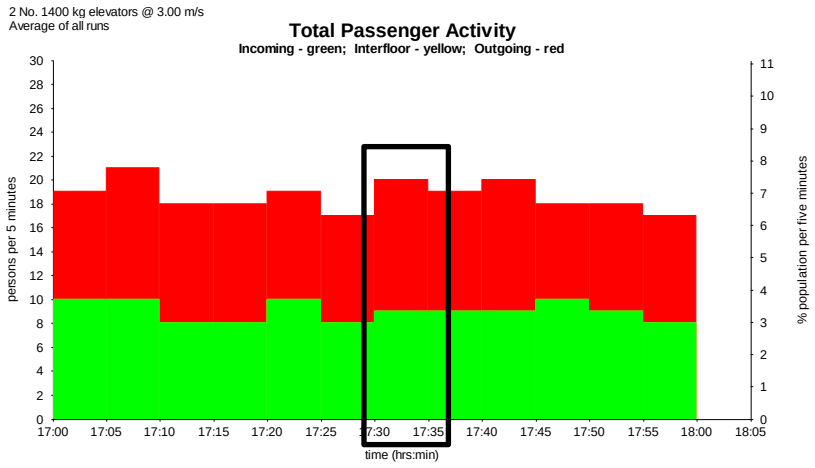
With an average waiting time of 42s, the current design will meet the criteria for the morning two-way pattern.

3.4.3 EVENING TWO-WAY

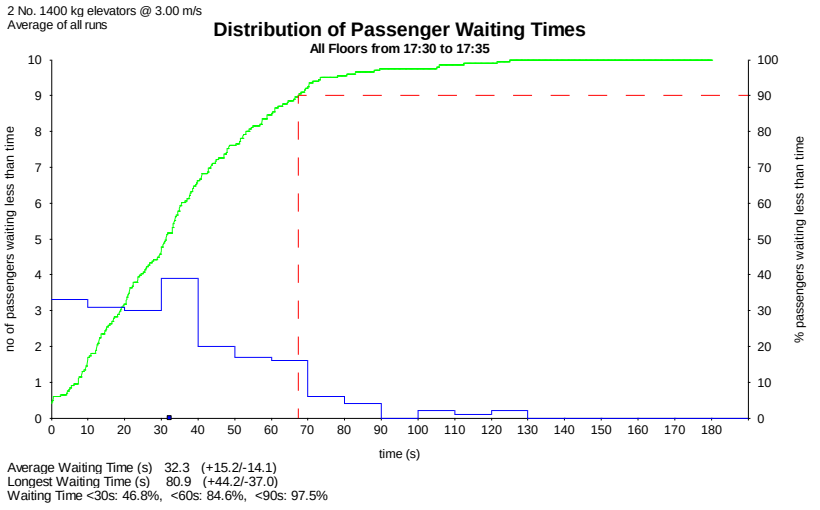
PASSENGER DATA	
Arrangement	Conventional for Single Deck elevators
Template	Constant traffic (% building pop per 5 mins)
Demand (% pop per 5 mins)	7.00
Incoming (%)	50.00
Outgoing (%)	50.00
Interfloor (%)	0.00
Start Time (hrs:mins)	17:00
End Time (hrs:mins)	18:00
Passenger Mass (kg)	75
Passenger Area (m^2)	0.00
Loading Time (s)	1.00
Unloading Time (s)	1.00
Stair Factor (%)	0.00
Capacity Factor by Mass (%)	80.00
Capacity Factor by Area (%)	100.00

Floor Name	*Entrance Bias*
B6	18.00
B5	28.00
B4	27.00
G	27.00

The simulation was run for the period 17:00-18:00 and the peak 5-minute period was determined to be 17:30-17:35.



Based on the peak 5-minute period, the average waiting time is 32s and 90% of calls were answered within 68s. The average longest waiting time is 81s.



With an average waiting time of 42s, the current design will meet the criteria for the evening two-way pattern.

3.5 BUILDING C

3.5.1 BUILDING PARAMETERS

Traffic simulations have been run using an expected population of 345 people.

ANALYSIS DATA

Analysis Type	Simulation
Measurement system	Metric
Dispatcher Algorithm	Group Collective Traffic mode: Normal
Time slice between simulation calculations (s)	0.10
No of time slices between screen updates	10
No of simulations to run for each configuration	10
No of learning runs	0
Random number seed for passenger generator	1
Energy Model	Off

BUILDING DATA

Floor	Marking	FFL	FTF	S	F	R	Use	BR-1	BR-2	BR-3	T U	1B	2B	3B	T P	CP	CP	
			-								-	-	-	-	-			
			-								-	-	-	-	-			
28	20	159,450	3,200	X		R	Residential	-	3	2	5	-	9	8	17			
27	19	156,250	3,100	X		R	Residential	-	3	2	5	-	9	8	17			
26	18	153,150	3,100	X		R	Residential	-	3	2	5	-	9	8	17			
25	17	150,050	3,100	X		R	Residential	-	3	2	5	-	9	8	17			
24	16	146,950	3,200	X		R	Residential	-	3	2	5	-	9	8	17			
23	15	143,750	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
22	14	140,650	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
21	13	137,550	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
20	12	134,450	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
19	11	131,350	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
18	10	128,250	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
17	9	125,150	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
16	8	122,050	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
15	7	118,950	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
14	6	115,850	3,100	X		R	Residential	-	5	1	6	-	15	4	19			
13	5	112,750	3,200	X		R	Residential	-	5	1	6	-	15	4	19			
12	4	109,550	3,200	X		R	Residential	1	4	1	6	2	12	4	18			
11	3	106,350	3,400	X		R	Residential	1	9	1	11	2	27	4	33			
10	2	102,950	5,600	X		R	Residential				-	-	-	-	-			
9	1	97,350	3,050	X	F		Main Entry				-	-	-	-	-			36%
8	UG	94,300	4,400				Retail				-	-	-	-	-			
7	G	89,900	4,700				Ground				-	-	-	-	-			
6	B1	85,200	3,000				Basement				-	-	-	-	-			
5	B2	82,200	3,000				Basement				-	-	-	-	-			
4	B3	79,200	3,000				Basement				-	-	-	-	-			
3	B4	76,200	3,000	X	F		Basement				-	-	-	-	-	39	78	23%
2	B5	73,200	3,000	X	F		Basement				-		-			43	86	25%
1	B6	70,200		X	F		Basement									27	54	16%
			89,250	23	4	19		2	83	23	108	4	249	92	345	109	218	

Express Zone

Lowest floor not served by elevators	B3
Highest floor not served by elevators	UG

ELEVATOR DATA

No of Elevators	2
Type	Single Deck
Capacity (kg)	1400
Car area (m²)	3.11
Door Pre-opening Time (s)	0.50
Door Open Time (s)	1.70
Door Close Time (s)	2.40
Door Dwell 1 (s)	3.00
Door Dwell 2 (s)	1.00
Speed (m/s)	3.00
Acceleration (m/s²)	1.00
Jerk (m/s³)	1.00
Start Delay (s)	0.50
Levelling Delay (s)	0.00
Home Floor	3

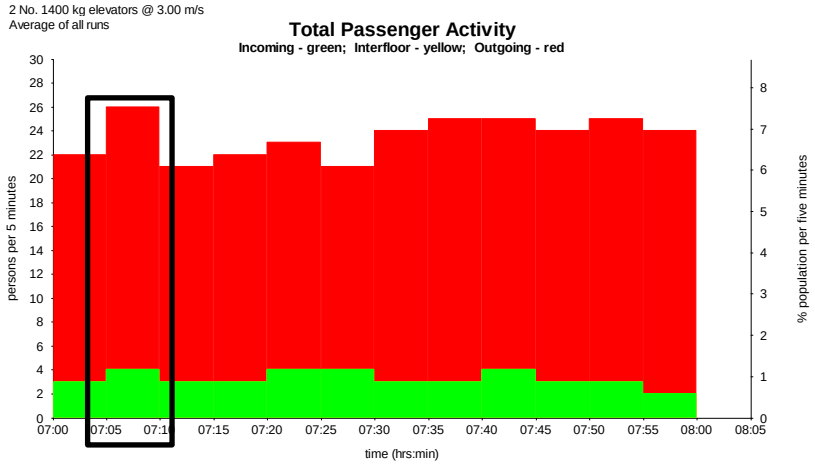
3.5.2 MORNING TWO-WAY

PASSENGER DATA

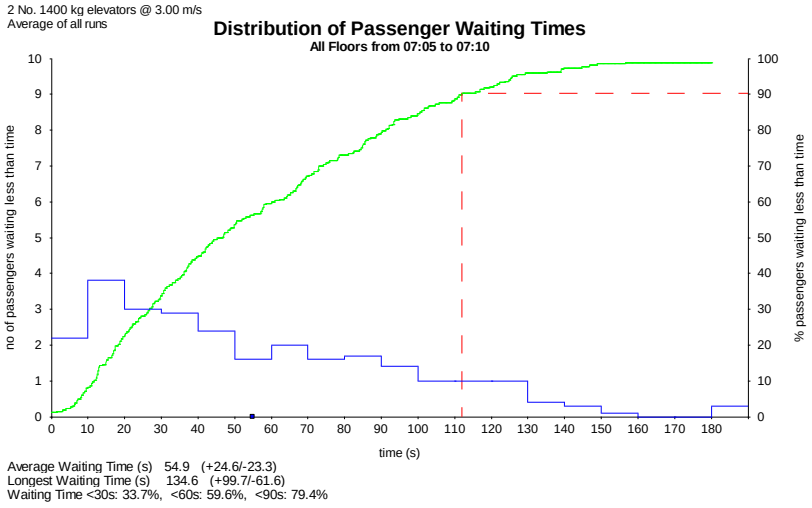
Arrangement	Conventional for Single Deck elevators
Template	Constant traffic (% building pop per 5 mins)
Demand (% pop per 5 mins)	7.00
Incoming (%)	15.00
Outgoing (%)	85.00
Interfloor (%)	0.00
Start Time (hrs:mins)	07:00
End Time (hrs:mins)	08:00
Passenger Mass (kg)	75
Passenger Area (m²)	0.21
Loading Time (s)	1.00
Unloading Time (s)	1.00
Stair Factor (%)	0.00
Capacity Factor by Mass (%)	80.00
Capacity Factor by Area (%)	100.00

Floor Name	*Entrance Bias*
B6	16.00
B5	25.00
B4	23.00
1	36.00

The simulation was run for the period 07:00-08:00 and the peak 5-minute period was determined to be 07:05-07:10.



Based on the peak 5-minute period, the average waiting time is 55s and 90% of calls were answered within 110s. The average longest waiting time is 135s.



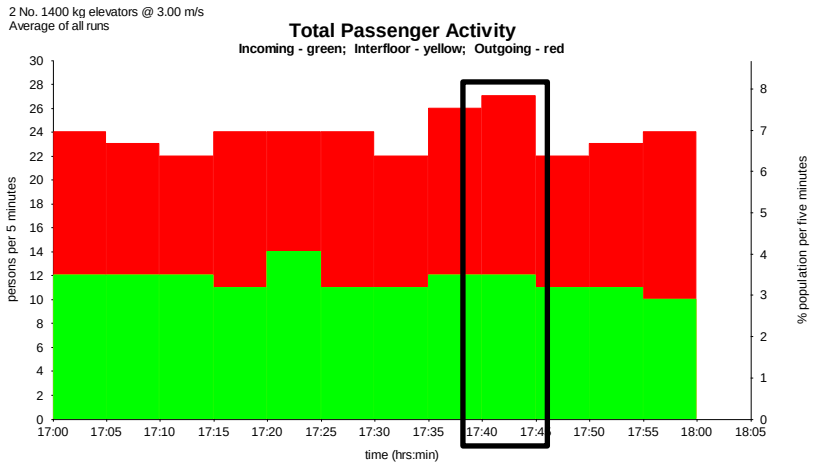
With an average waiting time of 55s, the current design meets the criteria for the morning two-way pattern.

3.5.3 EVENING TWO-WAY

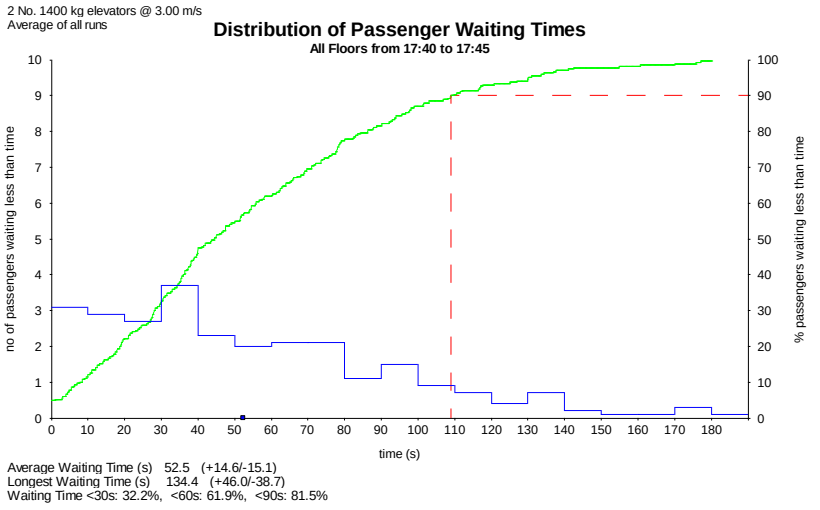
PASSENGER DATA	
Arrangement	Conventional for Single Deck elevators
Template	Constant traffic (% building pop per 5 mins)
Demand (% pop per 5 mins)	7.00
Incoming (%)	50.00
Outgoing (%)	50.00
Interfloor (%)	0.00
Start Time (hrs:mins)	17:00
End Time (hrs:mins)	18:00
Passenger Mass (kg)	75
Passenger Area (m^2)	0.21
Loading Time (s)	1.00
Unloading Time (s)	1.00
Stair Factor (%)	0.00
Capacity Factor by Mass (%)	80.00
Capacity Factor by Area (%)	100.00

Floor Name	*Entrance Bias*
B6	16.00
B5	24.00
B4	23.00
1	37.00

The simulation was run for the period 17:00-18:00 and the peak 5-minute period was determined to be 17:40-17:45.



Based on the peak 5-minute period, the average waiting time is 53s and 90% of calls were answered within 110s. The average longest waiting time is 134s.



With an average waiting time of 53s, the current design will meet the criteria for the evening two-way pattern.

3.6 BUILDING D

3.6.1 BUILDING PARAMETERS

Traffic simulations have been run using an expected population of 262 people.

ANALYSIS DATA

Analysis Type	Simulation
Measurement system	Metric
Dispatcher Algorithm	Group Collective Traffic mode: Normal
Time slice between simulation calculations (s)	0.10
No of time slices between screen updates	10
No of simulations to run for each configuration	10
No of learning runs	0
Random number seed for passenger generator	1
Energy Model	Off

BUILDING DATA

Floor	Marking	FFL	FTF	S	F	R	Use	BR-1	BR-2	BR-3	T U	1B	2B	3B	T P	CP	CP	
			-								-	-	-	-	-			
			-								-	-	-	-	-			
			-								-	-	-	-	-			
27	19	156,250	3,100	X	F		Residential	-	5	-	5	-	15	-	15			
26	18	153,150	3,100	X	F		Residential	-	5	-	5	-	15	-	15			
25	17	150,050	3,100	X	F		Residential	-	5	-	5	-	15	-	15			
24	16	146,950	3,200	X	F		Residential	-	5	-	5	-	15	-	15			
23	15	143,750	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
22	14	140,650	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
21	13	137,550	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
20	12	134,450	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
19	11	131,350	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
18	10	128,250	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
17	9	125,150	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
16	8	122,050	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
15	7	118,950	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
14	6	115,850	3,100	X	F		Residential	2	4	-	6	4	12	-	16			
13	5	112,750	3,200	X	F		Residential	2	4	-	6	4	12	-	16			
12	4	109,550	3,200	X	F		Residential	2	3	-	5	4	9	-	13			
11	3	106,350	3,400	X	F		Residential	2	3	-	5	4	9	-	13			
10	2	102,950	5,650	X	F		Commercial				-	-	-	-	-			
9	1	97,300	3,000				Retail				-	-	-	-	-			
8	UG	94,300	4,400	X	F		Main Entry				-	-	-	-	-			26%
7	G	89,900	4,700				Ground				-	-	-	-	-			
6	B1	85,200	3,000				Basement				-	-	-	-	-			
5	B2	82,200	3,000				Basement				-	-	-	-	-			
4	B3	79,200	3,000				Basement				-	-	-	-	-			
3	B4	76,200	3,000	X	F		Basement				-	-	-	-	-	34	68	26%
2	B5	73,200	3,000	X	F		Basement				-		-			39	78	30%
1	B6	70,200		X	F		Basement									24	48	18%
			86,050	22	22	0		26	70	-	96	47	210	-	262	97	194	

ELEVATOR DATA

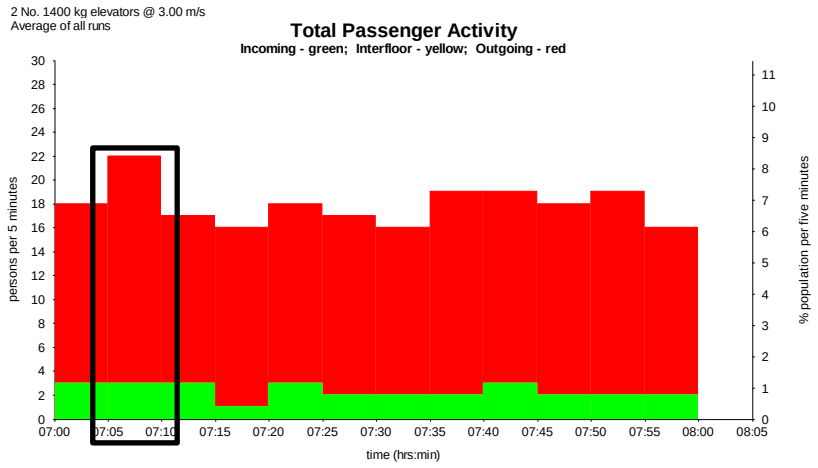
No of Elevators	2
Type	Single Deck
Capacity (kg)	1400
Car area (m^2)	3.11
Door Pre-opening Time (s)	0.50
Door Open Time (s)	1.70
Door Close Time (s)	2.40
Door Dwell 1 (s)	3.00
Door Dwell 2 (s)	1.00
Speed (m/s)	3.00
Acceleration (m/s^2)	1.00
Jerk (m/s^3)	1.00
Start Delay (s)	0.50
Levelling Delay (s)	0.00
Home Floor	UG

3.6.2 MORNING TWO-WAY

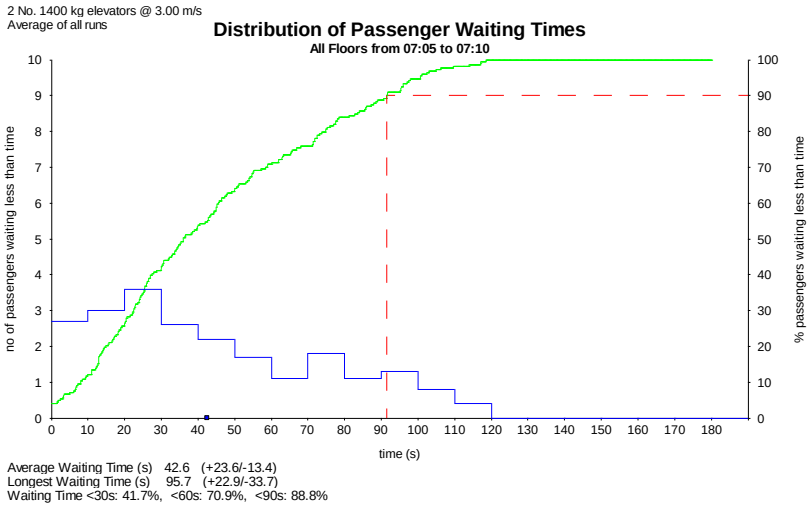
PASSENGER DATA	
Arrangement	Conventional for Single Deck elevators
Template	Constant traffic (% building pop per 5 mins)
Demand (% pop per 5 mins)	7.00
Incoming (%)	15.00
Outgoing (%)	85.00
Interfloor (%)	0.00
Start Time (hrs:mins)	07:00
End Time (hrs:mins)	08:00
Passenger Mass (kg)	75
Passenger Area (m^2)	0.00
Loading Time (s)	1.00
Unloading Time (s)	1.00
Stair Factor (%)	0.00
Capacity Factor by Mass (%)	80.00
Capacity Factor by Area (%)	100.00

Floor Name	*Entrance Bias*
B6	18.00
B5	30.00
B4	26.00
UG	26.00

The simulation was run for the period 7:00-8:00 and the peak 5-min period was determined to be 07:05-07:10.



Based on the peak 5-minute period, the average waiting time is 43s and 90% of calls were answered within 90s. The average longest waiting time is 96s.



With an average waiting time of 43s, the current design will meet the criteria for the morning two-way pattern.

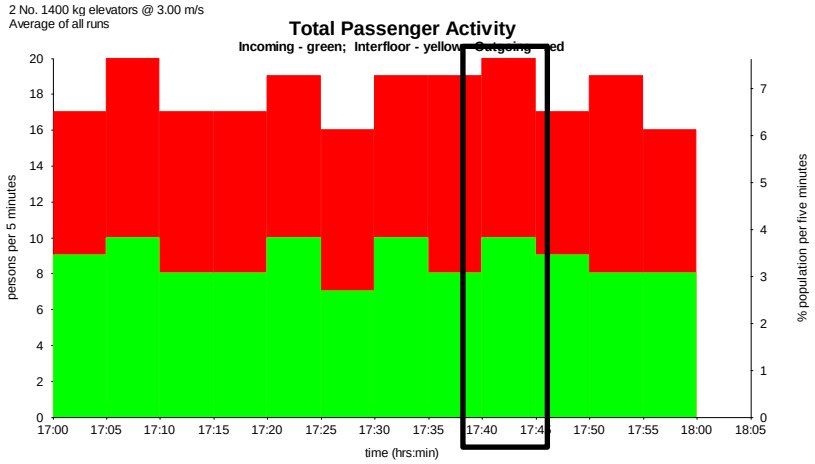
3.6.3 EVENING TWO-WAY CRITERIA

PASSENGER DATA

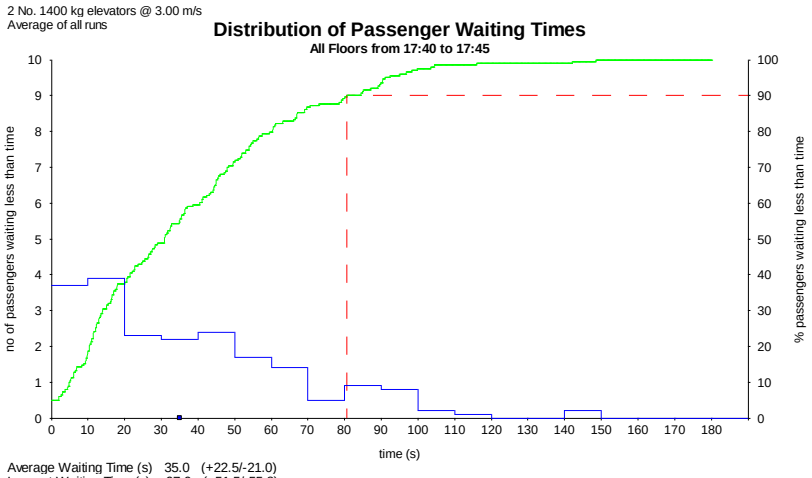
Arrangement	Conventional for Single Deck elevators
Template	Constant traffic (% building pop per 5 mins)
Demand (% pop per 5 mins)	7.00
Incoming (%)	50.00
Outgoing (%)	50.00
Interfloor (%)	0.00
Start Time (hrs:mins)	17:00
End Time (hrs:mins)	18:00
Passenger Mass (kg)	75
Passenger Area (m²)	0.00
Loading Time (s)	1.20
Unloading Time (s)	1.20
Stair Factor (%)	0.00
Capacity Factor by Mass (%)	80.00
Capacity Factor by Area (%)	100.00

Floor Name	*Entrance Bias*
B6	18.00
B5	27.00
B4	27.00
UG	28.00

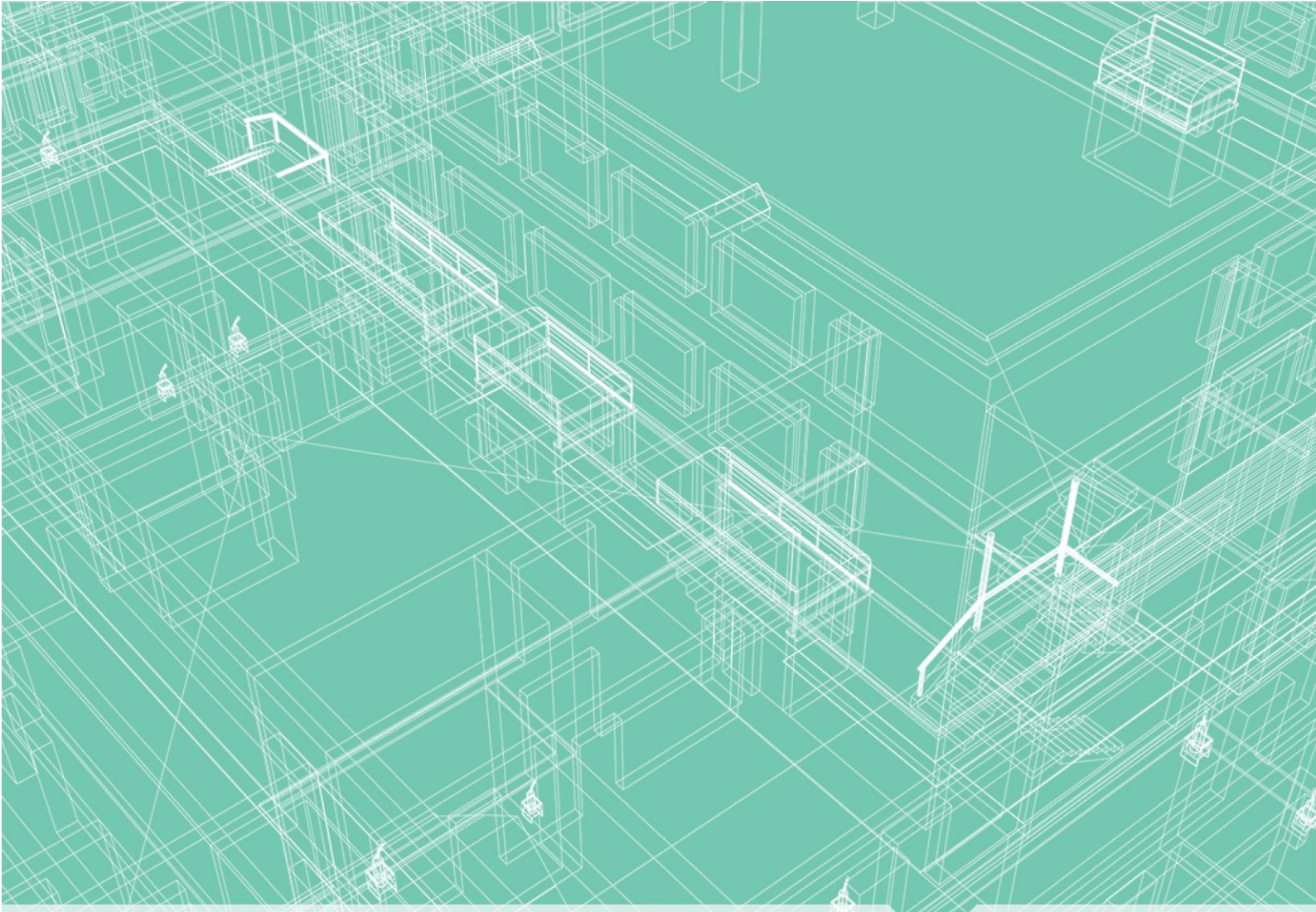
The simulation was run for the period 17:00-18:00 and the peak 5-minute period was determined to be 17:40-17:45.



Based on the peak 5-minute period, the average waiting time is 35s and 90% of calls were answered within 85s. The average longest waiting time is 97s.



With an average waiting time of 35s, the current design will meet the criteria for the evening two-way pattern.



LIFT TRAFFIC STUDY

DORAN DRIVE PRECINCT 2 RETAIL

VERTICAL TRANSPORTATION SERVICES

JHA

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DOCUMENT CONTROL SHEET

Project Number	200236
Project Name	Doran Drive Precinct 2
Description	Vertical Transportation Traffic Study Retail
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	REV							
	DATE							
	REV							
	DATE							

CONTENTS

1 EXECUTIVE SUMMARY

1.1 EXECUTIVE SUMMAY

Our review of the Vertical Transportation (VT) systems currently designed for the car park and retail levels located at Dorian Drive Precinct 2, is that, based on the information provided, as outlined within the documents detailed below the system will generally meet the guidelines of CIBSE Guide D 2020 for this type of building, see table below with results.

Table 1–Traffic study results

	Lunch time (two-way)	
	Recommended	Simulated
Car Park to Retails Lifts	40-60 s	38 s ✓

Each of the moving walks and escalators has a capacity of 4,500 people/hour, therefore they will people easily between the car park and retail levels. There is some scope for minor fluctuations in the building population without significantly impacting the level of service to be provided to the development.

1.2 DOCUMENTS PROVIDED AND REFERENCED

The traffic report has been based on the following documents:

- Turner's architectural drawings received 08/07/2021,
- D + R Architects Preliminary Fitout Plan received 13/05/2021,
- CIBSE Guide D, The Charted Institution of Building Services Engineers

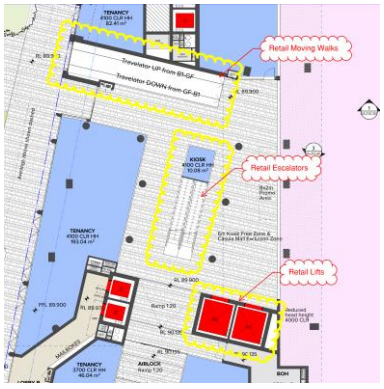
Any changes to the above will require re-assessment to determine the VT system meets the guidelines.

1.3 EXTENT OF WOKS

The vertical transportation scope of works to be carried through to design development include but are not limited to:

- Two (2) retail lifts serving levels B3, B2, B1, G, UG, 1
- Two (2) moving walks serving levels B3-B2
- Two (2) moving walks serving levels B2-B1
- Two (2) moving walks serving levels B1-G
- Two (2) escalators serving levels G-UG
- Two (2) escalators serving levels UG-1

Figure 1–Location of VT units



2 PROCESS

In determining the efficiency of the proposed VT system, we have drawn the following key data from the information provided

- Lift travels
- Entrance openings
- Number of parking spots on each level

The key data is then used to determine the car park population which is based on the number of spots on each floor. CIBSE Guide D provides recommendations on occupancy factors.

This information is then entered into Elevate™, lift traffic simulation software, for analysis. The results are compared to the recommend levels specified in CIBSE Guide D, ranging from 40-60s.

The results and key data are displayed in the building summary, section 3.3.1.

Car park population is calculated by the number of parking spots multiplied by the factors below:

Table 2–Car park quantities and estimated population

	People	Level B1		Level B2		Level B3		Totals	
Car Park Type	/ Car	Spots	People	Spots	People	Spots	People	Spots	People
Accessible	2	2	4	2	4	2	4	6	12
Parents with prams	3	4	12	5	15	5	15	14	42
Pick-up	1	0	0	0	0	0	0	0	0
Retail	2	80	160	96	192	94	188	270	540
Wash	2	0	0	0	0	0	0	0	0
Share	2	0	0	0	0	8	16	8	16
Staff	1.2	0	0	26	31	17	20	43	51
Totals		86	176	129	242	126	243	341	661

The total car park population is 661.

The population that will use the lift is 54 comprising of Accessible and Parents with prams.

80% of remaining parking population, 485, will use the moving walks and escalators to move through the building. Each moving walk and escalator has a capacity to transport 4,500 people/hour.

The balance population of 122 is assumed will also use the lift.

Therefore, total lift usage population is 176.

Car park will turnover over a one-hour period and the traffic profile is based on

- Lift handling capacity will be 17% of the population per 5-minutes,
- Incoming (from car park levels to retail levels) 35%,
- Outgoing (from retail levels to car park levels) 35%, and
- Inter-floor (between retail floors) 30%.

3 TRAFFIC SIMULATIONS

3.1 GENERAL

3.1.1 TRAFFIC SIMULATION SOFTWARE

Lift traffic analysis software used is Elevate™, Version 8.25, Dr Richard Peters, Peters Research. For each analysis, Elevate™ runs 10 simulations with the same configuration; the results of each simulation are then averaged to produce the final results. Also, for each simulation, Elevate™ generates a random number seed to make a list of people and their arrival time based on the building and passenger data. By changing the random number seed, the simulation will have the same number of people generated but they will arrive at different times.

3.1.2 DEFINITIONS

Table 3–List of terms and their definitions

Two-way traffic	is a traffic condition which exists when the dominant traffic flow is to and from the main floor
Incoming traffic	the part of the total demand that corresponds to passenger arriving at the entrance floor
Outgoing traffic	the part of the total demand that corresponds to passenger arriving the other floors, and travelling to the entrance floor—exit traffic
Handling Capacity	defined as the percentage of the building population transported by the lift system in a five-minute period
Average Waiting Time	defined as the average period of time in seconds from when a passenger either registers a landing call, or joins a queue, until the responding lift begins to open its doors at the boarding floor
Capacity Factor	allows for passengers not loading the elevators to their rated capacity
Loading Time	The time taken, in seconds, for a single passenger to load the car
Unloading Time	The time taken, in seconds, for a single passenger to unload from the car

3.1.3 LEGEND FOR DISTRIBUTION OF PASSENGER WAITING TIMES CHART

Green line: plots against the right-hand side y axis, a graph showing what percentage of passengers have waiting times less than or equal to the value on the x axis, dotted red line identifies the 90-percentile.
Blue line: plotted against the y1 axis, identifies the number of passengers who have waited in each of the specified time ranges.

3.1.4 NOTE

Note: Lift simulations are based on theoretical models that are used to assist with system selection for performance, differences between this report and the actual service provided by the indicated equipment may be encountered due to variations in user behaviour or building design which were not anticipated when this report was prepared. Results can also differ between suppliers.

3.2 REQUIREMENTS

As outlined in Section 2 above, we need to complete traffic pattern calculation with the following parameters:

1. Two-way comprising of incoming 35%, outgoing 35%, and inter-floor 30%
2. Average Waiting Time: 40-60s
3. Handling capacity: 17%

3.3 CAR PARK TO RETAIL

3.3.1 BUILDING PARAMETERS

Traffic simulations have been run using an expected population of 369 people.

ANALYSIS DATA

Analysis Type	Simulation
Measurement system	Metric
Dispatcher Algorithm	Group Collective Traffic mode: Normal
Time slice between simulation calculations (s)	0.10
No of time slices between screen updates	10
No of simulations to run for each configuration	10
No of learning runs	0
Random number seed for passenger generator	1
Energy Model	Off

BUILDING DATA

Floor	Marking	FFL	FTF	S	F	R	Use		Pop	T P	CP	CP	%BP
6	1	98,150	3,900	X	F		Retail		42	42			
5	UG	94,250	4,350	X	F		Retail		26	26			
4	G	89,900	4,700	X	F		Retail		107	107		-	
3	B1	85,200	3,000	X	F		Basement					48	27%
2	B2	82,200	3,000	X	F		Basement					64	37%
1	B3	79,200		X	F		Basement					64	37%
			18,950	6	6	0		-	175	175	-	176	

ELEVATOR DATA

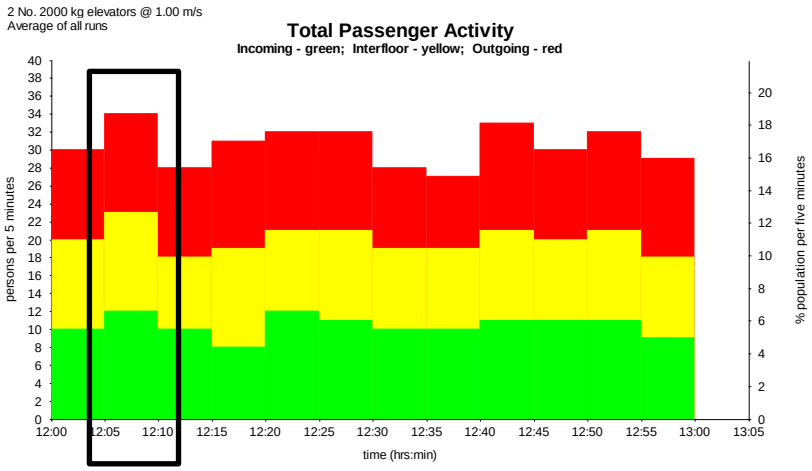
No of Elevators	2
Type	Single Deck
Capacity (kg)	2000
Car area (m^2)	4.00
Door Pre-opening Time (s)	0.50
Door Open Time (s)	2.00
Door Close Time (s)	3.30
Door Dwell 1 (s)	3.00
Door Dwell 2 (s)	1.00
Speed (m/s)	1.00
Acceleration (m/s^2)	0.60
Jerk (m/s^3)	0.80
Start Delay (s)	0.50
Levelling Delay (s)	0.00
Home Floor	G

3.3.2 TWO-WAY

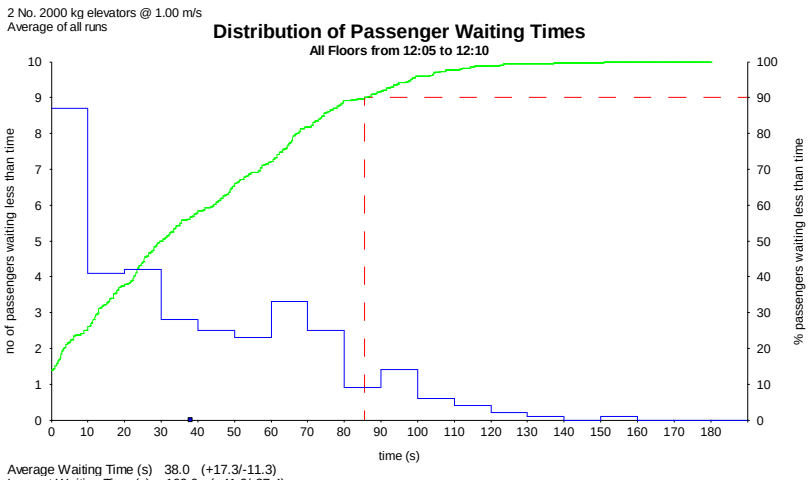
PASSENGER DATA	
Arrangement	Conventional for Single Deck elevators
Template	Constant traffic (% building pop per 5 mins)
Demand (% pop per 5 mins)	17.00
Incoming (%)	35.00
Outgoing (%)	35.00
Interfloor (%)	30.00
Start Time (hrs:mins)	12:00
End Time (hrs:mins)	13:00
Passenger Mass (kg)	75
Passenger Area (m^2)	0.21
Loading Time (s)	3.00
Unloading Time (s)	3.00
Stair Factor (%)	0.00
Capacity Factor by Mass (%)	60.00
Capacity Factor by Area (%)	100.00

Floor Name	*Entrance Bias*
B3	37.00
B2	37.00
B1	27.00

The simulation was run for the period 12:00-13:00 and the peak 5-minute period was determined to be 12:05-12:10.

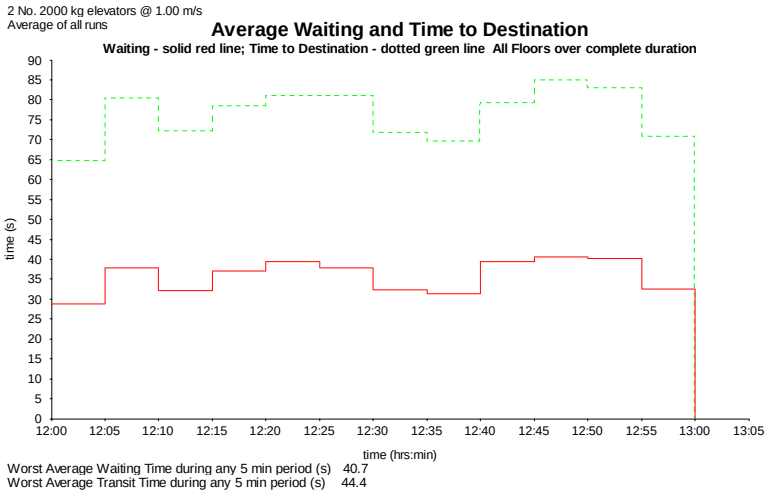


Based on the peak 5-minute period, the average waiting time is 38s and 90% of calls were answered within 88s. The average longest waiting time is 109s.



With an average waiting time of 38s, the current design will meet the criteria for the two-way pattern.

The chart below shows the average waiting time for each 5-min period during the one-hour simulation. The average waiting time for the worst 5-min period is 44s.



The following two charts show the lift loading (utilisation) during the period. The lift capacity is showing less than 20%, this will accommodate people with trolleys or prams comfortably; it also shows the lift has extra capacity to cope for peaks.