

# Waterfront South Central Proposed SHD Scheme

Report on Passenger Lift  
Performance

10th October 2020

 **axiseng**  
consulting engineers



Dunbar Boardman



## Issue / Revision Record

Issue	Date	By	Checked	Comment
1	10/05/2019	CG	SL	Change to design
2	20/06/2019	LM	SL	Change to design
3	30/07/2019	LM	SL	Change to occupancy
4	30/09/2019	LM	HMcG	Change to design
5	10/10/2019	LM	SL	Change to design
6	May 2020	LM	NR	Change of use to Block C
7	16/10/2020	LM	NR	Change of occupancy Block C
8	18/12/2020	LM		Cover Image change and formatting



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It is our ultimate goal to work closely with our fellow professionals and clients to minimise carbon emissions and to deliver a better environment for us all to live in.

# Contents

	Page
<b>1.0 Client and Brief</b>	<b>3</b>
<b>2.0 Reference Guidelines and Standards</b>	<b>3</b>
<b>3.0 Current Lift Provision</b>	<b>3</b>
<b>4.0 Schedule of Accommodation</b>	<b>5</b>
4.1 Occupancy Factors	
4.2 Predicted Population	
<b>5.0 Definitions</b>	<b>9</b>
<b>6.0 Performance Criteria</b>	<b>9</b>
<b>7.0 Traffic Analysis</b>	<b>9</b>
7.1 Method and Traffic Templates	
7.2 Lift Arrangements Considered	
7.3 Results	
<b>8.0 Firefighter Lifts</b>	<b>10</b>
<b>9.0 Dimensions</b>	<b>11</b>
<b>10.0 Summary</b>	<b>12</b>
<b>Appendix A: Block C Tower 3 – Commercial Use</b>	<b>13</b>

## 1.0 Client and Brief

Waterside Block 9 Developments Limited, c/o Axiseng Consulting Engineers, appointed TÜV SÜD Dunbar Boardman to undertake an analysis of the proposed vertical transportation (VT) provision and lift system performance at Waterfront South Central, a residential development in Dublin.

The aim of this report is to provide vertical transportation consultancy and an independent strategy that fits within the architectural concept and meets the required standards for the residential buildings within this development.

It details the design criteria, methods and assumptions used for carrying out lift traffic calculations and analysing the performance of the passenger lift system.

## 2.0 Reference Guidelines and Standards

For the purpose of this report, the following documents are referenced:

- The Chartered Institute of Building Services Engineers (CIBSE) Guide D: Transportation systems in buildings
- EN 81-70 - Accessibility to lifts for persons including persons with disability
- The Building Regulations: Part M Access to and use of buildings – Volume 1: Dwellings
- Lifetime Homes Design Guide

## 3.0 Current Lift Provision

The Waterfront South Central Project is a development of six buildings with three for residential use and three for commercial use. The residential buildings (blocks A, B and C) will comprise of private, rental and Part V housing units plus commercial, retail and amenity spaces. Block C Core 3 is for commercial use only and has been analysed separately (see Appendix A).

The following lift diagram show the lift provision included in the current design.

Key:

□	Passenger lift (also indicates levels served)
⊗	Headroom
⊗	Pit
⊙	Machine room

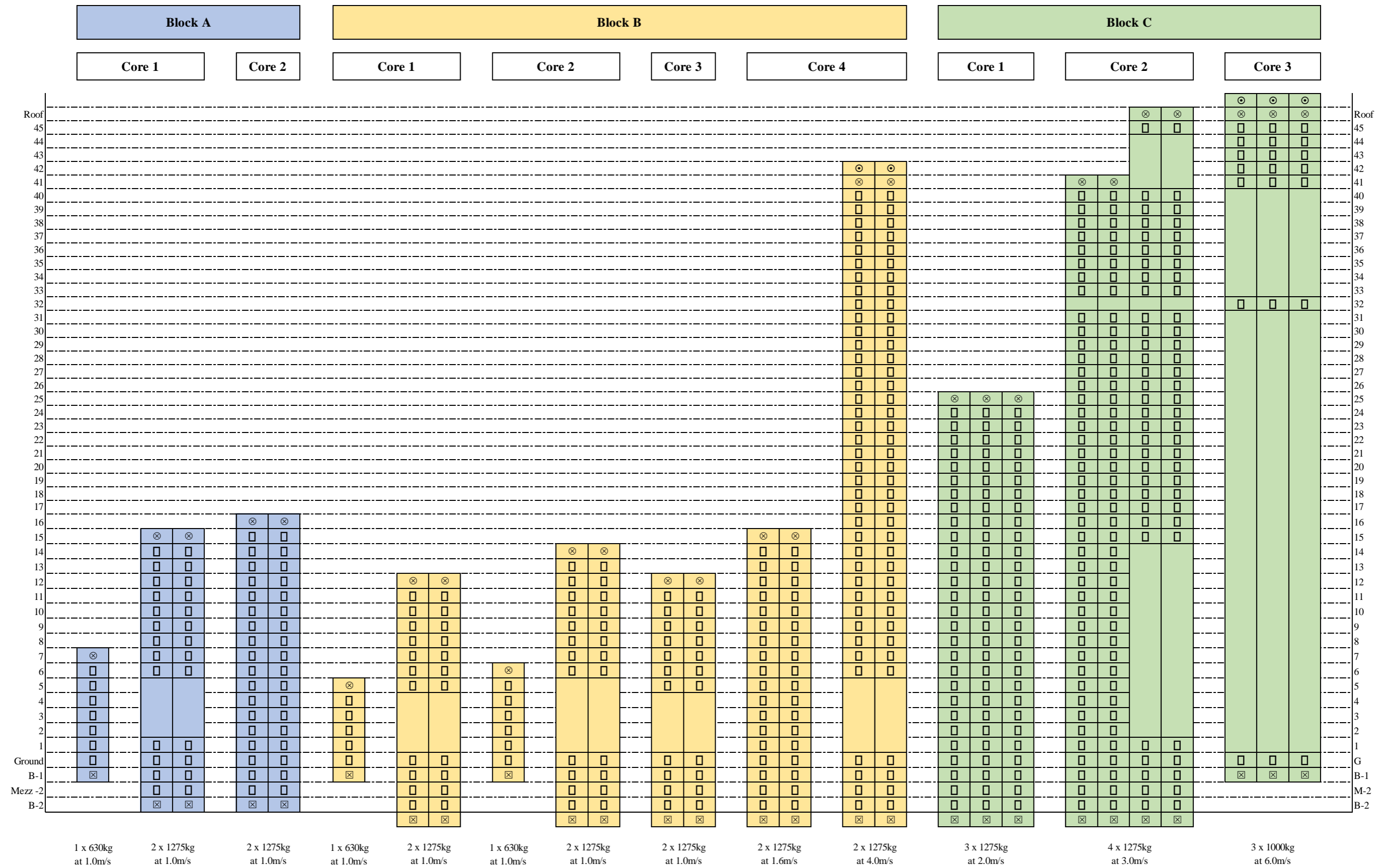


Figure 1 – Proposed lift system provision

## 4.0 Schedule of Accommodation

### 4.1 Occupancy Factors

The CIBSE Guide D occupancy factors, shown below, have been used to determine the buildings population based on three occupancy types. The apartment mix has been taken from Henry J Lyons Housing Quality Assessment Report dated May 2020.

Type	Luxury	Normal	Social
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

Table 1 - CIBSE Guide D occupancy factors (people) for residential buildings

### 4.2 Predicted Population

#### Block A Core 1 – Part V Apartments

Floor	Floor Height (m)	Part V (Social Occupancy Type)		
		1 Bed Apartment	2 Bed Apartment	Total Population
5	3.35	0	4	16
4	3.35	4	5	28
3	3.35	4	5	28
2	3.35	4	5	28
1	3.35	4	5	28
Ground	4.5	Entrance		

Table 2 – Predicted population of Block A Core 1 – Part V apartments

#### Block A Core 1 – Normal Occupancy Type

Floor	Floor Height (m)	Normal Occupancy Type		
		1 Bed Apartment	2 Bed Apartment	Total Population
13	3.35	5	4	21
12	3.35	5	4	21
11	3.35	4	5	22
10	3.35	4	5	22
9	3.35	4	5	22
8	3.35	4	5	22
7	3.35	4	5	27
6	3.35	4	5	31
5	3.35	4	1	10
4	3.35	Open Hoist		
3	3.35			
2	3.35			
1	3.35			
Ground	4.5	Entrance		
B-1	5.2	Amenities		
M-2	4.5	Plant		
B-2		Car Parking		

Table 3 – Predicted population of Block A Core 1 – Normal type occupancy apartments

#### Block A Core 2 – Normal Occupancy Type

Floor	Floor Height (m)	Normal Occupancy Type		
		1 Bed Apartment	2 Bed Apartment	Total Population
14	3.35	0	0	n/a
13	3.35	3	1	8
12	3.35	3	1	8
11	3.35	3	1	8
10	3.35	4	2	13
9	3.35	4	2	13
8	3.35	4	2	13
7	3.35	6	3	20
6	3.35	6	3	20
5	3.35	6	3	20
4	3.35	6	3	20
3	3.35	6	3	20
2	3.35	6	2	17
1	3.35	6	2	17
Ground	4.5	Entrance		
B-1	5.2	Amenities		
M-2	4.5	Plant		
B-2		Car parking		

Table 4 – Predicted population of Block A Core 2 – Normal type occupancy apartments

#### Block B Core 1 – Part V Apartments

Floor	Floor Height (m)	Part V (Social Occupancy Type)		
		1 Bed Apartment	2 Bed Apartment	Total Population
4	3.35	4	5	28
3	3.35	4	5	28
2	3.35	4	5	28
1	3.35	4	5	28
Ground	4.5	2	2	n/a

Table 5 – Predicted population of Block B Core 1 – Part V apartments

#### Block B Core 1 – Normal Occupancy Type

Floor	Floor Height (m)	Normal Occupancy Type		
		1 Bed Apartment	2 Bed Apartment	Total Population
11	3.35	3	1	8
10	3.35	4	3	16
9	3.35	4	3	16
8	3.35	4	3	16
7	3.35	4	5	22
6	3.35	4	5	22
5	3.35	4	5	22
4	3.35	Open hoist		
3	3.35			
2	3.35			
1	3.35			
Ground	4.5	Entrance		
B-1	5.2	Amenities		
M-2	4.5	Plant		
B-2		Car parking		

Table 6 – Predicted population of Block B Core 1 – Normal type occupancy apartments

**Block B Core 2 – Part V Apartments**

Floor	Floor Height (m)	Part V (Social Occupancy Type)		
		1 Bed Apartment	2 Bed Apartment	Total Population
5	3.35	3	2	14
4	3.35	3	2	14
3	3.35	3	2	14
2	3.35	3	2	14
1	3.35	0	0	n/a
Ground	4.5	0	0	n/a

Table 7 – Predicted population of Block B Core 2 – Part V apartments

**Block B Core 2 – Normal Occupancy Type**

Floor	Floor Height (m)	Normal Occupancy Type		
		1 Bed Apartment	2 Bed Apartment	Total Population
13	3.35	3	2	11
12	3.35	3	2	11
11	3.35	3	2	11
10	3.35	3	2	11
9	3.35	3	2	11
8	3.35	3	2	11
7	3.35	3	2	11
6	3.35	3	2	14
5	3.35	Open hoist		
4	3.35			
3	3.35			
2	3.35			
1	3.35	Residential amenity space		
Ground	4.5	Entrance		
B-1	5.2	Amenities		
M-2	4.5	Plant		
B-2		Car parking		

Table 8 – Predicted population of Block B Core 2 – Normal type occupancy apartments

**Block B Core 3 – Normal Occupancy Type**

Floor	Floor Height (m)	Normal Occupancy Type		
		1 Bed Apartment	2 Bed Apartment	Total Population
11	3.35	3	1	8
10	3.35	3	1	8
9	3.35	3	1	8
8	3.35	3	1	8
7	3.35	4	4	19
6	3.35	4	4	19
5	3.35	4	3	16
4	3.35	4	4	19
3	3.35	4	4	19
2	3.35	4	2	13
1	3.35	4	2	13
Ground	4.5	Entrance		
B-1	5.2	Amenities		
M-2	4.5	Plant		
B-2		Car parking		

Table 9 – Predicted population of Block B Core 3 – Normal type occupancy apartments

**Block B Core 4 – Normal Occupancy Type**

Floor	Floor Height (m)	Normal Occupancy Type		
		1 Bed Apartment	2 Bed Apartment	Total Population
14	3.35	Communal amenities		
13	3.35	3	4	17
12	3.35	4	4	19
11	3.35	4	4	19
10	3.35	4	4	19
9	3.35	4	4	19
8	3.35	4	4	19
7	3.35	4	4	19
6	3.35	4	4	19
5	3.35	4	4	19
4	3.35	4	4	19
3	3.35	4	4	19
2	3.35	4	4	19
1	3.35	5	3	18
Ground	4.5	Entrance		
B-1	5.2	Amenities		
M-2	4.5	Plant		
B-2		Car parking		

Table 10 – Predicted population of Block B Core 4 – Normal type occupancy apartments

**Block B Core 4 – BTS (Normal and Luxury Occupancy Type)**

Floor	Floor Height (m)	BTS (Normal & Luxury Occupancy Type*)		
		1 Bed Apartment	2 Bed Apartment	Total Population
40	3.35	0	2	4
39	3.35	0	4	8
38	3.35	0	4	8
37	3.35	0	4	8
36	3.35	0	4	12
35	3.35	0	4	12
34	3.35	0	4	12
33	3.35	0	4	12
32	3.35	0	4	12
31	3.35	0	4	12
30	3.35	0	4	12
29	3.35	0	4	12
28	3.35	0	4	12
27	3.35	0	4	12
26	3.35	0	4	12
25	3.35	0	4	12
24	3.35	0	4	12
23	3.35	0	4	12
22	3.35	0	4	12
21	3.35	0	4	12
20	3.35	Plant		
19	3.35	0	4	12
18	3.35	0	4	12
17	3.35	0	4	12
16	3.35	0	4	12
15	3.35	0	4	12

14	3.35	Communal amenities		
13	3.35	3	2	11
12	3.35	3	2	11
11	3.35	3	2	11
10	3.35	3	2	11
9	3.35	3	2	11
8	3.35	3	2	11
7	3.35	3	2	11
6	3.35	3	2	14
5	3.35	Open hoist		
4	3.35			
3	3.35			
2	3.35			
1	3.35			
Ground	4.5	Entrance		
B-1	5.2	Amenities		
M-2	4.5	Plant		
B-2		Car parking		

Table 11 – Predicted population of Block B Core 4 – BTS apartments (normal and luxury type occupancy)

\*Luxury Occupancy Type applied from Level 37 for BTS Premium & Penthouse Type Apartments

**Block C Core 1 – Normal Occupancy Type**

Floor	Floor Height (m)	Normal Occupancy Type		
		1 Bed Apartment	2 Bed Apartment	Total Population
24	3.35	Amenities		
23	3.35	2	3	13
22	3.35	2	3	13
21	3.35	2	3	13
20	3.35	2	3	13
19	3.35	2	3	13
18	3.35	2	3	13
17	3.35	2	3	13
16	3.35	2	3	13
15	3.35	2	3	13
14	3.35	2	3	13
13	3.35	2	3	13
12	3.35	2	3	13
11	3.35	2	3	13
10	3.35	4	5	22
9	3.35	4	5	22
8	3.35	4	5	22
7	3.35	4	5	22
6	3.35	4	5	22
5	3.35	4	4	19
4	3.35	4	4	19
3	3.35	4	4	19
2	3.35	5	4	21
1	3.35	6	3	20
Ground	4.5	Entrance		
B-1	5.2	Amenities		
M-2	4.5	Plant		
B-2		Car parking		

Table 12 – Predicted population of Block C Core 1 – Normal type occupancy apartments

**Block C Core 2 – BTS (Normal and Luxury Occupancy Type)**

Floor	Floor Height (m)	BTS (Normal & Luxury*)			Total Population
		1 Bed Apartment	2 Bed Apartment	3 Bed Apartment	
45		Roof garden			
44	4.5	Open hoist			
43	4.2				
42	4.2				
41	4.2				
40	4.5			2	6
39	4.5		2	1	7
38	4.5		4		8
37	4.2		4		8
36	4.2		4		8
35	4.2	1	3		8
34	4.2	1	3		8
33	3.35	2	2		10
32	3.35	Restaurant			
31	3.35	4	2		13
30	3.35	4	2		13
29	3.35	4	2		13
28	3.35	4	3		16
27	3.35	4	3		16
26	3.35	4	2		13
25	3.35	3	2		11
24	3.35	Amenities			
23	3.35	5	2		15
22	3.35	5	2		15
21	3.35	5	2		15
20	3.35	5	2		15
19	3.35	5	2		15
18	3.35	5	2		15
17	3.35	5	2		15
16	3.35	5	2		15
15	3.35	5	2		15
14	3.35	5	2		15
13	3.35	5	2		15
12	3.35	5	2		15
11	3.35	5	2		15
10	3.35	5	2		15
9	3.35	5	2		15
8	3.35	5	2		15
7	3.35	5	2		15
6	3.35	5	2		15
5	3.35	5	2		15
4	3.35	5	2		15
3	3.35	5	2		15
2	3.35	5	1		12
1	3.35	3	0		5
Ground	4.5	Entrance			
B-1	5.2	Amenities			
M-2	4.5	Plant			
B-2		Car parking			

Table 13 – Predicted population of Block C Core 2 – BTS apartments (normal and luxury type occupancy)

\*Luxury Occupancy Type applied from Level 34 for BTS Premium & Penthouse Type Apartments



## 5.0 Definitions

**Handling capacity (HC5):** Percentage of the building population which can be transported in a peak 5-minute period by the lift system.

**Average waiting time (AWT):** Average waiting time between the moment a passenger pushes a hall call button and the moment lift arrives at the landing.

**Time to destination (TTD):** Time taken for a passenger to reach their destination including AWT.

**Directional collective system (also referred to as full collective control system):** Traditional lift control system which includes two buttons on each landing except on the terminal and the top landings. Prospective passengers press either up or down depending on their desired direction of travel.

## 6.0 Performance Criteria

The lift performance is assessed by the quantity of service measured in terms of lift handling capacity and the quality of service measured in terms of passenger waiting times. The handling capacity relates to the building population determined above. The quality of service represented by waiting times varies depending on the type of building.

For residential buildings, the following represents the relevant lift system performance criteria as defined in CIBSE Guide D.

Type	Luxury	Normal	Social
Handling capacity (two-way)	8 %	6 – 8%	5 – 7%
Average waiting time	≤ 40 seconds	≤ 48 seconds	≤ 56 seconds

Table 14 - Performance criteria based on CIBSE Guide D

For example, if the development was to be of all 'Normal' type occupancy, the Guide recommends a target worst average waiting time of 48s or less and a two-way handling capacity of minimum 6% in the peak 5-minute period. There are no published recommendations for time to destination in residential buildings.

In addition to the target performance levels given above, the following regulations and design guides have been considered.

### The Building Regulations: Part M Access to and use of buildings – Volume 1: Dwellings

The requirements in relation to the provision of communal lifts for Category 2 – Accessible and adaptable dwellings M4(2) and Category 3 – Wheelchair user dwellings M4(3) are:

- The is a clear landing, a minimum of 1500mm long and 1500mm wide, directly in front of the lift door at every floor level.
- The lift is equivalent to or meets the requirements of BS EN81-70 for a type 2 lift.
- The car is a minimum of 1100mm wide and 1400mm deep inside.
- Doors have a minimum clear opening width of 800mm.
- Landing and car controls are 900-1200mm above the car floor and a minimum of 400mm (measured horizontally) from the inside of the front wall.
- The lift has an initial dwell time of five seconds before its doors begin to close after they are fully open.

## Lifetime Homes Design Guide

**Criterion 1b** – The access route between the parking and communal entrance (or in the case of basement parking, the lift core) should maintain a minimum clear width of 1200mm.

**Criterion 2** – The distance between all parking and entrances should be as short as practicable. Parking adjacent to entrances is the optimum arrangement. On large developments, communal parking should be within 50 metres of the relevant communal entrance or (in the case of underground parking) the lift core. If a distance in excess of 50 metres cannot be avoided, level resting areas should be provided along the route.

**Criterion 5b** – Provision of a lift is not a Lifetime Home requirement, but where a lift is provided, it should:

- Have minimum internal dimensions of 1100mm x 1400mm.
- Have clear landings adjacent to the lift entrance of 1500mm x 1500mm.
- Have lift controls at a height between 900mm and 1200mm from the floor and 400mm from the lift's internal front wall.

Good practice recommendations that exceed, or are in addition to, the above requirements:

- Provide lift access to all dwellings above entrance level as far as practicable.
- Provide access to two lifts within blocks of 4 or more storeys.
- Where lift access is not provided, consider potential to enable provision at a later date (by provision of space and/or adaptation).

## 7.0 Traffic Analysis

### 7.1 Method and Traffic Templates

The traffic analysis has been undertaken with a software simulation in Elevate™. This method uses CIBSE Guide D's two residential design templates for morning and evening peak traffic, shown in the following figures. Each template has twelve 5-minute periods representing the peak hour experienced in residential buildings.

The method considers the most demanding traffic periods expected in residential buildings:

- 1.) a two-way morning traffic split 15/85 incoming/outgoing traffic condition; and
- 2.) a two-way traffic split 50/50 incoming/outgoing, typical of the evening traffic expected.

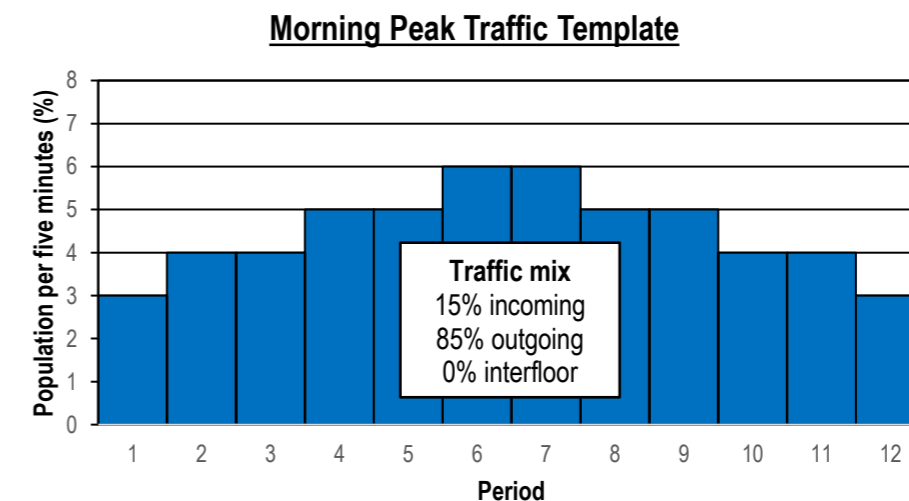


Figure 2 – CIBSE Guide D morning peak traffic template

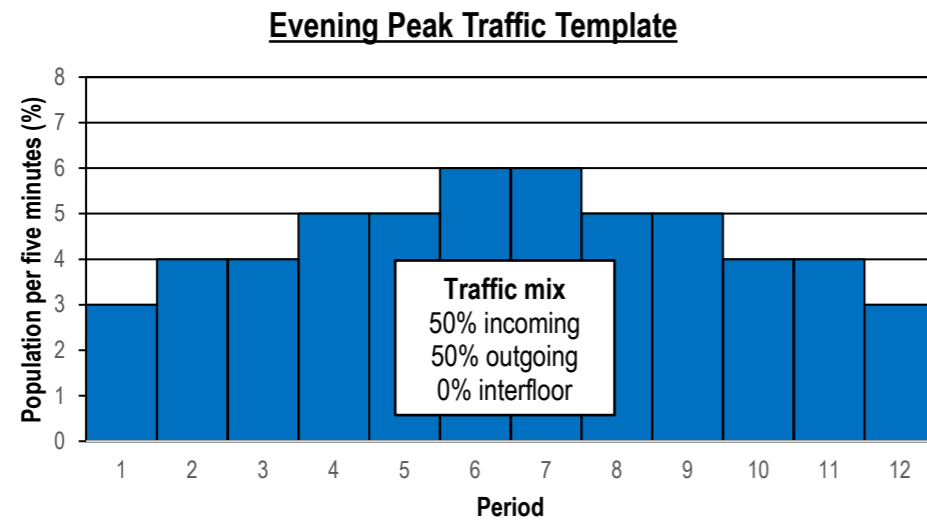


Figure 3 – CIBSE Guide D evening peak traffic template

## 7.2 Lift Arrangements Considered

For Block A (Cores 1) and Block B (Cores 1 and 2), the analysis considered one electric traction machine room less (MRL) lift with a capacity of 630kg / 8 person to serve the Part V at a speed of 1.0m/s using conventional full collective control system and 900mm wide two panel centre opening doors.

For Block A (Cores 1 and 2) and Block B (Cores 1, 2 and 3), the analysis considered a 2-car group of electric traction MRL lifts with a capacity of 1275kg / 17 person to serve the apartment / private rental units at a speed of 1.0m/s.

For Block B Core 4, two 2-car groups with a capacity of 1275kg / 17 person were considered. One of the two car groups would be MRL lifts serving all levels up to Level 14 (Amenities) at a rated speed of 1.6m/s. The second group of lifts would serve levels B-2, M-2, B-1 and Ground Floor then Levels 14 to 40 (BTS) at a rated speed of 4.0m/s. This lift group will require a machine room.

For Block C Core 1, a three-car group of MRL lifts with a capacity of 1275kg / 17 person at a speed of 2.0m/s was considered to serve the apartment / private rental units. For Core 2, a four-car group of MRL lifts with a capacity of 1275kg / 17 person at a speed of 3.0m/s was considered to serve the BTS units including the roof garden at Level 45.

All 1275kg / 17person lifts would be with conventional full collective control system and 1100mm wide two panel centre opening doors.

It is recommended that one of the passenger lifts in each core is combined passenger/firefighting. However, the number and location of the firefighting lifts required will need to be determined and confirmed by the Fire Engineer.

An overview of the arrangements considered is given in the following table.

Block	Core	Number of Lifts	Capacity	Speed	Entrance Bias
A	1	1	630kg / 8-person	1.0m/s	n/a
		2	1275kg / 17-person	1.0m/s	B-2 (10%), B-1 (3%), G (87%)
	2	2	1275kg / 17-person	1.0m/s	B-2 (10%), B-1 (3%), G (87%)
B	1	1	630kg / 8-person	1.0m/s	n/a
		2	1275kg / 17-person	1.0m/s	B-2 (10%), B-1 (3%), G (87%)
	2	1	630kg / 8-person	1.0m/s	n/a
		2	1275kg / 17-person	1.0m/s	B-2 (10%), B-1 (3%), G (87%)
	3	2	1275kg / 17-person	1.0m/s	B-2 (10%), B-1 (3%), G (87%)
	4	2	1275kg / 17-person	1.60m/s	B-2 (10%), B-1 (3%), G (84%), L14 (3%)
		2	1275kg / 17-person	4.0m/s	B-2 (10%), B-1 (3%), G (84%), L14 (3%)
	C	1	3	1275kg / 17-person	2.0m/s
2		4	1275kg / 17-person	3.0m/s	B-2 (26%), B-1 (3%), G (68%), PM 65%, L24 (3%), L45 (0%), PM 3%

Table 15 – Passenger lift configurations analysed

The same entrance bias was applied for Morning and Evening except where indicated.

### 7.3 Results

For each lift arrangement described, a results summary is presented in the table below.

Block	Core	Lift Arrangement	CIBSE Traffic Template	Average Waiting Time, AWT (s)	Time to Destination, TTD (s)	Meets Recommended Performance?	
A	1	1 x 630kg/ 8 person, 1.0 m/s	Morning	27.1	56.0	Yes	
			Evening	22.3	49.8	Yes	
		2 x 1275kg / 17 person, 1.0m/s	Morning	47.9	106.1	Yes	
			Evening	44.8	100.2	Yes	
	2	2 x 1275kg / 17 person, 1.0m/s	Morning	46.5	102.9	Yes	
			Evening	39.7	94.4	Yes	
B	1	1 x 630kg/ 8 person, 1.0m/s	Morning	22.2	47.5	Yes	
			Evening	17.0	40.0	Yes	
		2 x 1275kg / 17 person, 1.0m/s	Morning	28.7s	72.1s	Yes	
			Evening	24.3s	67.1s	Yes	
	2	1 x 630kg/ 8 person, 1.0m/s	Morning	19.4s	45.4s	Yes	
			Evening	18.3s	44.3s	Yes	
		2 x 1275kg / 17 person, 1.0m/s	Morning	33.1s	87.6s	Yes	
			Evening	23.7s	73.0s	Yes	
	3	2 x 1275kg /17 person, 1.0m/s	Morning	21.2s	55.4s	Yes	
			Evening	16.8s	49.5s	Yes	
	4	2 x 1275kg / 17 person, 1.6m/s	Morning	32.2s	71.6s	Yes	
			Evening	23.2s	57.8s	Yes	
		2 x 1275kg / 17 person, 4.0m/s	Morning	44.8s	103.1s	~	
			Evening	41.9s	93.3s	~	
	C	1	3 x 1275kg / 17 person, 2.0m/s	Morning	43.9	87.2	Yes
				Evening	40.5	79.6	Yes
2		4 x 1275kg / 17 person, 3.0m/s	Morning	47.5	94.7	~	
			Evening	38.1	74.2	~	

Table 16 – Traffic analysis results

~ meets standard performance requirements but not luxury (limited number of BTS premium and penthouse apartments in each core).

The results shown above are assessed against CIBSE Guide D's recommendations based on 'Social' and 'Normal' type building occupancy which consider a target worst average waiting time of ≤ 56 seconds with a handling capacity of 7% and ≤ 48 seconds and a handling capacity of 6% respectively.

### 8.0 Firefighter Lifts

Firefighters lifts and shafts must be designed in accordance with BS 9999 and EN 81-72.

They are required where the distance between the fire service access level (FSAL) and the top floor served is more than 18m or the lowest level served is 10m below the FSAL. Therefore, the new office development will require firefighters lifts.

One firefighters lift is required for buildings with a floor area up to 900m<sup>2</sup> on any storey and at least two shafts where the floor area on any storey exceeds 900m<sup>2</sup>.

Firefighters lifts must be minimum 630kg rated load (8-person) with internal car dimensions of 1100mm wide by 1400mm deep. If a firefighters lift is intended to be used for evacuation and accommodate a stretcher or bed, then the minimum rated load must be 1000kg with internal car dimensions of 1100mm wide by 2100mm deep.

The electrical equipment in the firefighters lift well must be protected against water ingress which will require either a 25mm high ramp up to the firefighters lift threshold or a drain system at all landings to prevent the ingress of water into the lift shaft.

Each firefighters lift needs to travel from the FSAL to the top floor served in less than 60s; it needs to serve all storeys and must be within a firefighting shaft which contains stairs, lobbies, fire main and the lift itself.

In addition, the firefighters lifts must not be used for moving goods or refuse.

## 9.0 Dimensions

Indicative shaft dimensions for the lift arrangements considered are given below.

The lift shaft dimensions given suit a range of major lift suppliers' products and are for clear plumb lift shafts and any construction tolerance would need to be added.

Block	Capacity	Speed	Car Size (w x d x h)	Door Type	Door Size (w x h)	Shaft Size (w x d)	Overhead <sup>1</sup>	Pit Depth <sup>2</sup>	Motor Room
Block A Core 1	630 kg / 8 person	1.0 m/s	1100 x 1400 x 2200	2 panel centre opening	900 x 2100	2000 x 1700	4100	1300	Without
Block B Cores 1 & 2									
Block A Cores 1 & 2	1275 kg / 17 person	1.0 m/s	1200 x 2300 x 2200	2 panel centre opening	1100 x 2100	2000 x 2700	4100	1550	Without
Block B Cores 1, 2 & 3									
Block B Core 4	1275 kg / 17 person	1.6 m/s	1200 x 2300 x 2200	2 panel centre opening	1100 x 2100	2000 x 2700	4750	1800	Without
Block C Core 1	1275 kg / 17 person	2.0 m/s	1200 x 2300 x 2200	2 panel centre opening	1100 x 2100	2000 x 2700	4950	2000	Without
Block C Core 2	1275 kg / 17 person	3.0 m/s	1200 x 2300 x 2200	2 panel centre opening	1100 x 2100	2000 x 2700	5360	3100	Without
Block B Core 4	1275 kg / 17 person	4.0 m/s	1200 x 2300 x 2200	2 panel centre opening	1100 x 2100	2000 x 2700	6520	4020	5200 x 4000 x 2800

Table 17 – Summary of lift schedule and indicative shaft dimensions (all dimensions are in millimetres)

<sup>1</sup> Overhead – the measurement from the top FFL served to the underside of the lift shaft slab soffit (or the lifting device)

<sup>2</sup> Pit depth – the measurement from first FFL served to the pit floor base

## 10.0 Summary

For the current design of the residential buildings at Waterfront South Project, CIBSE Guide D Transportation systems in buildings has been used to determine and assess the passenger lift system performance. The Guide recommends a target average waiting time of less than 56s and a handling capacity of minimum 5% in the peak 5-minute period for 'Social' type of building occupancy. For 'Normal' type of occupancy, the recommended AWT is less than 48s with a minimum handling capacity of 6% and for 'Luxury' type, it is less than 40 seconds and minimum of 8%.

The lift analysis shows that the following lifts are required per residential block per occupancy type to provide performance in line with CIBSE Guide D:

- Part V type units in Block A (Core 1) and Block B (Cores 1 and 2) require one lift per core
- Apartment type units in Block A (Cores 1 and 2) and Block B (Cores 1, 2, 3 and 4) would require two lifts per core and Block C Core 1 would require three lifts. All of the lifts would be under group collective control.
- BTS type units in Block B Core 4 requires two lifts and Block C Core 2 requires 4 lifts under group collective control.

While the traffic analysis shows that one 630kg / 8 person lift is adequate to transport the proposed occupancy for Part V (social housing) in Block A (Core 1) and Block B (Core 1 and 2), we would recommend that these lifts are minimum 1000kg/13-person, typically preferred for residential buildings to allow movement of more standard furniture (double mattress/bed, wardrobe etc) and stretchers.

Capacity	Speed (m/s)	Car Size (w x d x h)	Door Type	Door Size (w x h)	Plumb Shaft Size (w x d)	Headroom	Pit Depth
1000kg / 13 persons	1.0	1100 x 2100 x 2200	2 panel centre opening	900 x 2100	2000 x 2440	4100	1300

We would suggest two lifts for the Part V accommodation in Block A (Core 1) and Block B (Core 1 and 2) as per Lifetime Homes Design Guide recommendations. The advantages would be as follows:

- In the unavoidable event of a lift going out of service due to a breakdown, the building is still fully accessible
- As the equipment will age and require modernisation /refurbishment / replacement, a second lift will be providing transportation in the event of one having to be placed out of service for a period of time while works are being completed

### Machine Room Lifts

For the 4.0m/s recommendation for Block C Core 2, there is only a machine room option and the machine room should be directly above the shaft. A lift machine located anywhere but directly overhead increases the number of sheaves. This leads to reduced rope life and increased noise.

### Budget Costs

Block	Core	Capacity (persons)	No of Units	No of Stops	Speed (m/s)	Lift Type	Budget per Lift	Cost per Group of Lifts	
Block A	1	8	1	6	1.00	MRL	€ 62,000.00	€ 62,000.00	
		17	2	13	1.00	MRL	€ 165,000.00	€ 330,000.00	
	2	17	2	18	1.00	MRL	€ 195,000.00	€ 390,000.00	
Block B	1	8	1	5	1.00	MRL	€ 60,000.00	€ 60,000.00	
		17	2	15	1.00	MRL	€ 180,000.00	€ 360,000.00	
	2	8	1	6	1.00	MRL	€ 62,000.00	€ 62,000.00	
		17	2	13	1.00	MRL	€ 165,000.00	€ 330,000.00	
	3	17	2	15	1.00	MRL	€ 180,000.00	€ 360,000.00	
		4	17	2	18	1.60	MRL	€ 195,000.00	€ 390,000.00
			17	2	44	4.00	M/R	€ 350,000.00	€ 700,000.00
Block C	1	17	3	28	2.00	MRL	€ 230,000.00	€ 690,000.00	
		17	2	43	3.00	MRL	€ 300,000.00	€ 600,000.00	
	2	17	2	48	3.00	MRL	€ 300,000.00	€ 600,000.00	
ESTIMATED TOTAL (excluding vat)								€ 4,934,000.00	

In Block A Core 1 and Block B Core 1, 2 and 3, there are express zones / open hoist ways. This is where there is an interval between the ground floor and the next floor served. For example, Block A Lift Core 1, the two designated apartment lifts will service B-2, M-2, B-1 and Ground then the next floor served is Level 5 to Level 13. It will be required to install safety access doors in this portion of the lift shaft. These doors, by code requirement, are to be at a maximum interval of 11 metres. For firefighting lifts, the maximum interval is reduced to 7 metres.

In Building C, Levels 32, 41, 42, 43 & 44 were not included within this analysis as they will be served by a separate lift group.

### Goods Lifts Requirements

With retail at the ground floor of Blocks A, B and C, goods lifts may be required to serve from the basement levels up to the ground floor. The lifts may not need to serve all basements levels, just from a delivery level perhaps B-1 to Ground. We suggest minimum 1600kg / 21 person deep car at 1.6m/s and two lifts on a common service corridor to give an alternative if a lift fails.

Dimensions for Machine-Room-less 21 person / 1600kg Goods/Passenger Lift

Car Size (w x d x h)	Door Type	Door Size (w x h)	Plumb Shaft Size (w x d)	Pit Depth	Headroom
1400 x 2400 x 2200	2PSO	1300 x 2100	2400 x 2800	1800	4750

Dimensions above are approximate dimensions allowing for multiple contractors.

It should also be considered if separate service lifts would be required for access to the communal amenity levels in all three blocks along with the plant level; also, in Block C Level 32 (restaurant), Levels 41-43 (commercial office space), Level 44 (bar/function room) and Level 45 (roof garden).

## Appendix A: Block C Tower Core 3 – Commercial Use

The information presented in Appendix A considers an option for changing the use of Levels 41-44 in Block C of the development from residential apartments to:

- Commercial office accommodation at Levels 41, 42 and 43 and
- Public viewing terrace / function room at Level 44

As indicated previously, Block C will also comprise a public restaurant at Level 32 and a roof terrace/viewing platform at Level 45.

To provide efficient vertical circulation within the building, it is recommended that Levels 32, 41 to 45 are served by a separate lift group, which is in addition to the proposed 3- car group in Core 1 and the 4-car group in Core 2.

The following table, provided by Michael Slattery Associates, indicates the proposed maximum occupancy figures for the restaurant and public viewing terraces.

Level	Occupancy	Comments
32 - Restaurant	143	Total occupancy must not exceed 143 occupants
44 - Public viewing terrace / function room	300	Access to these two levels will need to be managed/controlled such that both levels combined do not exceed 300 occupants between them.
45 Public viewing terrace		

Regarding the commercial office spaces at Levels 41-43, 1 person per 10m<sup>2</sup> NIA has been used for our traffic analysis, as recommended by CIBSE/BCO for high density offices. This reflects an occupancy of 1 person per 8m<sup>2</sup> with 20% absenteeism.

Level	Occupancy	Comments
41 - Office	68	Based on 675m <sup>2</sup> NIA per floor / 10m <sup>2</sup> per person.
42 - Office	68	
43 - Office	68	

For office buildings, BCO/CIBSE Guide D recommend the following performance criteria:

Up-peak handling capacity, HC5 = 12%

Up-peak average waiting time, AWT ≤ 25 seconds (30 seconds may be accepted where time to destination, TTD ≤ 80 seconds)

Up-peak TTD ≤ 90 seconds (110 seconds may be accepted where AWT ≤ 25 seconds)

Lunch HC5 = 13%

Lunch AWT ≤ 40 seconds

Lunch TTD - not specified

There is no guidance for acceptable performance criteria for restaurants or viewing platforms. However, since the proposed development includes a mixed-use accommodation of office space, restaurant and roof terrace/viewing platform, it is recommended that the criteria of BCO/CIBSE Guide D for a target average waiting time for all occupancy types is followed to assess the performance of the lift provision.

It is recommended that for the proposed design of the office accommodation, both CIBSE Guide D and BCO Guide to Specification are used to determine and assess the passenger lift system performance.

Both Guides recommend assessing the lift system performance by:

- the quality of service measured in terms of waiting times and
- the quantity of service measured in terms of handling capacity or passenger demand.

The handling capacity relates to the building population. The quality of service represented by waiting times varies depending on the type of building. Guidance for acceptable performance in commercial offices, including waiting times and handling capacity recommendations, is summaries below.

Up-peak handling capacity, HC5 = 12%

Up-peak average waiting time, AWT ≤ 25 seconds (30 seconds may be accepted where time to destination, TTD ≤ 80 seconds)

Up-peak TTD ≤ 90 seconds (110 seconds may be accepted where AWT ≤ 25 seconds)

Lunch HC5 = 13%

Lunch AWT ≤ 40 seconds

Lunch TTD - not specified

Based on the traffic analysis assumptions detailed below, we recommend 3no of 1000kg / 13 person lifts at 6m/s. This arrangement is sufficient to move office, restaurant and viewing platform traffic (at Level 45 with at least 150 people incoming & 150 people outgoing in one hour i.e. between 12:00-13:00).

2no of 1000kg / 13 person lifts at 6.0m/s could handle the demand of office levels and restaurant without any population travelling to level 45.

Consideration may need to be given in relation to the general public using the same lifts to access the restaurant at level 32 and Levels 44 & 44 as the office staff to access Levels 41-43. There may require additional security provisions.

Lift Arrangement	Traffic Profile	Type of Traffic	Average Waiting time, AWT (s)	Time to Destination, TTD (s)	Meets Recommended Performance?
3 x 1000kg/13-person lifts at 6.0m/s	Morning up-peak	Office only (L41-L43)	19.1	61.8	Yes
	Lunch peak	Office (L41-L43), restaurant (L32) & viewing platform (L45)	35.1	89.2	Yes

### TRAFFIC ANALYSIS ASSUMPTIONS

For morning traffic (i.e. assuming the most demanding period is between 08:30-09:30):

- Population considered: Office only (levels 41, 42 & 43)
- Traffic profile: BCO Morning (traffic split 85% incoming / 10% outgoing / 5% interfloor) with maximum demand of 12%

For lunch traffic (assuming the most demanding period is between 12:00-13:00) – also more onerous scenario than morning peak:

- Population considered: **Office + Restaurant + Viewing platform** - all independent e.g. office staff assumed to travel to/from office floors only (i.e. no traffic of office staff to/from restaurant or platform floors), restaurant clientele assumed to travel to Level 32 only.
- Traffic profile **Office**: BCO Lunch (traffic split 45/45/10) with maximum demand of 13%
- Traffic profile **Restaurant**: custom (assumed) to reflect a total occupancy of 143 people (traffic split: 100% incoming during 12:00-12:45 and 85% incoming/15% outgoing between 12:45-13:00) with maximum demand of 12%
- Traffic profile **Viewing platform**: assumed constant traffic with demand of 8% (split 50% incoming / 50% outgoing)

Additional Notes / Assumptions:

- Level 44 (function + viewing platform) was not considered in the traffic analysis. The function space at Level 44 is assumed to be used in the evening.

- For the lunch peak analysis, we have assumed that passengers intending to go to the viewing platform will travel to Level 45, and not Level 44.
- Office floors: 41, 42 and 43 with an occupancy density of 1:8 with 20% absenteeism
- The analysis was calculated based on the lift running under destination control.
- Lifts travelling at 6.0m/s require separate machine rooms.
- While it is noted that two lifts would meet the requirements to service the office and restaurant levels only, we would recommend that a minimum of three lifts are installed. In the inevitable event that one of the lifts is out of service for repair or breakdown, the two remaining lifts could provide a reasonable service; in the case only two lifts were installed then a single lift would not be able to support the demands of the lift service required.
- The lifts are not serving Levels B-1, B-2 & B-3.

**DIMENSIONS**

Indicative shaft dimensions for the lift arrangement considered are given below.

The lift shaft dimensions given suit a range of major lift suppliers' products and are for clear plumb lift shafts and any construction tolerance would need to be added.

Capacity	Speed	Car Size (w x d)	Door Type	Door Size (w)	Shaft Size (w x d)	Overhead (minimum)	Pit Depth (minimum)	Internal Machine Room Dimensions (w x d x h)
1000kg / 13person	6.0m/s	1600mm x 1400mm	2 Panel Centre Opening	1100mm	2400mm x 1920mm	7050mm	4350mm	7050mm x 5430mm x 2800mm



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