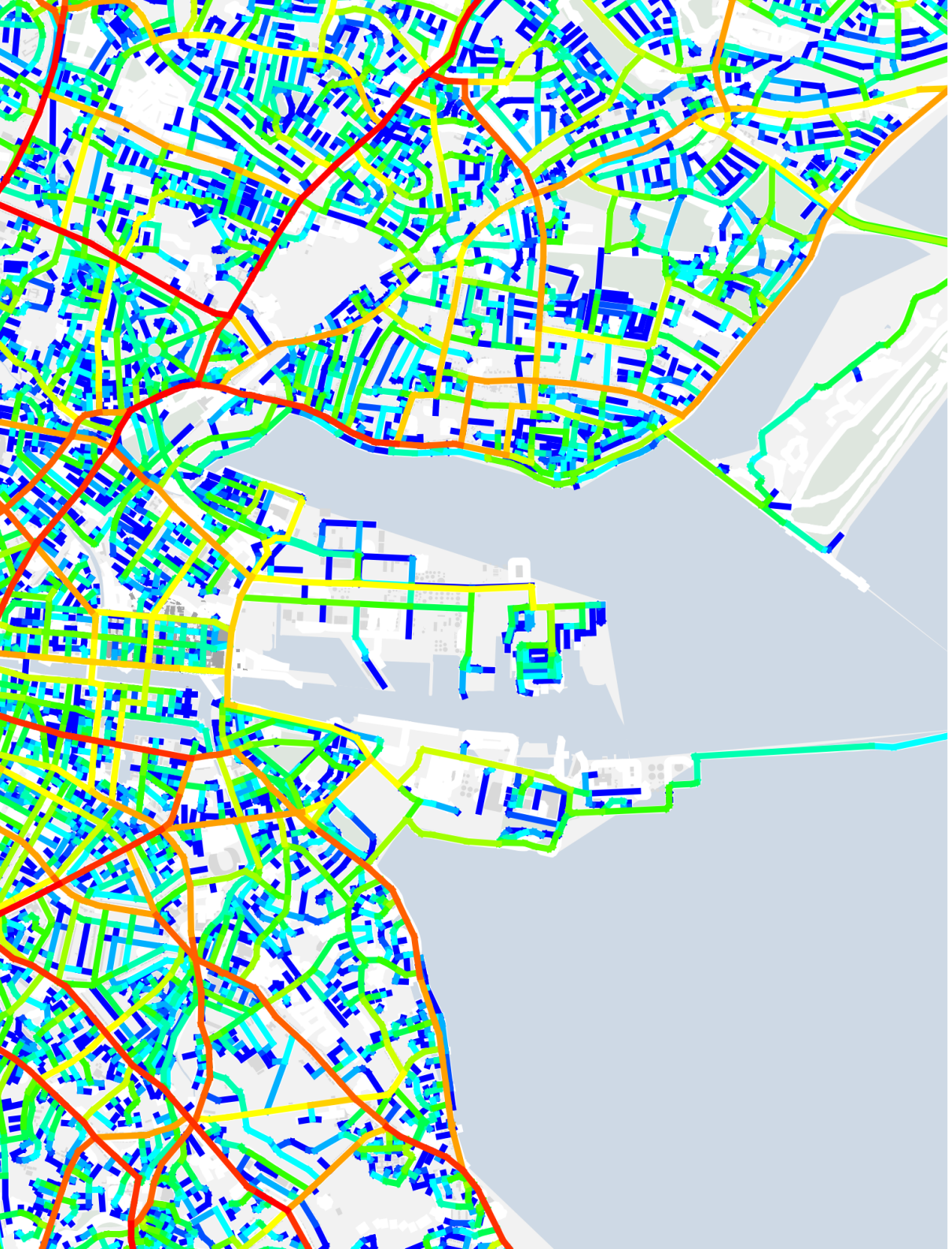

Dublin South Waterfront Central

Waterside Block 9 Developments Limited

Waterfront South Central

Pedestrian Capacity Analysis

January 2021

Revision 1

Space Syntax

Space Syntax

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Disclaimer

The scope of this Report, and all Services performed in connection with it, are limited to the Project as disclosed to us and defined in the Proposal. Any models created, and any evaluations and/or recommendations made by Space Syntax Limited in connection with the Project are specifically designed for the parameters of the Project and may only be used in the context of the Project. Space Syntax Limited excludes all liability for any use made by the Client or by its customers of any Space Syntax Deliverables or Services in any other context including in respect of any changes subsequently made to the parameters of the Project.

CONTENTS

Executive Summary

Introduction

Waterside Block 9 Developments Limited are developing a housing and commercial project close to the Three Arena on Dublin's north docklands.

It is located in the "North Lotts and Grand Canal Dock Strategic Development Zone" (SDZ) – one of the 11 areas throughout Ireland designated by the Irish Government to facilitate the development of schemes of strategic social or economic importance to the State. It is identified as City Block 9.

For the purposes of the proposed applications, the site is split in two - SDZ, and SHD. The area under assessment in this study includes both SDZ and SHD.

Space Syntax have been invited to assess the pedestrian capacity of the surrounding street network and analyse the levels of pedestrian movement that the SDZ and SHD will generate and their impact on the pedestrian comfort levels on the pavements around the development, and on the public realm within the site.

We understand that Dublin City Council questioned the capacity of the street network to accommodate the levels of likely pedestrian movement at the tripartite meeting with An Bord Pleanála (ABP).

This assessment is looking at the impact of the combined SDZ and SHD developments, since this represents the busiest scenario in terms of demand for pedestrian movement.

Key Questions

Space Syntax will address the above questions based on evidence-based urban design and research methods, as well as detailed knowledge and experience of urban form and human behaviour analysis. The analysis will consist of four elements to understand how the proposed scheme will influence the emergent flows of pedestrians in and around the proposed design.

1. What is the emergent pattern of pedestrian movement in and around the proposed design?

2. What is the capacity of the routes and pavements in and around the proposed design?

3. How will the proposed design impact on the pedestrian comfort levels and on the capacity of the routes and pavements in and around the proposed design?

Executive Summary

Methodology

Building the Future Baseline Model

Space Syntax have built a 'future baseline spatial accessibility model' for the proposed design within the area under assessment and the urban context of Dublin. This model includes the routes proposed by the SDZ and SHD developments.

The model of the entire city of Dublin is used to first understand the location and role of the site in the city. This indicates also the expected origins and destinations of future users of the new development.

Pedestrian movement forecast modelling

The Spatial Accessibility Analysis of the future baseline model and agreed assumptions about the development are used to forecast how the emergent pedestrian movement will be distributed within and around the site: from the building entrances and site access points, as a result of spatial accessibility around the site, and influenced by walking distances from public transport nodes and car parking.

We have modelled only the movement to and from the two developments within the area if assessment. The natural movement in the areas is not modelled. This is due to a lack of data available on current pedestrian movement patterns in the area. Collecting pedestrian movement data now will not reflect the 'everyday' scenario due to the restrictions imposed due to COVID-19. While this is a limitation, we think that due to the nature of the site location the 'normal' urban background movement would be very low. See page 6 for further details about these limitations.

**Source: Pedestrian planning and design– 1 Jan. 1971 by John J Fruin*

***Source: Transport for London Pedestrian Comfort Guidance for London, Guidance Document, version 2 (2019)*

Street Capacity, Pedestrian Comfort and Capacity Risk Assessment

Dublin City Council currently do not have prescribed guidelines for pedestrian comfort levels. We have therefore used the Fruin Level of Service guidelines as well as the Transport for London Pedestrian Comfort Level guidelines.

Fruin Level of Service guidelines*

The Fruin Level of Service (LoS) is an indication of the ease of movement in a pedestrian environment.

LoS is classified A-F (refer pg.48). LoS A indicates if sufficient space is provided for pedestrians to freely select their own walking speed, to bypass slower pedestrians and to avoid conflicts with others, while LoS F indicates as situation in which all pedestrian walking speeds are extremely restricted and forward progress can only be made by shuffling. There would be frequent, unavoidable contact with other pedestrians and reverse or crossing movements would be almost impossible. This level of service is representative of a loss of control and a complete breakdown in traffic flow.

For pedestrian movement in typical city environment the Level of Service should ideally not exceed B.

Transport for London guidelines**

We also determine the capacity of the routes and pavements in and around the proposed development using Transport for London (TfL) guidelines: http://content.tfl.gov.uk/pedestrian-comfort-guidance-technical-guide.pdf

For both residential and office/retail areas it is recommended that the Pedestrian Comfort Level (PCL) should not be below PCL B+ and B respectively.

Assumptions and test scenario

Peak scenario assumptions

We have modelled the evening scenario as it is likely to be the busiest on a typical day to assess the Pedestrian Comfort Levels in and around the development.

45% of the entire evening peak is assumed to arrive during the busiest hour in order to model the busiest scenario.

User assumptions

The evening peak scenario will consist of –

- Office workers leaving the site
- Residents returning home from work
- Visitors arriving to the site for retail, F+B uses
- Visitors arriving for special/recreation uses like the terrace garden.

- Residents and office workers who are walking or using public transport to the site are modelled. Visitors who walk, use public transport, or drive to the area are modelled.

- Cycles and cars for commuting residents and office workers are not modelled as they are unlikely to use the pavements and public realm during the peak scenario.

- Office occupancy is assumed to by 80% at any given time,

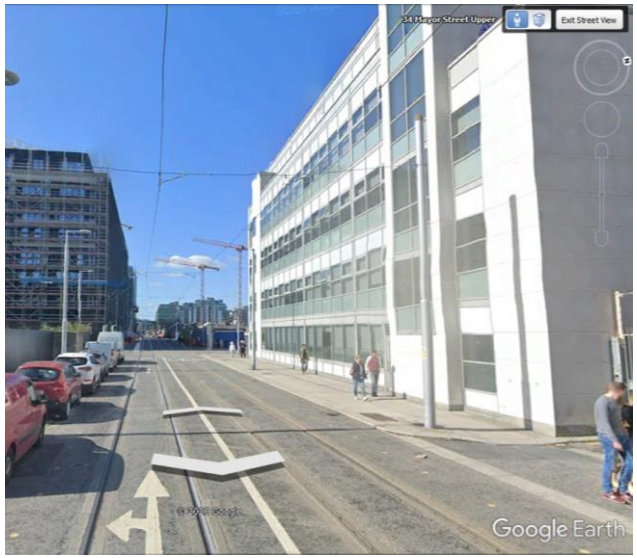
- The percentage of residents who work is assumed to be 62%.

Executive Summary Limitations

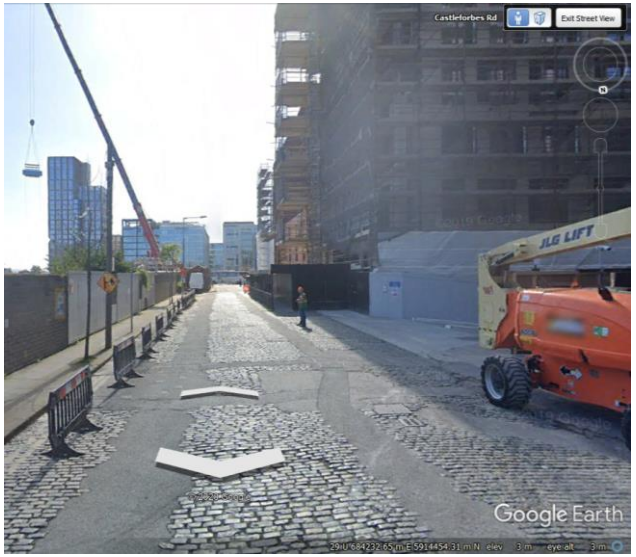
The analysis only models the predicted movement to and from the SDZ and SHD developments, based on their development quantum and resulting population. We have not modelled the background movement in the area due to a lack of data availability. Collecting new pedestrian movement data now will not reflect the 'everyday' scenario due to the restrictions imposed by COVID-19.

The area is known to have relatively low volumes of existing pedestrian movement. The major attractor near the site is the Three Arena which is active only on specific days where the high volume of visitors are carefully managed. Thus the overlap of the Three Arena users and the development users is not a probable scenario which needs to be considered for this study.

The study also provides a calculation of the limit of people that the pavements and public realm in and around the development can accommodate without causing pedestrian discomfort and capacity issues. In the absence of pedestrian surveys this can serve as a useful benchmark.

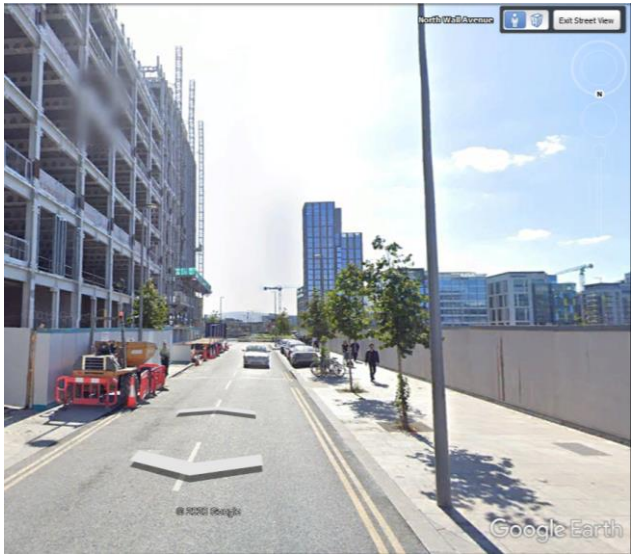


Mayor Street Upper looing West



Castleforbes Road looking South

North Wall Quay looking West



North Wall Avenue looking South

Executive Summary Findings

The public realm and landscape design for the area under assessment (includes both SHD and SDZ) provides more than sufficient width to accommodate the forecasted flows of pedestrians during the evening peak.

Inside the SHD and SDZ developments

The highest level of movement at any point within the combined SHD and SDZ development is 800 people per hour, which is much lower than the capacity of the routes of the public realm. All the space have a TfL PCL (pedestrian comfort level) of A+, A- and A as per TfL guidance.

Pavements around the SHD and SDZ developments

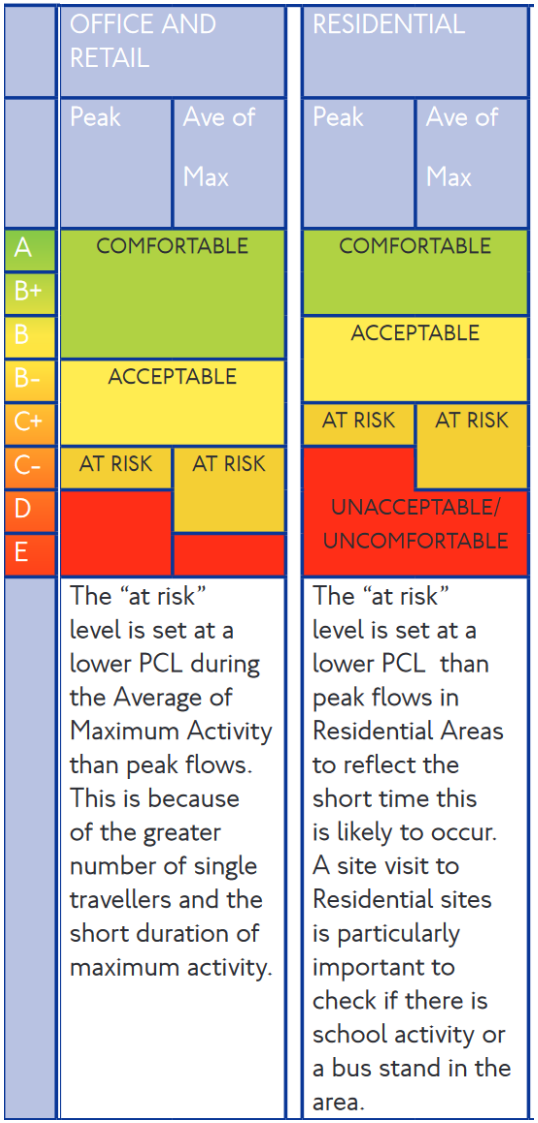
The pavements around the development also have sufficient capacity to deal with the forecasted flows of pedestrian to and from the development with TfL PCL (pedestrian comfort level) of A+, A , A- and B+ as per TfL guidance. These PCL levels are all within the 'Comfortable' range as per the guidance. The highest flow is 1,070 people per hour on the pavement along North Wall Quay to the south-east of the site.

We have also tested the internal public realm and external pavements using the Fruin standard and all of the spaces have a Grade A* which means there are less than 23 people per minute per metre passing through the internal spaces and pavements around the site.

This means pedestrians can freely select their own walking speed to bypass slower pedestrians and to avoid conflicts with others.

Given there is no concern with regards to pedestrian comfort in relation to the combined SDZ and SHD scheme it can be deducted that the SDZ and SHD on their own would also not present any issues related to pedestrian capacity.

Transport for London
Pedestrian Comfort Guidance for London



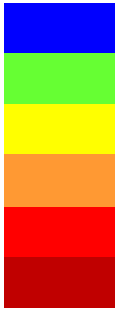
Source: Transport for London Pedestrian Comfort Guidance for London, Guidance Document, version 2 (2019)

Fruin Level of Service guidelines
Flow capacity assessment

**At Grade A level sufficient space is provided for pedestrians to freely select their own walking speed, to bypass slower pedestrians and to avoid conflicts with others.*

Pedestrian density for footways
People per metre per minute

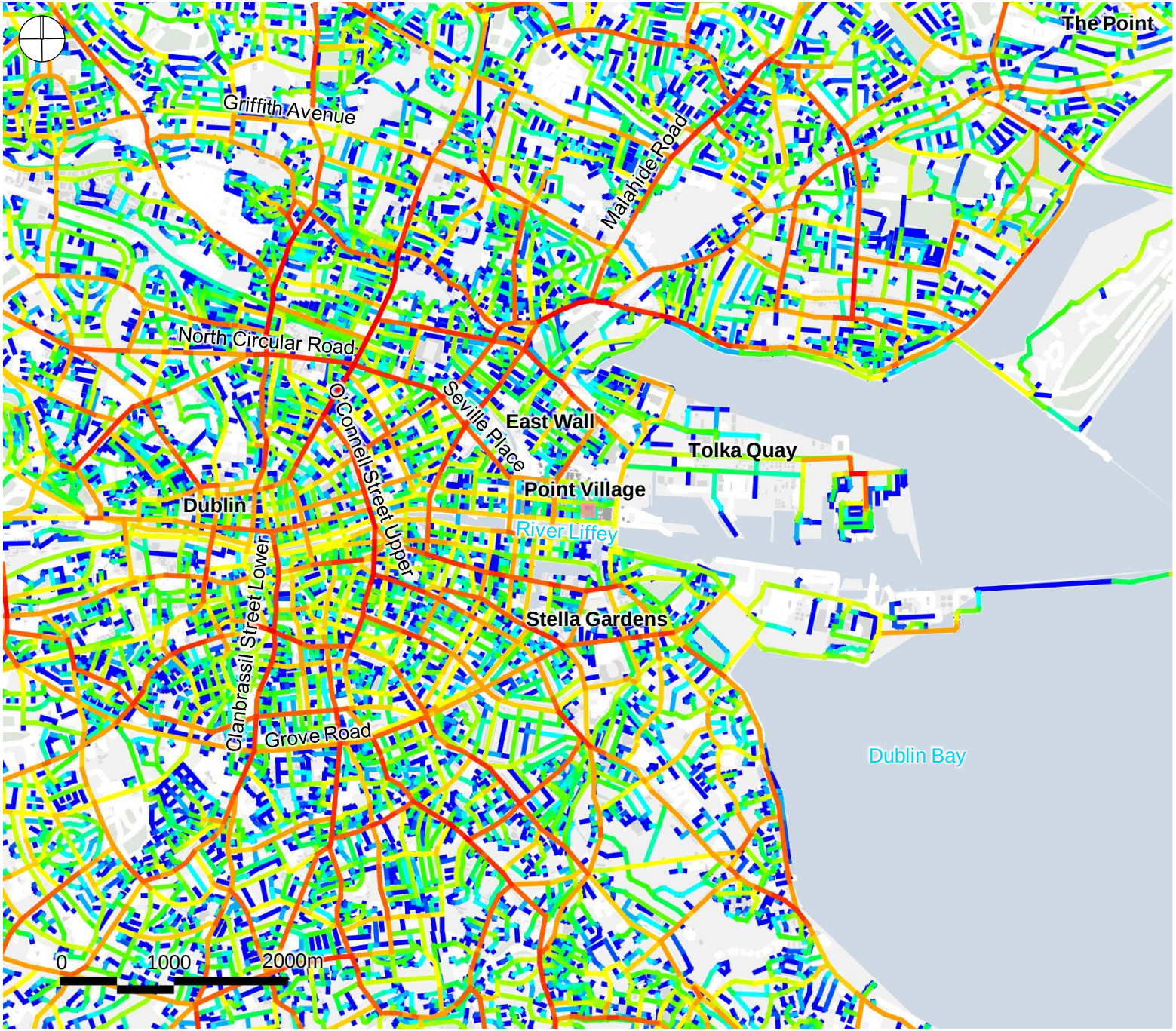
A	< 23
B	23–32
C	32–49
D	49–66
E	66–82
F	> 82



Source: Pedestrian planning and design– 1 Jan. 1971 by John J Fruin

Building the Future Baseline Model

Spatial accessibility Local route hierarchy Future baseline



Space Syntax have build the Future Baseline Model of Dublin which includes the new routes created by the proposed SDZ and SHD developments.

This model is used to assess how pedestrians are likely to access the site from different parts of Dublin using various modes of transport.

The image on left shows the local scale spatial accessibility analysis for Dublin. The analysis highlights the most spatially accessible streets in red and the least accessible in blue (through green).

Our research has shown that spaces with higher local scale spatial accessibility also have higher levels of pedestrian movement.

Thus this analysis is used to inform how people walking to the site are likely to distribute as they approach or leave the proposed SDZ and SHD developments.

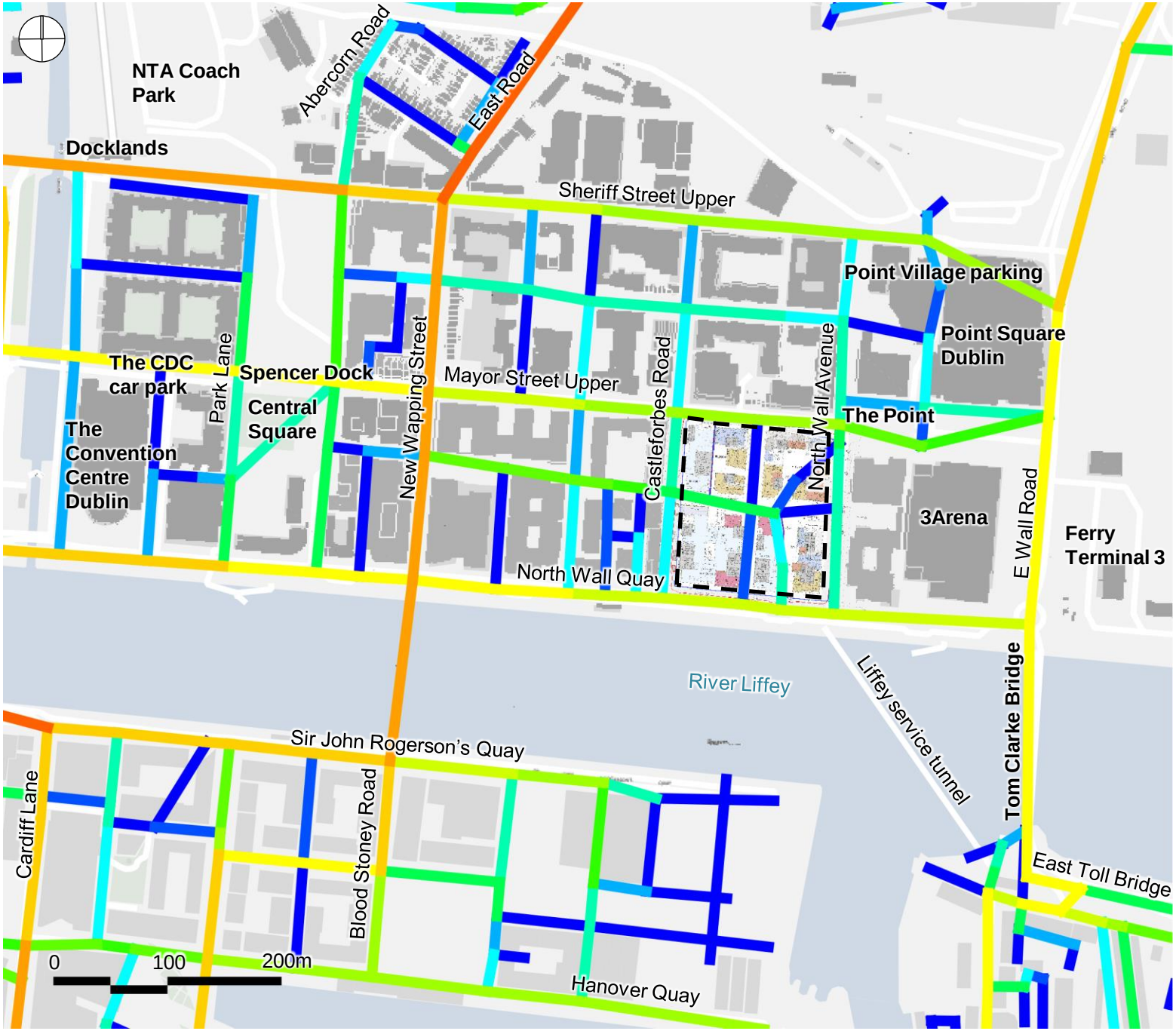
Spatial accessibility

high

low

Site boundary

Spatial accessibility Local route hierarchy Dublin Waterfront South Central



Mayor Street Upper, North Wall Quay, New Wapping Street and E Wall Road are the ones the analysis shows have the highest levels of local spatial accessibility in the area around the proposed SDZ and SHD development.

These are the streets which are mostly likely to be used to enter and leave the area using the local spatial accessibility as a proxy for pedestrian movement patterns.

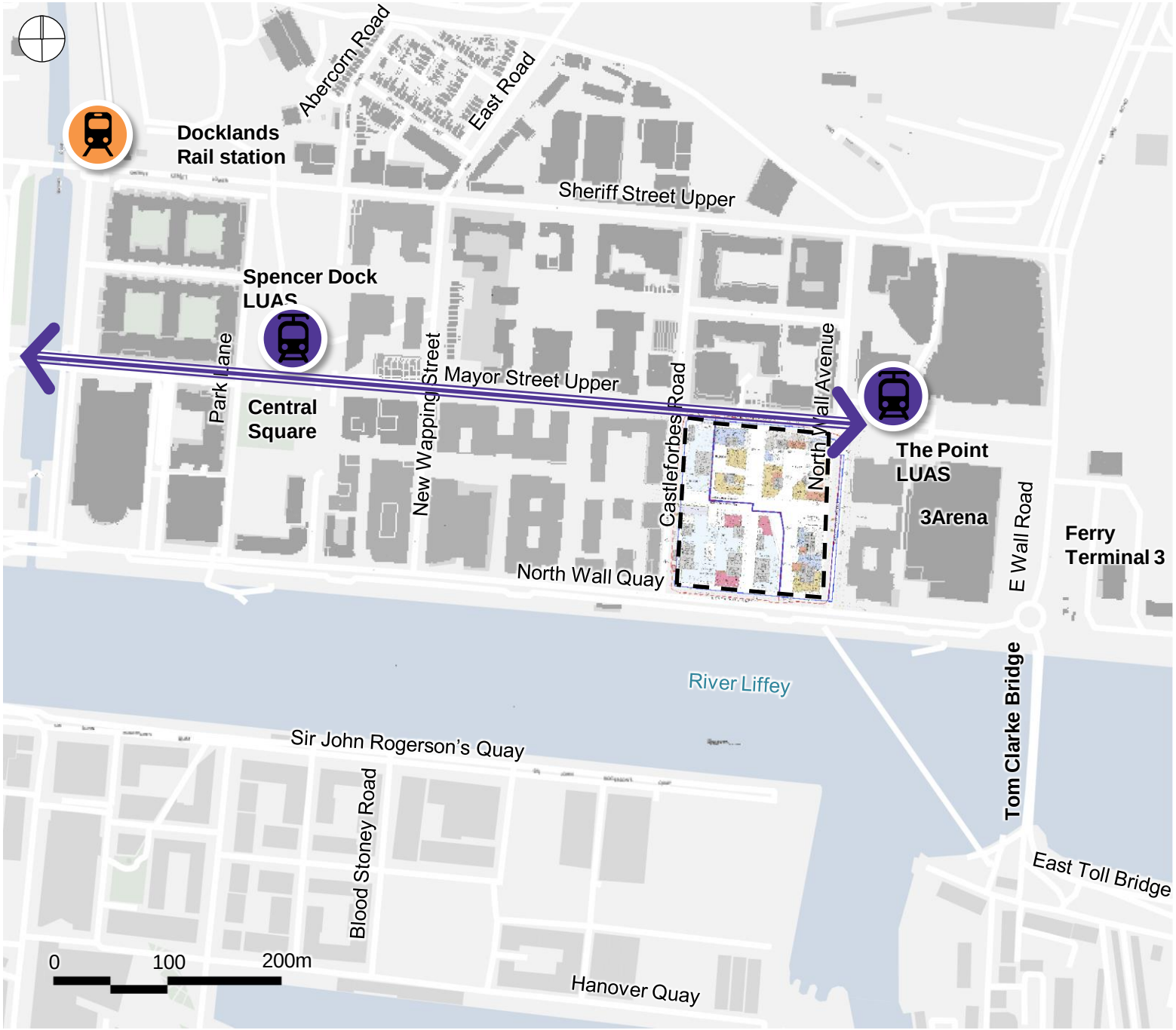
Spatial accessibility

high

low

Site boundary

Transport attraction Rail and LUAS Existing



We have included the Docklands Railway stations and the two LUAS stations in the area around the SDZ and SHD developments in our model.

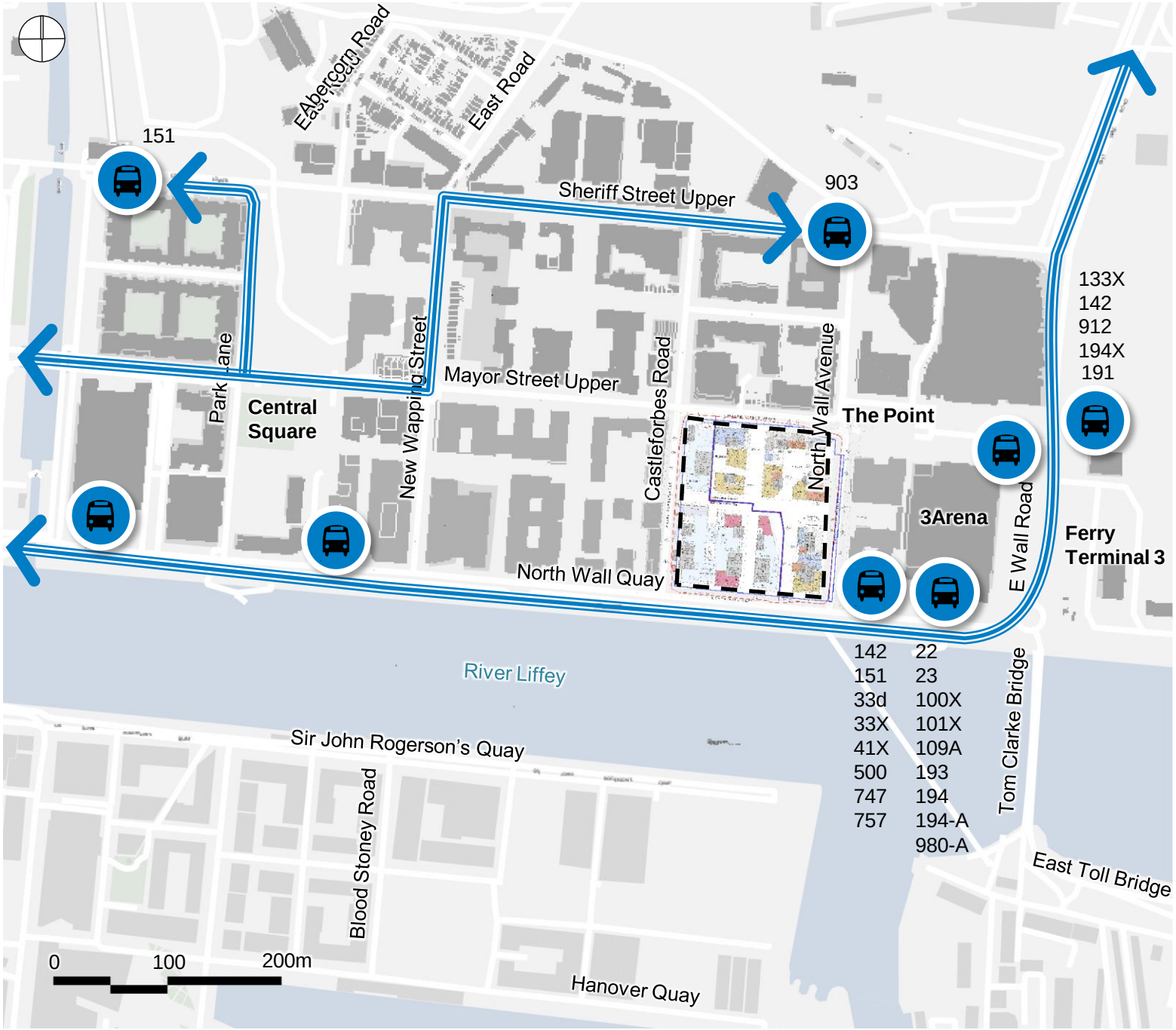
Our model assumes the development users using the railway station and LUAS to access or leave the SDZ and SHD developments will move to and from the respective stations using the shortest route between the development access points and the Railways and LUAS stations.

Docklands Rail station

LUAs station

Site Boundary

Transport attraction Bus routes Existing



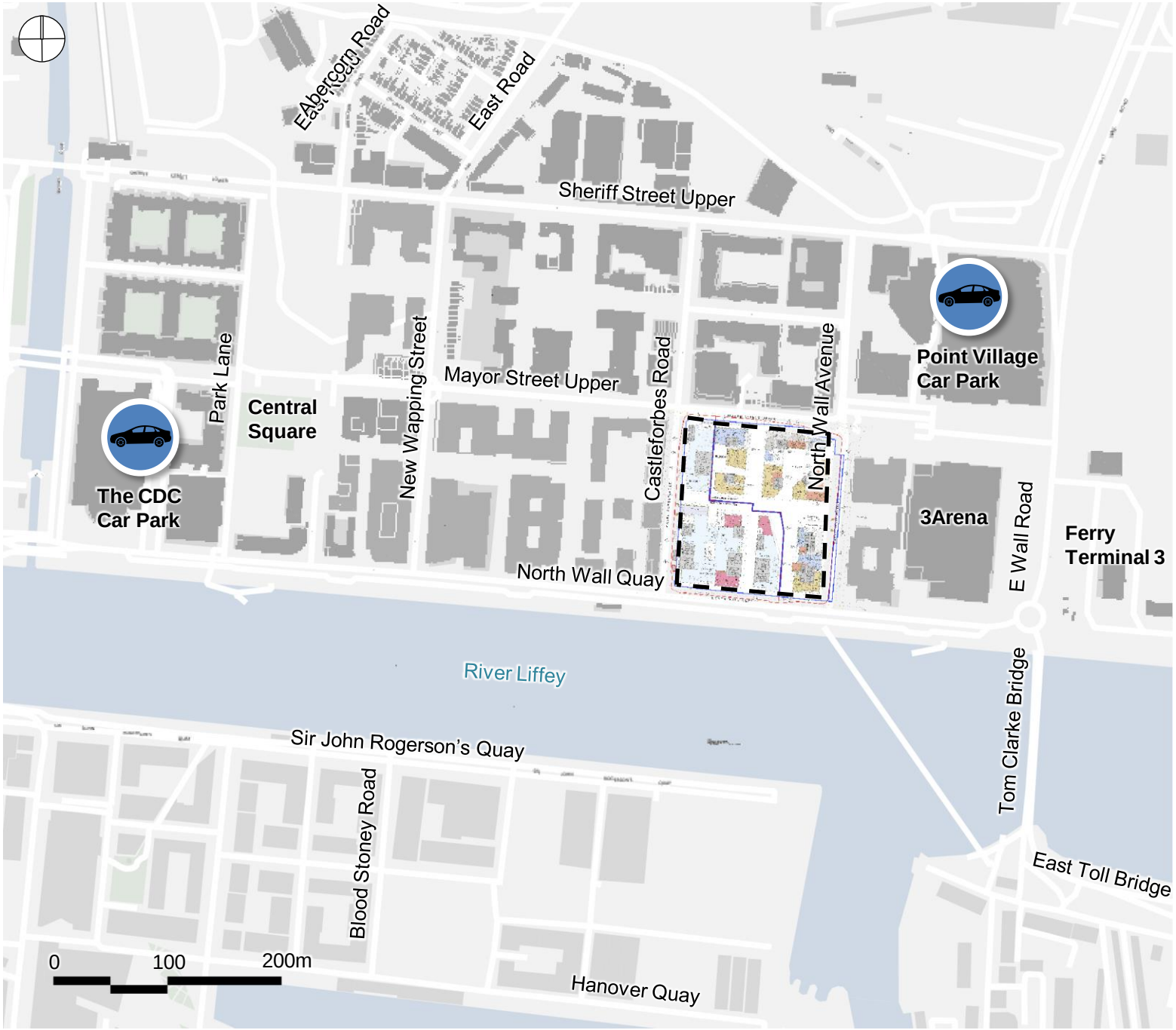
We have included the bus stops in the area around the SDZ and SHD developments in our model.

Our model assumes the development users using buses to access or leave the SDZ and SHD developments will move to and from the respective bus stops using the shortest route between the development access points and the bus stops.

Bus stop

Site boundary

Transport attraction Car Parks Existing



We have included the public car parks in the area around the SDZ and SHD developments in our model.

The visitors to the development for retail, F+B and recreation uses in the car modal split will move to and from these locations while accessing or leaving the SDZ and SHD developments.

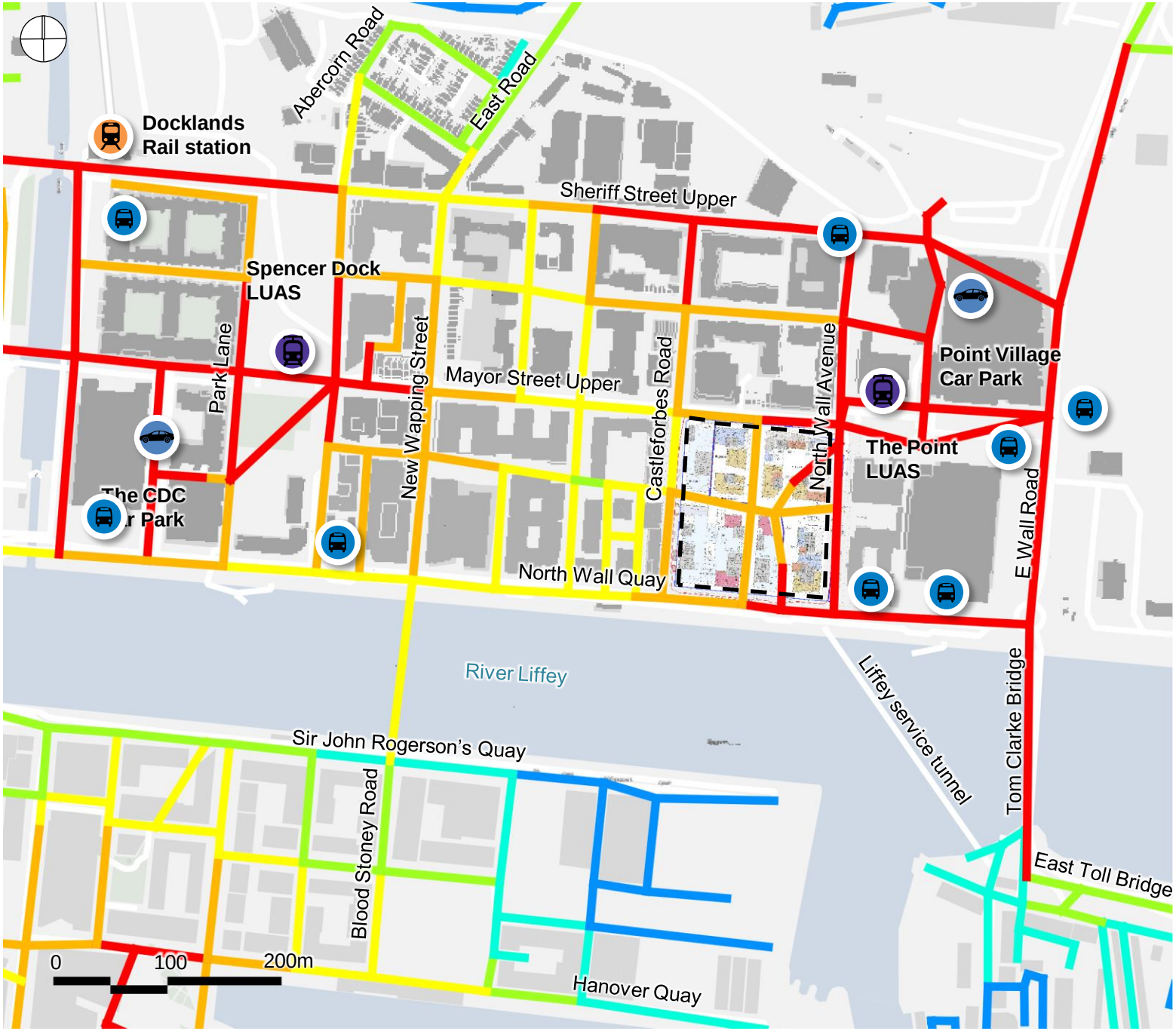
Our model assumes visitors to the development for retail, F+B and recreation using cars to access or leave the SDZ and SHD developments will move to and from the respective public car parks using the shortest route between the development access points and the car parks.

The office workers and residents driving to the SDZ and SHD respectively are not modelled as they will use the on site basement parking and will not need to move through the public realm to access their destination.

Car Park

Site boundary

Transport attraction Walking distances from site



The analysis shows the metric distance from the Railway station, LUAS stations, bus stops and the public car parks to the SDZ and SHD development.

This analysis is used by our model to calculate the shortest routes between the access points of the SDZ and SHD developments to the different transport modes.

Our model assumes the development users will move to and from their desired mode of transport based on modal split data using the shortest route between the development access points and the required transport mode.

Metric distance (m) and walking time (min)

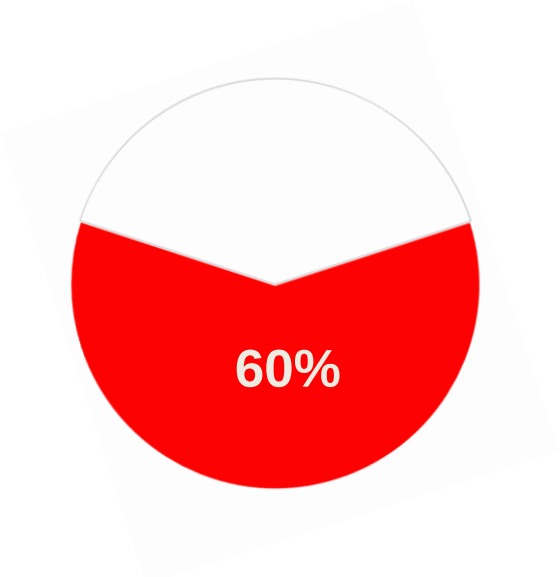
900 – 1000 m	
800 – 900 m	
700 – 800 m	10min walk
600 – 700 m	
500 – 600 m	
400 – 500 m	
300 – 400 m	5min walk
200 – 300 m	
100 – 200 m	
0 – 100 m	

- LUAS stop
- Bus stop
- Rail stop
- Car park
- Site boundary

Scenario assumptions

Evening peak scenario
We will model the evening peak scenario as it will be the busiest period with an overlap of different trip types.

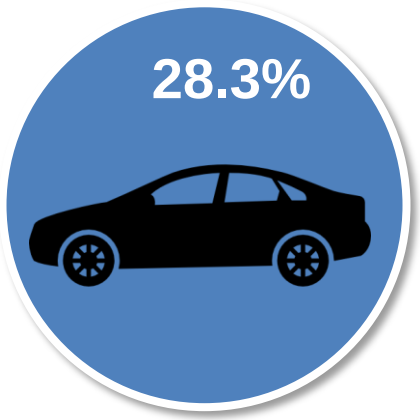
1. Office workers leaving the development.
2. Residents returning home from work.
3. Visitors to retail and F+B
4. Visitors to the roof terrace.



60% of the daily capacity will arrive during the peak hour
Based on Space Syntax experience of working on mixed use developments we assume that 60% of the daily commuters will arrive or leave the site during the peak hour.
This assumption is used to model the worst-case scenario.

'Pedestrian Comfort Level' will be calculated using TfL and Fruin guidelines.
TfL and Fruin Pedestrian comfort guidelines have been used to calculate Pedestrian Comfort levels in and around the development.

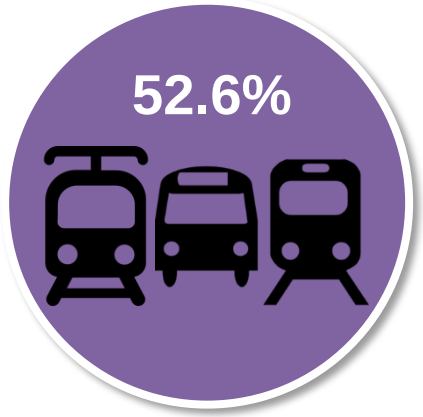
Travel demand Modal split assumptions



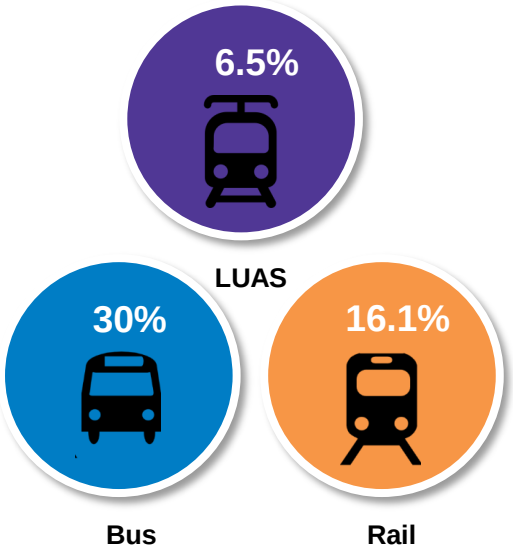
Private vehicles

Walking

Cycling



Public transport



Bus **Rail**

Mode share of people crossing the canal cordon,
Canal Cordon Report 2018Report on trends in mode share of vehicles and people crossing the Canal Cordon2006 to 2018, pg15
National Transport Authority
Dublin City Council
https://www.nationaltransport.ie/wp-content/uploads/2019/04/Canal_Cordon_Report_2018.pdf

Travel demand Modal split assumptions

Pedestrians

Pedestrians will distribute into the street network after leaving the site based on the spatial accessibility analysis. We have chosen a walking distance of 2km to calculate the spatial accessibility as it connects the development to the surrounding residential neighborhoods and Central Dublin.

Bus users

Users commuting via bus will move to the metrically closest bus stop.

LUAS users

Users commuting via LUAS will go to either the Point or the Spencer Dock station prioritizing the closer one as both the stations are on the Red line.

Rail users

Users commuting via Rail will go to either the Docklands Rail station.

User assumptions Transport modes used

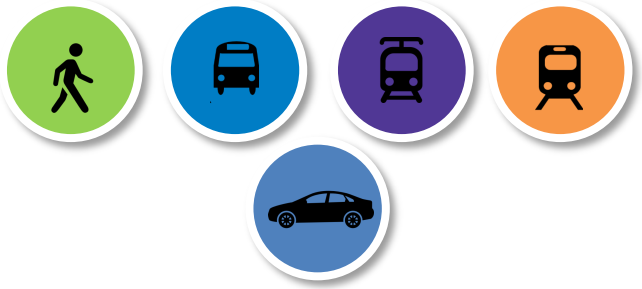
Office workers

Office workers driving or cycling to the development will go directly to the basement car park and will go to their destinations without using the pavements or public realm.

Residents

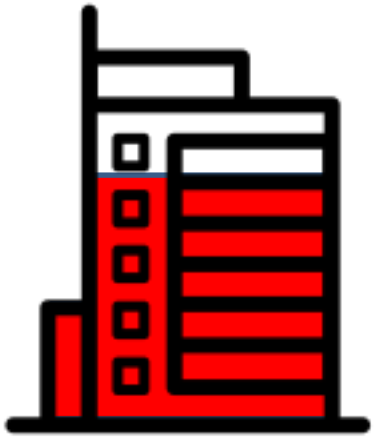
Residents driving or cycling to the development will go directly to the basement car park and will go to their destinations without using the pavements or public realm.

Retail, F+B and recreation visitors



Visitors to the site who are driving to the site will park at public car parks and will walk to the site and are thus included in the model

Capacity assumptions Occupancy, work participation and special events



80% office occupancy

The office will be 80% occupied at any given day

62% residents are part of the work force

62% of the residents of the development will be modelled returning home during the evening peak.

Number of people in employment reaches record high
The Irish Times, Peter Hamilton
Feb 19, 2019
https://www.irishtimes.com/business/economy/number-of-people-in-employment-reaches-record-high-1.3798999

The roof terrace will be at the full capacity of 300 visitors

To model the worst-case scenario it is assumed the terrace will be at maximum capacity.

Capacity assumptions Retail, F+B, Informal market and childcare

Retail and F+B daily visitors

Based on Space Syntax experience of working on mixed use developments we assume the daily visitors to F+B and retail are calculated using the assumption of 1 visitor per sqm of facility.

Informal shopping stalls

The visitors to the informal market stalls are not considered in the model as the market is planned to take place on Sunday only and we have modelled the typical evening peak

Childcare centre

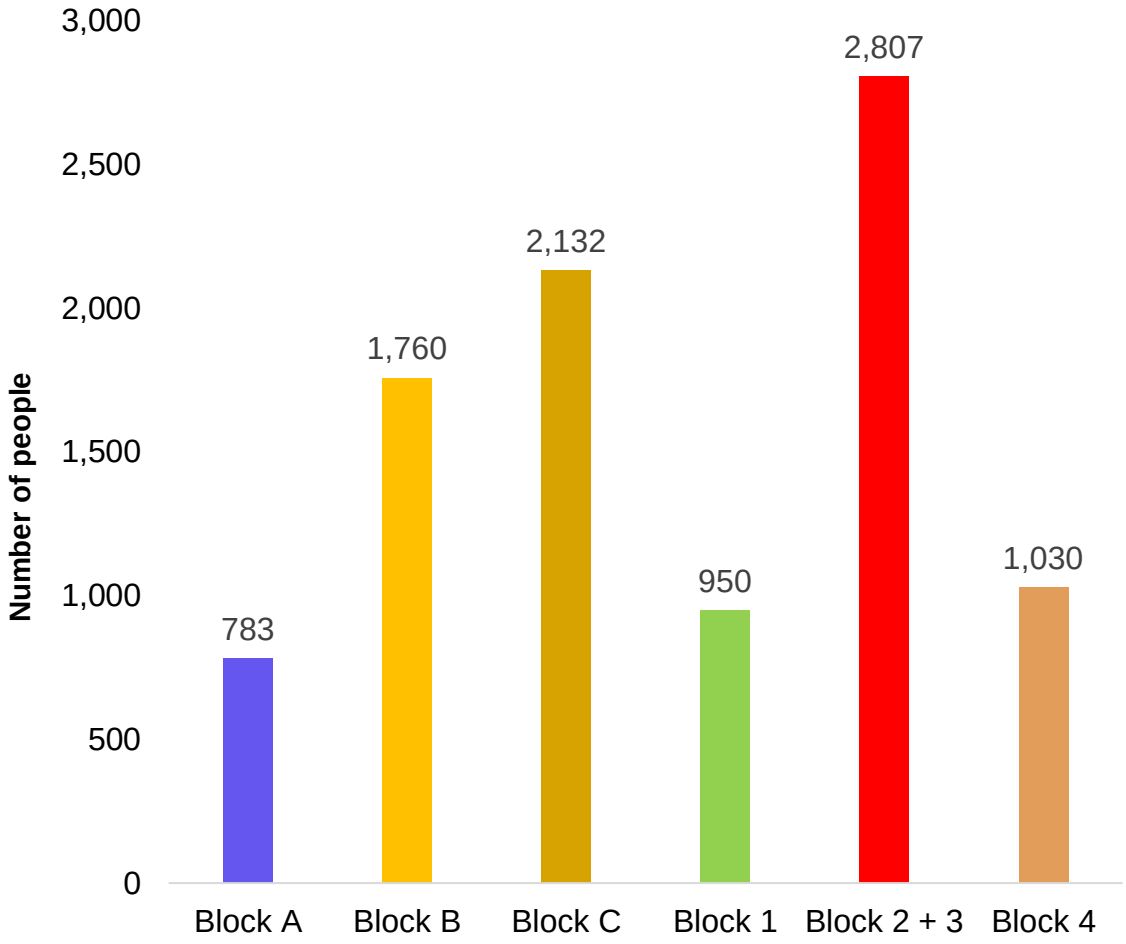
The visitors the childcare centre are calculated using the average area required per child (2.34 sqm per child) and the assumption of 1 adult visitor will come to collect the child during the evening peak.

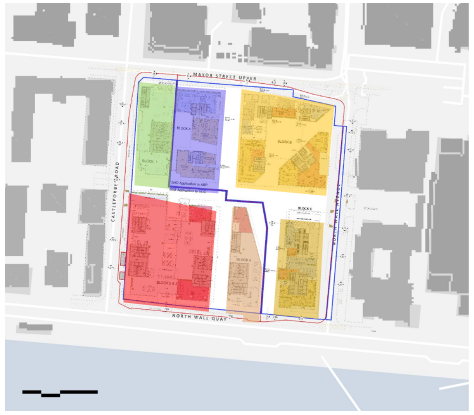
Development data

Block and entrance data

Based on data package received from Henry J Lyons on 09/10/2020 and 11/10/2020 and 04/01/2021

Development capacity Distribution per block





Maximum capacity of all blocks

9,462

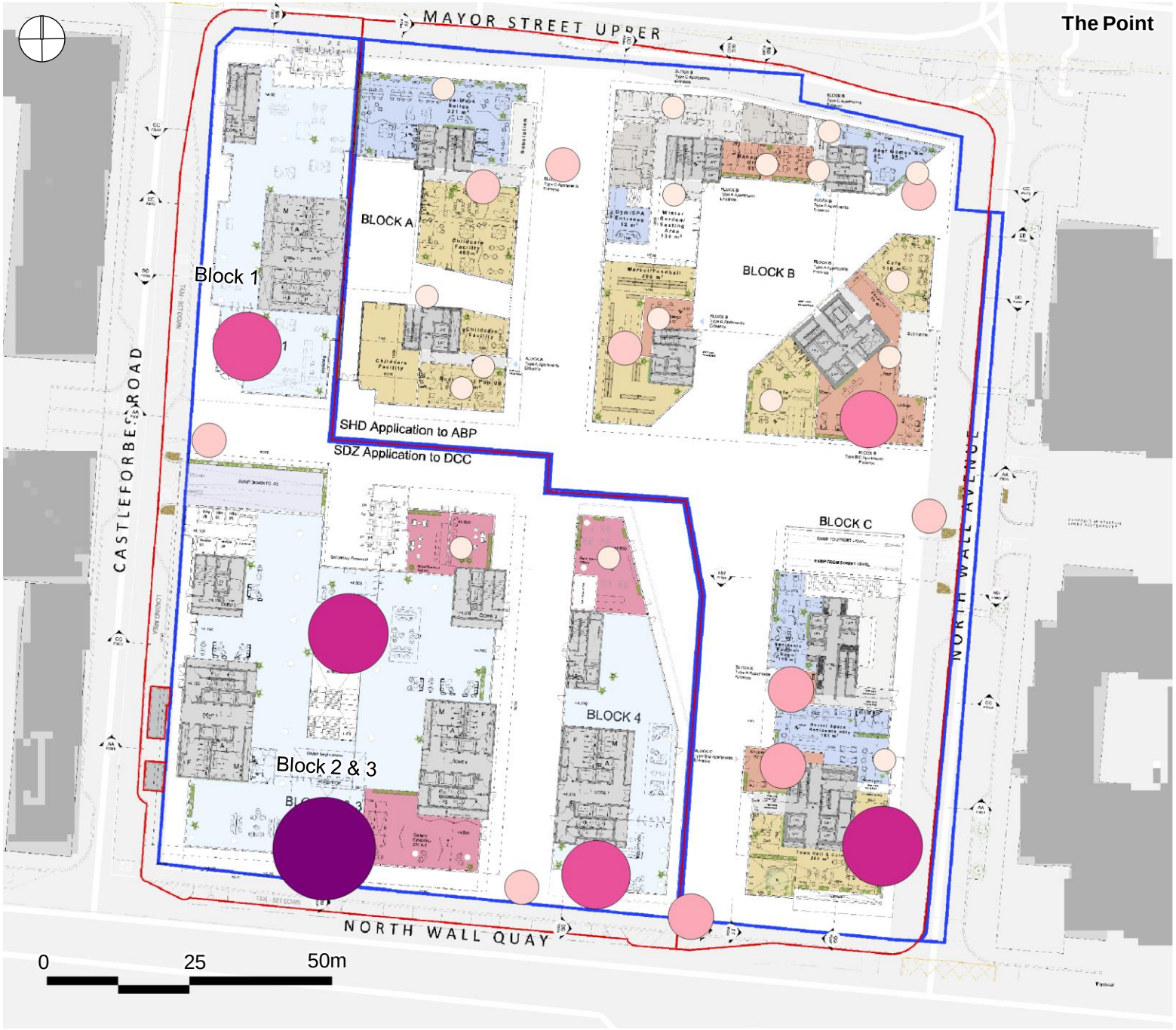
Based on data package received from Henry J Lyons on 09/10/2020 and 11/10/2020

	SHD Residential			SDZ Commercial			Total per Land use
	Block A	Block B	Block C	Block 1	Block 2 + 3	Block 4	
Residential	481	1,160	897	-	-	-	**2,538**
Office	-	24	339	950	2,661	891	**4,865**
Retail and childcare facilities	192	299	-	-	146	139	**776**
Food and beverage	110	277	896	-	-	-	**1,283**
Total capacity	**783**	**1,760**	**2,132**	**950**	**2,807**	**1,030**	**9,462**

Location and types of block entrances

- Area under Assessment
- Site access points
- Residential entrance
- Office entrance
- F+B entrance
- Retail + childcare facilities

Development capacity Distribution per block entrance



Area under Assessment

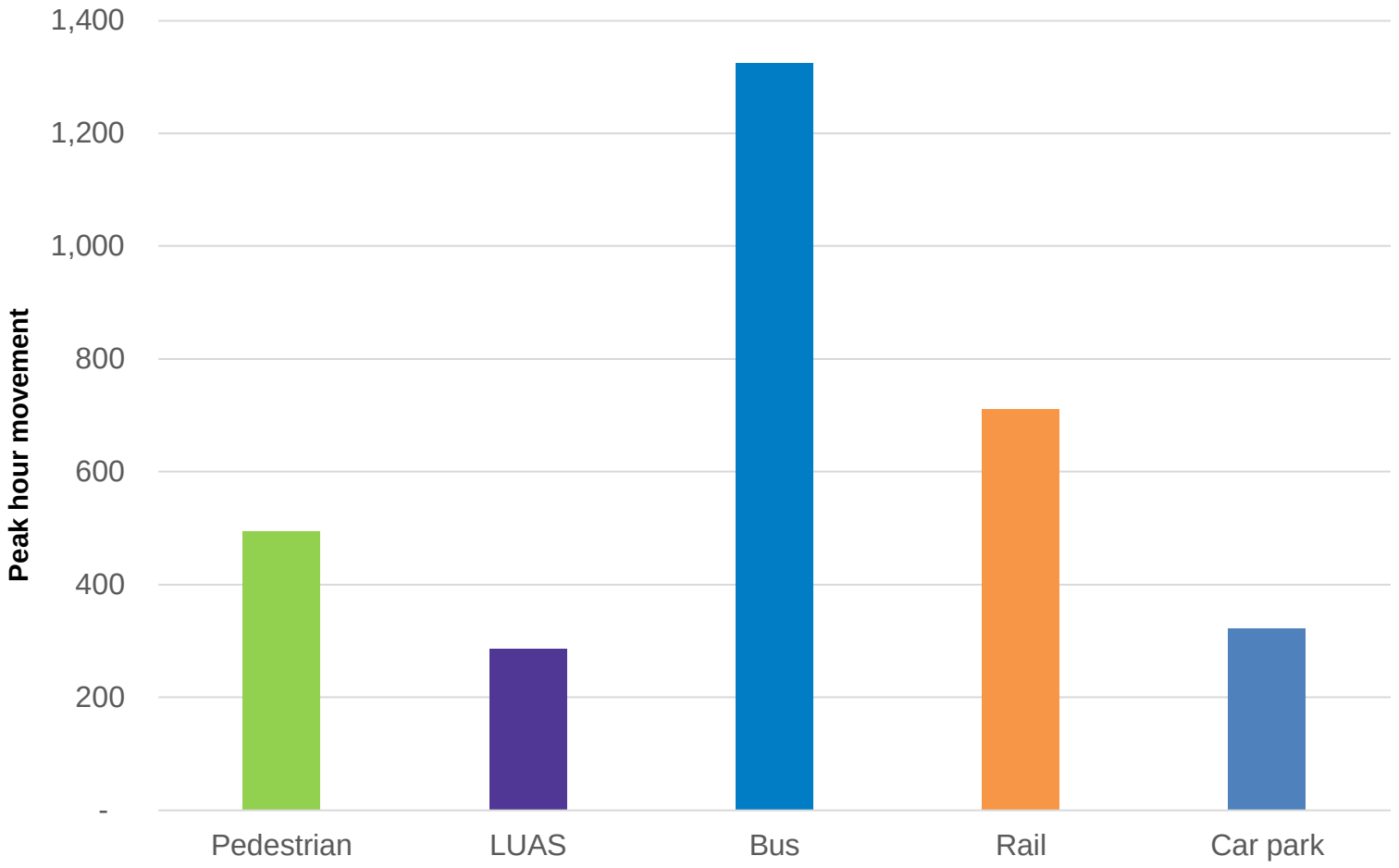
Capacity

1400 – 1600

800 – 1000

1 - 200

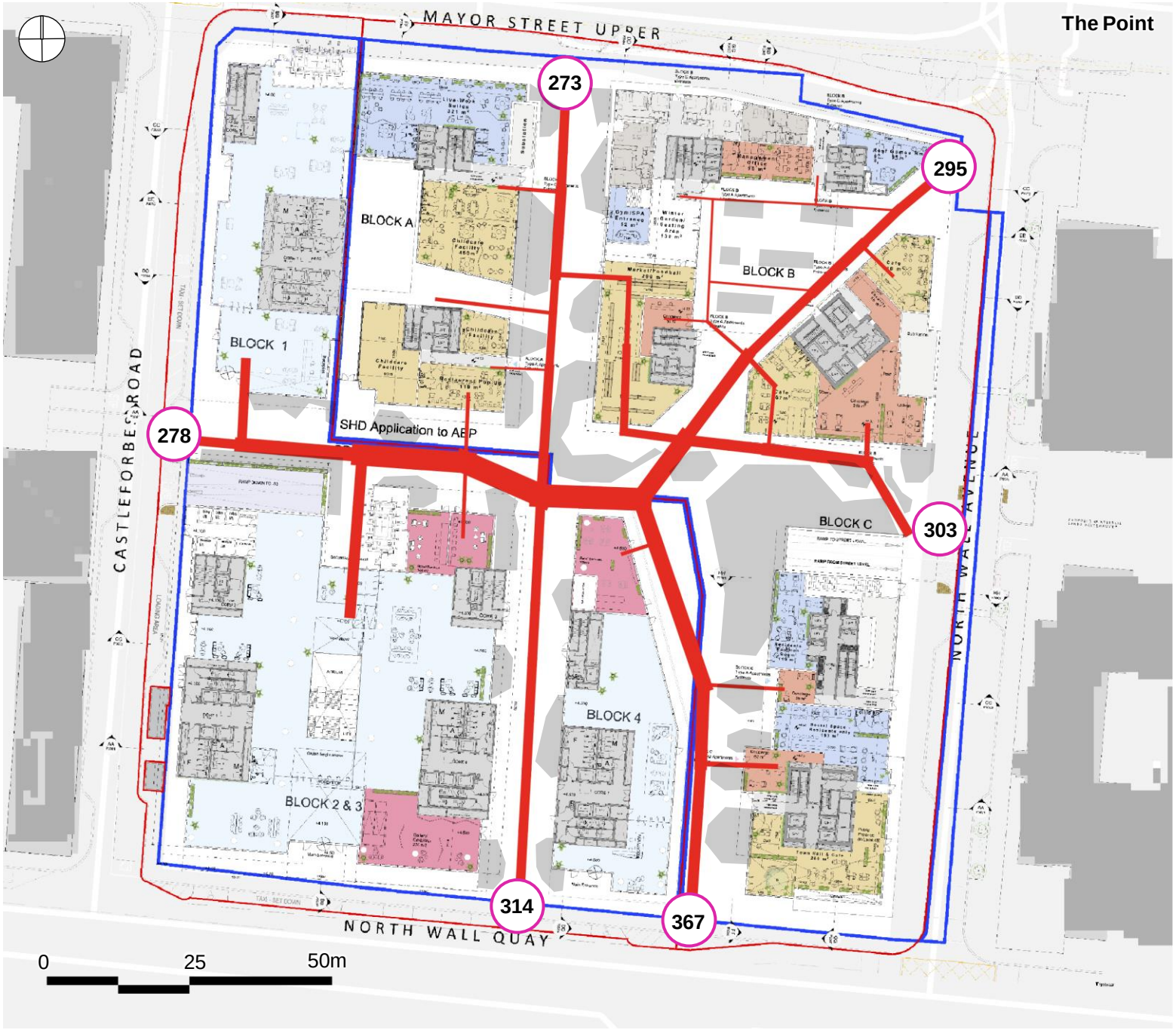
Peak hour movement Distribution per travel mode per peak hour



The peak scenario modal split occupancy and work force participation assumptions are applied to calculate the number of people who will access the development across the day.

Pedestrian movement forecast modelling

Circulation patterns All modes



Total **1,831**

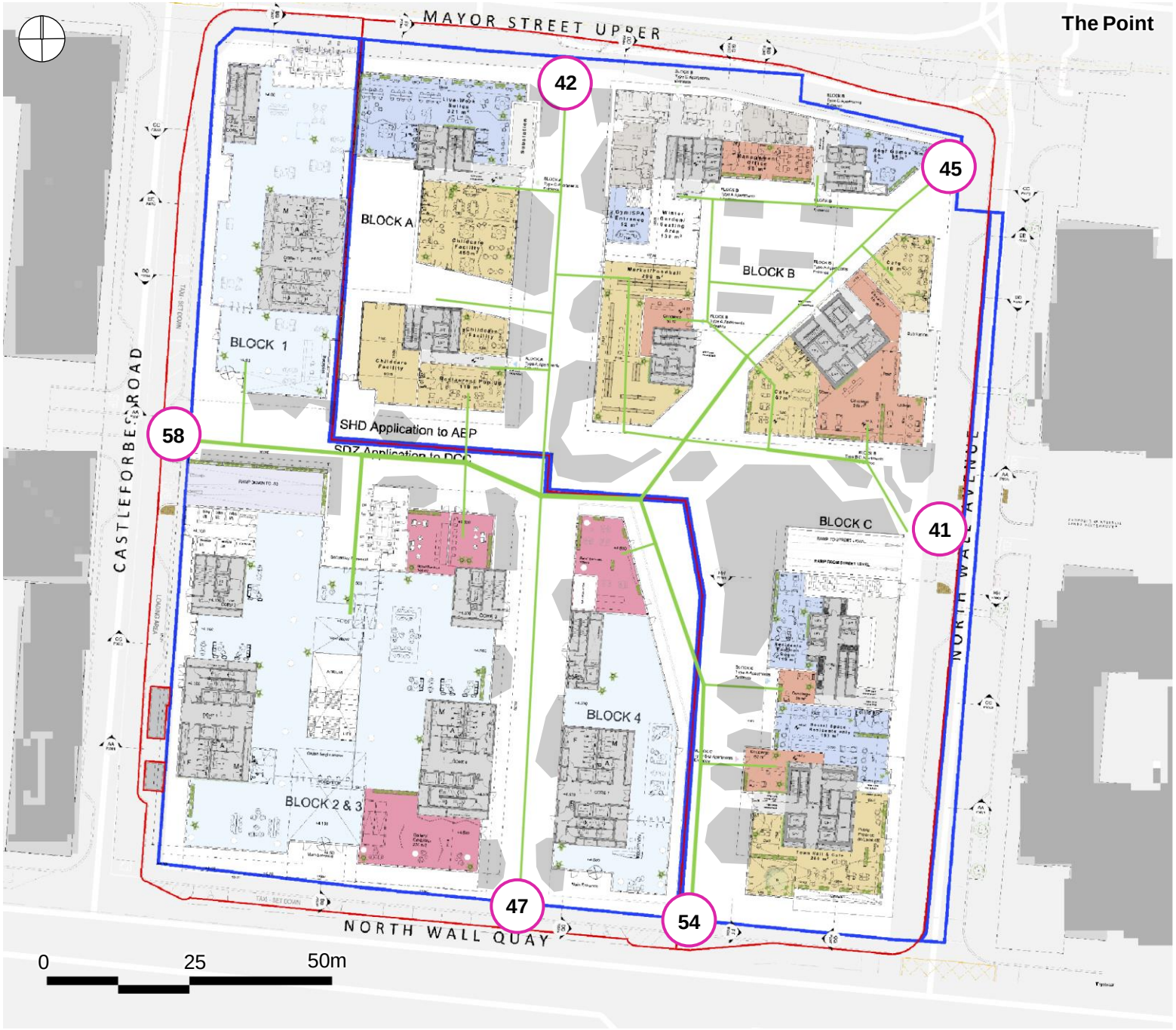
Area under Assessment

Site access origin

Flow

640 – 800
480 – 640
320 – 480
160 – 320
1 - 160

Circulation patterns Pedestrian



Total pedestrian **287**

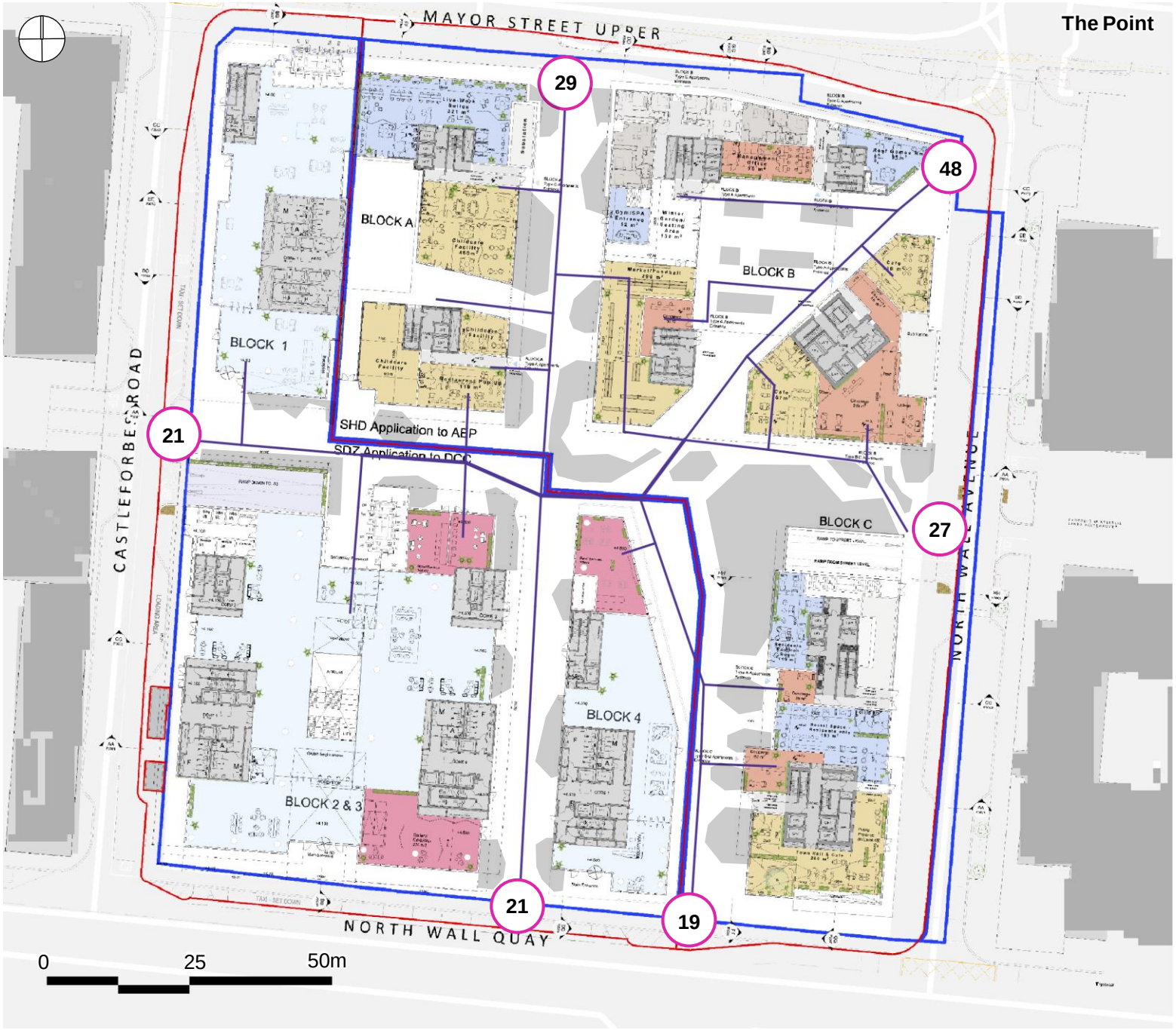
Area under Assessment

Site access origin

Flow

- 640 – 800
- 480 – 640
- 320 – 480
- 160 – 320
- 1 - 160

Circulation patterns Public transport LUAS



Total LUAS **166**

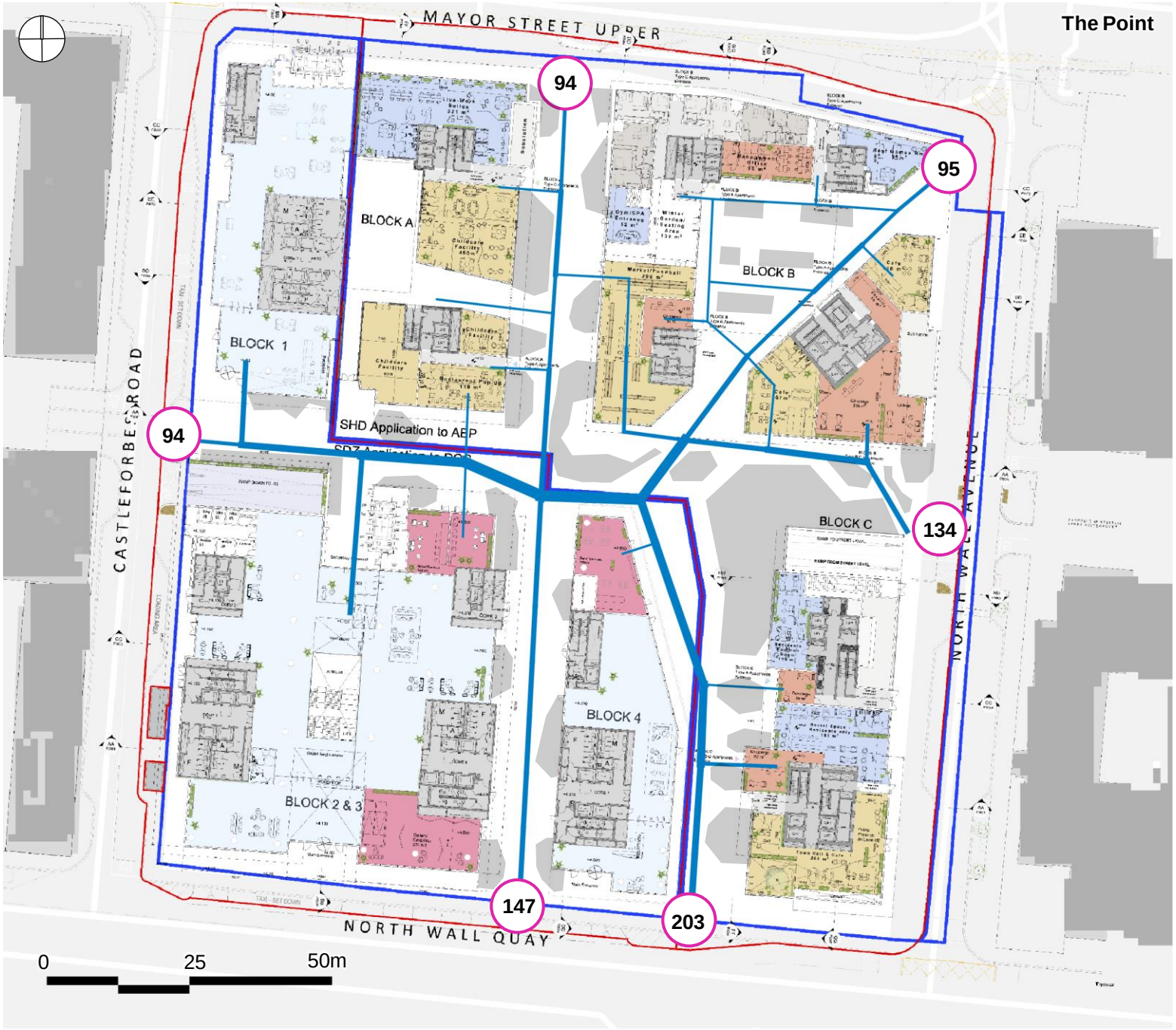
Area under Assessment

Site access origin

Flow

- 640 – 800
- 480 – 640
- 320 – 480
- 160 – 320
- 1 - 160

Circulation patterns Public transport Bus



Total bus **768**

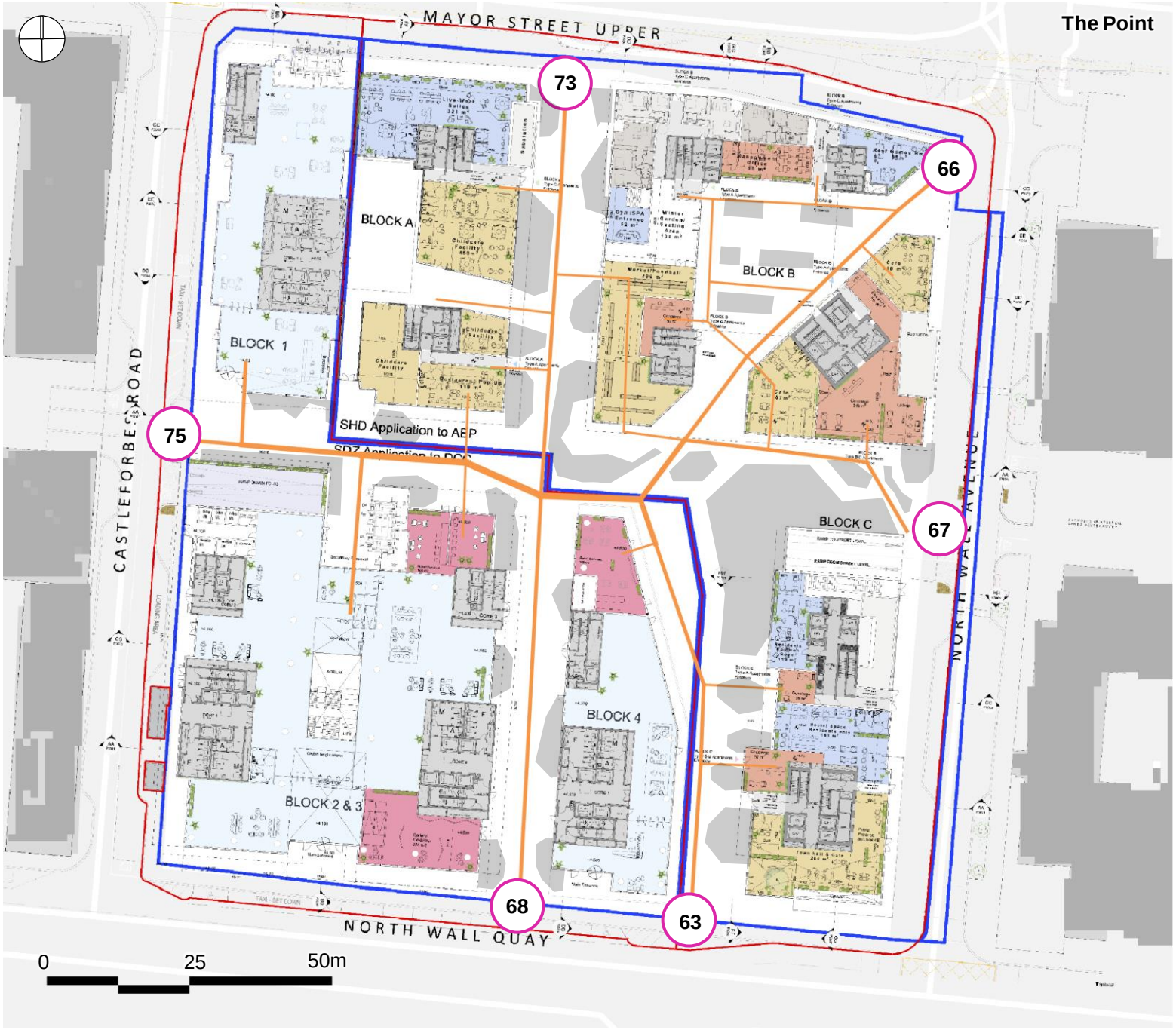
Area under Assessment

Site access origin

Flow

640 – 800
480 – 640
320 – 480
160 – 320
1 - 160

Circulation patterns Public transport Rail



Total rail **412**

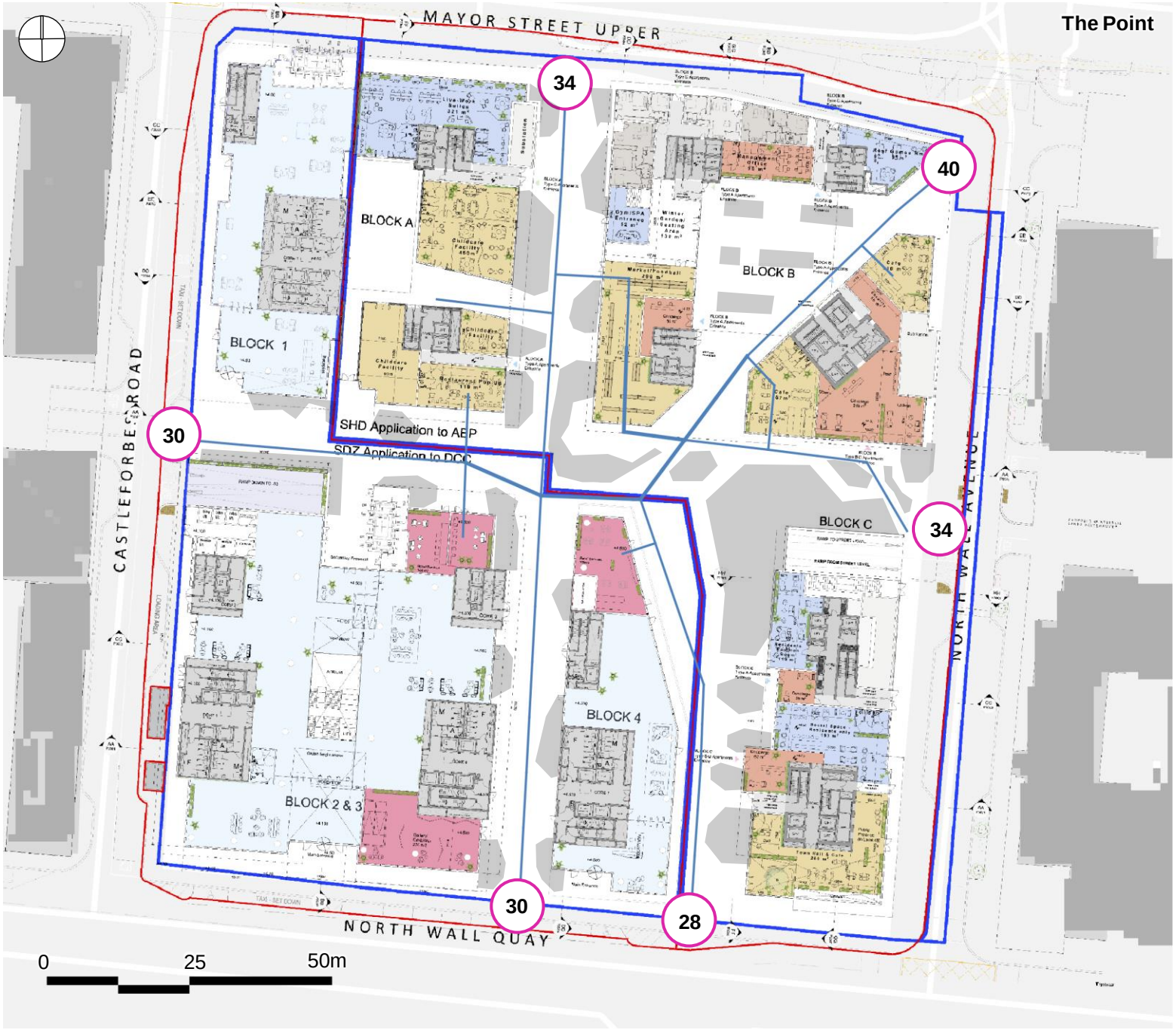
Area under Assessment

Site access origin

Flow

- 640 – 800
- 480 – 640
- 320 – 480
- 160 – 320
- 1 - 160

Circulation patterns Private vehicles used by visitors to access retail and F+B



Total private vehicles **197**

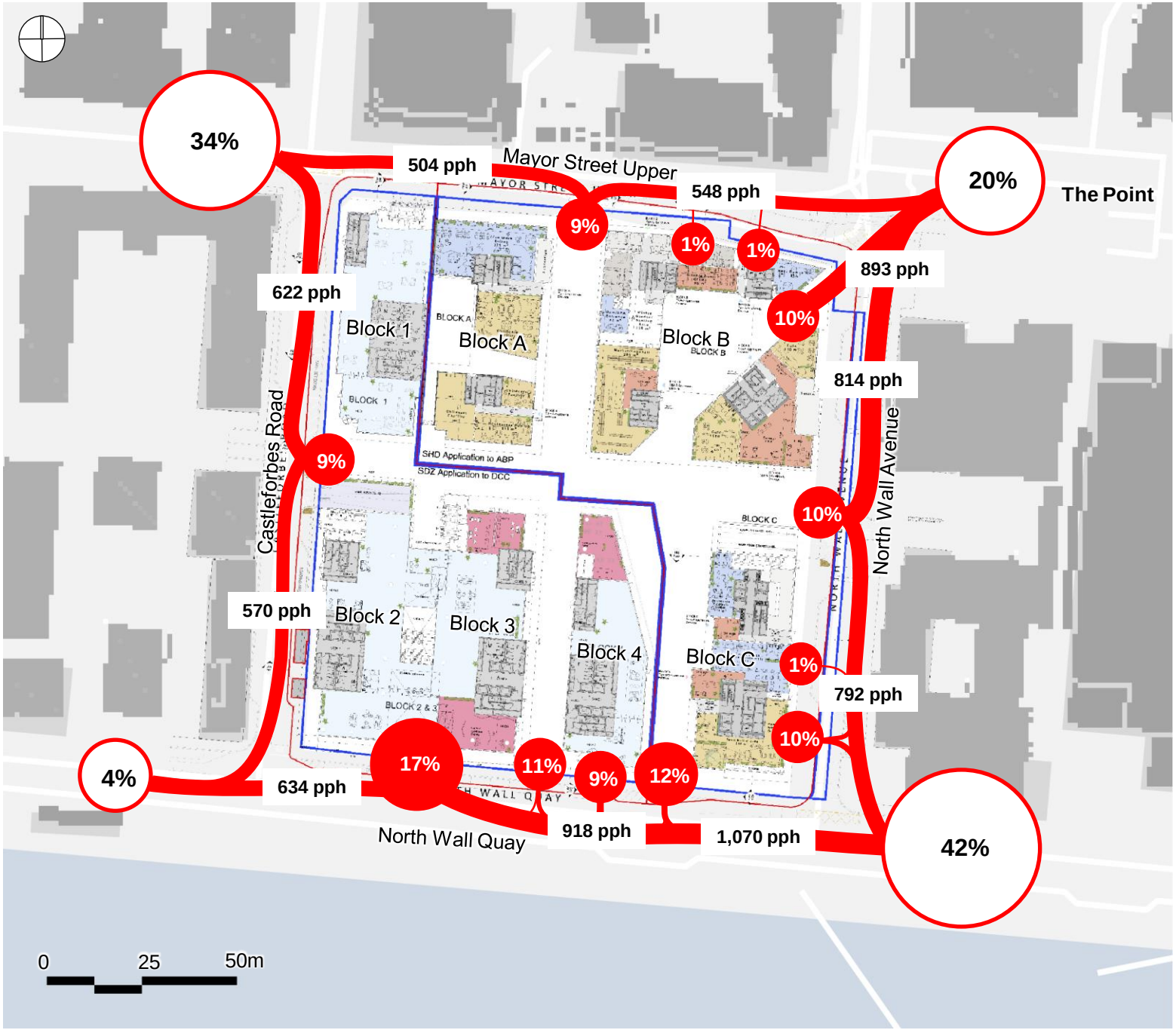
Area under Assessment

Site access origin

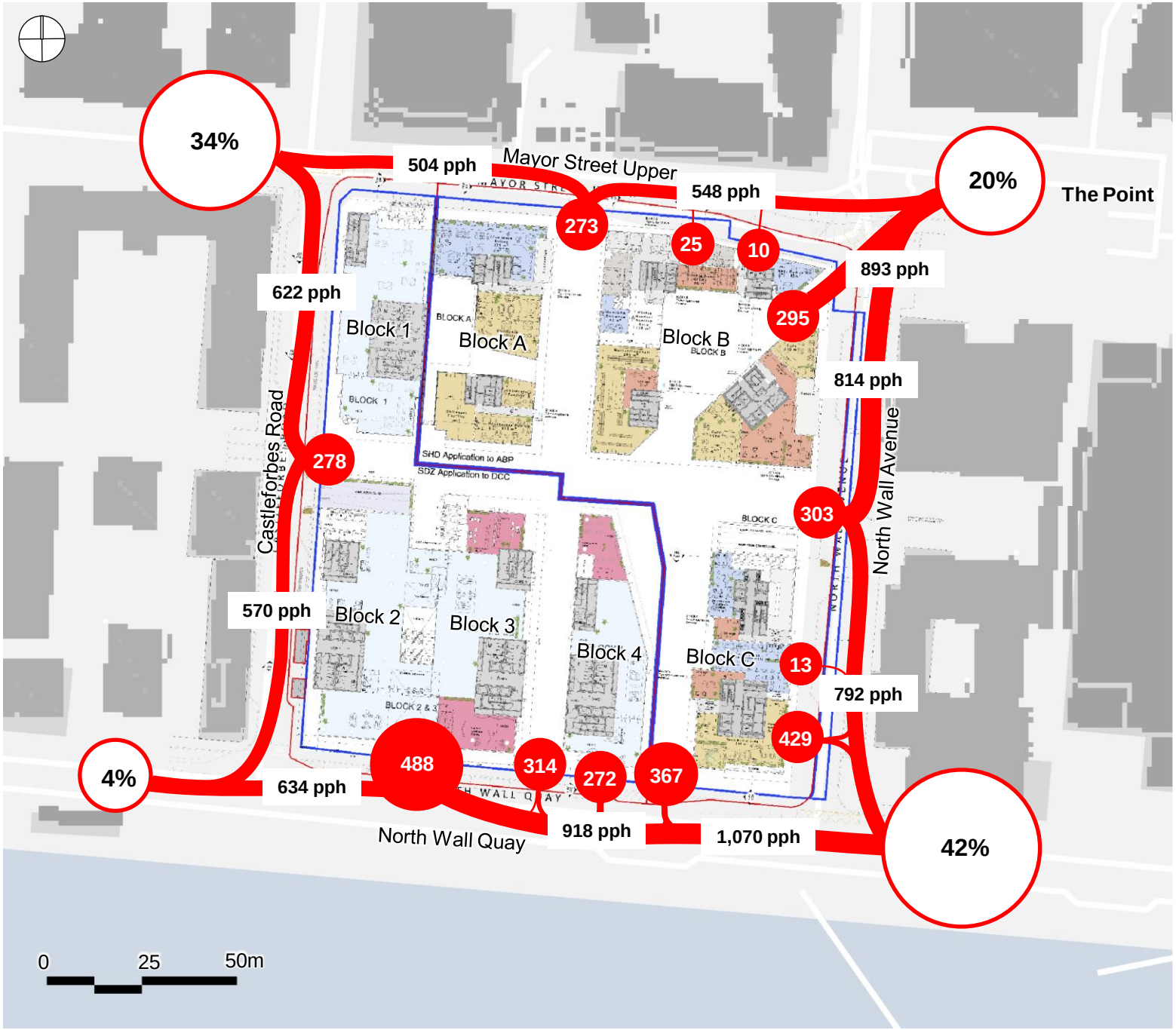
Flow

640 – 800
480 – 640
320 – 480
160 – 320
1 - 160

Circulation patterns Movement around the development Percentage split

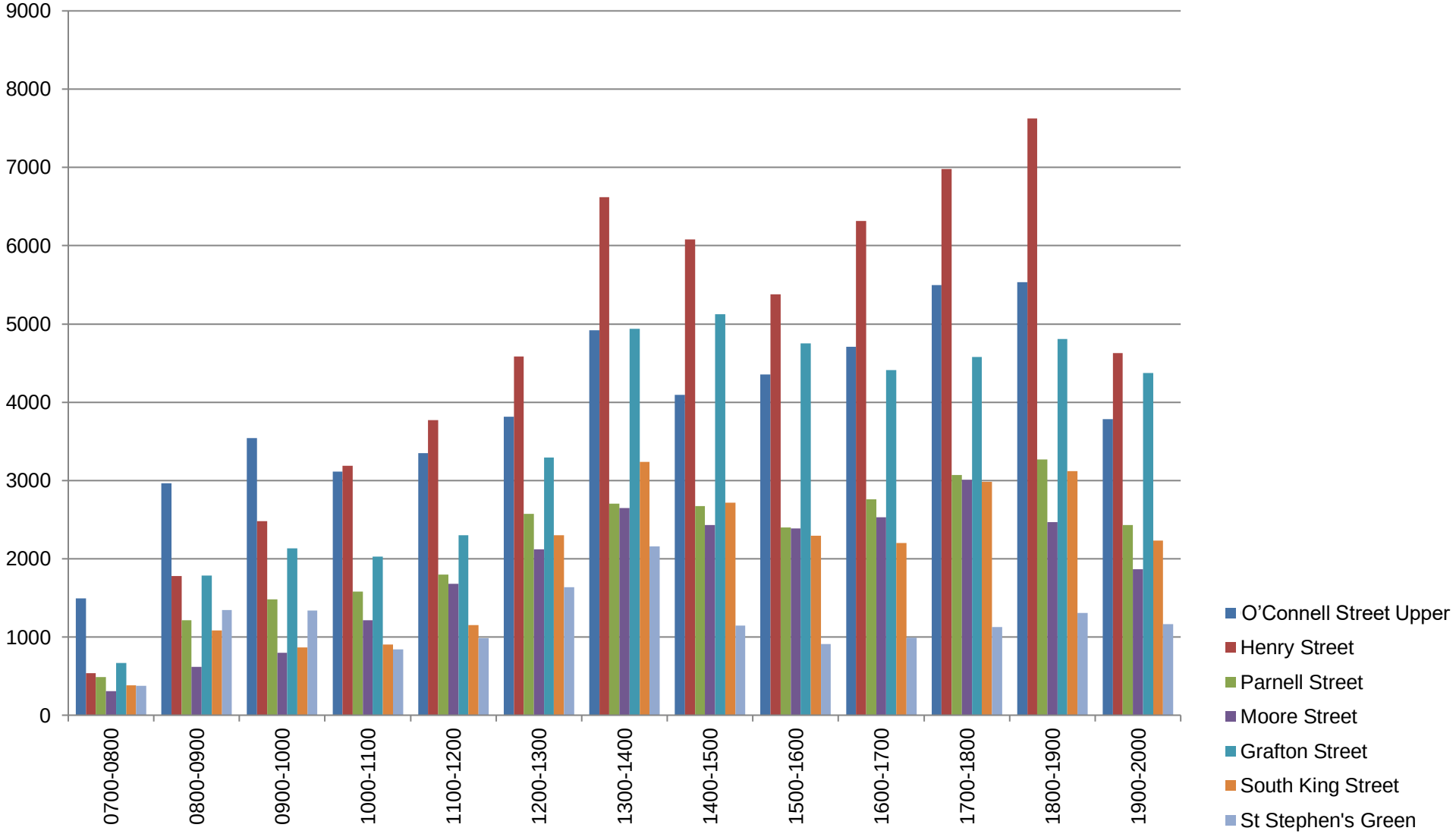


Circulation patterns Movement around the development Absolute numbers



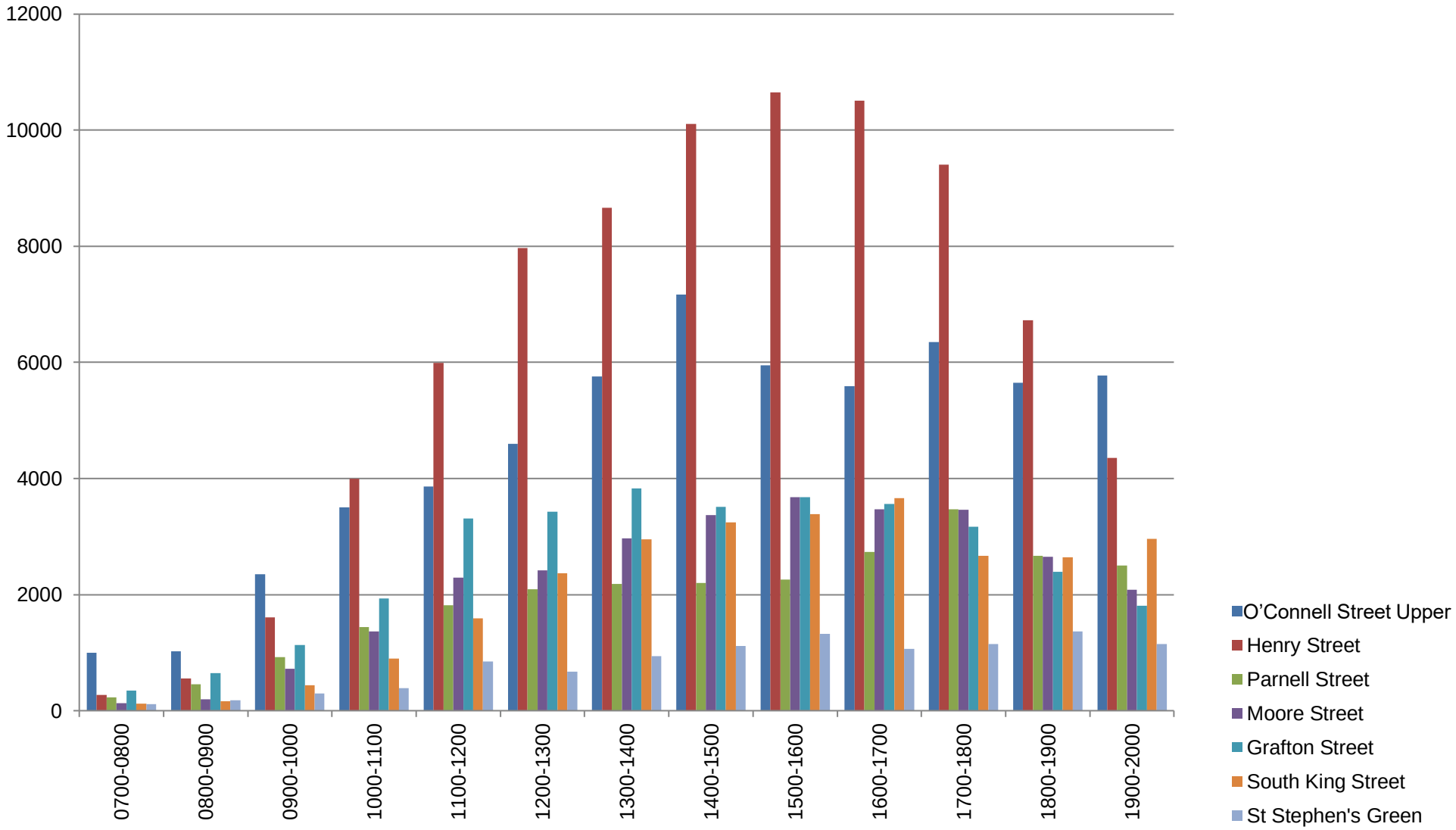
Movement benchmark Central Dublin Weekday

Source:
*27 gate locations were observed on Saturday, **29th September and Tuesday, 2nd October 2018** as part of surveys organised by Space Syntax.*
*All locations were recorded by cameras between **07:00 and 20:00** on both days. A 10 minute pedestrian count was extracted every 30 minutes for all gates. The counts were converted to hourly figures.*

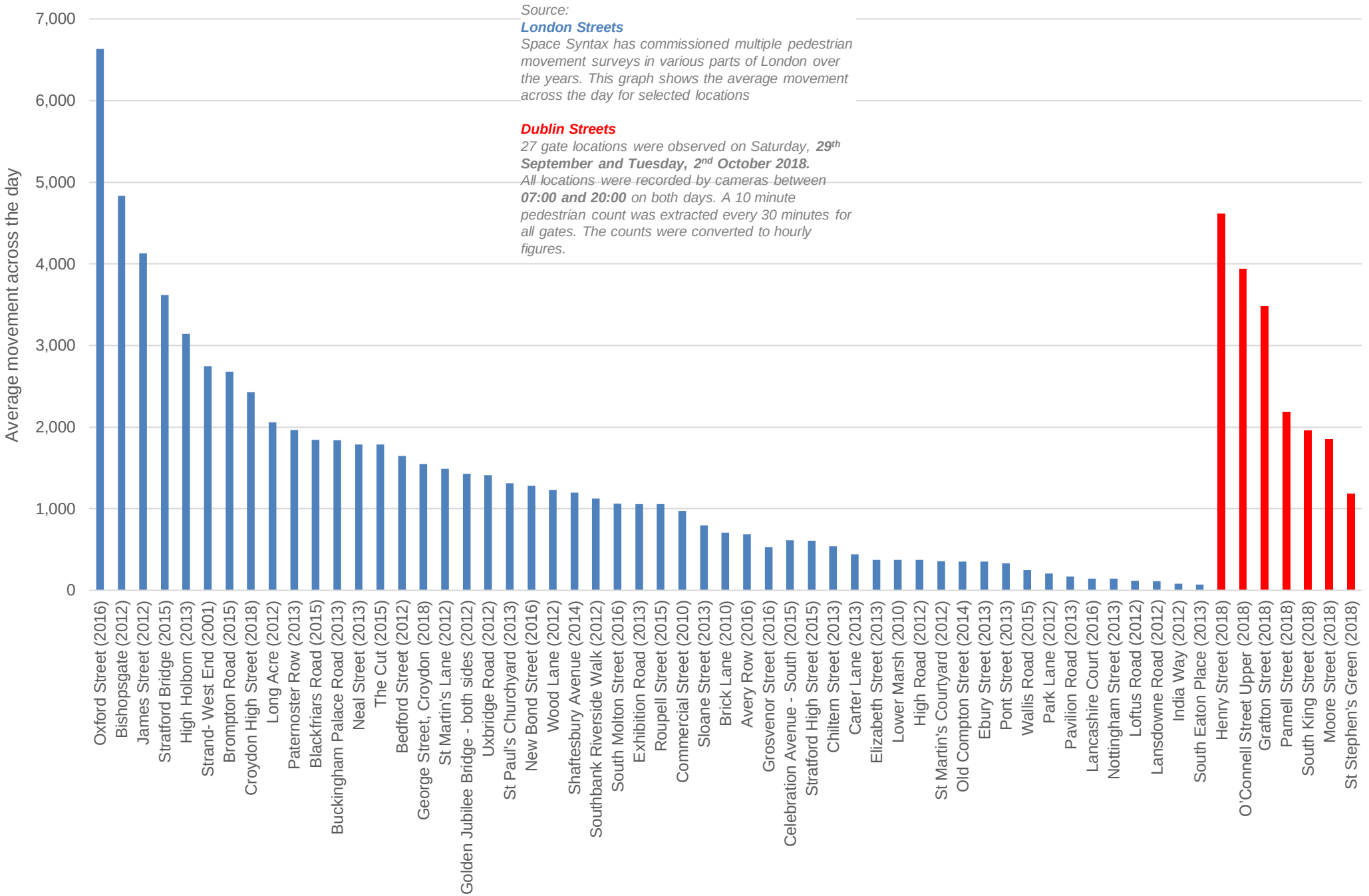


Movement benchmark Central Dublin Weekend

Source:
*27 gate locations were observed on Saturday, **29th September and Tuesday, 2nd October 2018** as part of surveys organised by Space Syntax.*
*All locations were recorded by cameras between **07:00 and 20:00** on both days. A 10 minute pedestrian count was extracted every 30 minutes for all gates. The counts were converted to hourly figures.*

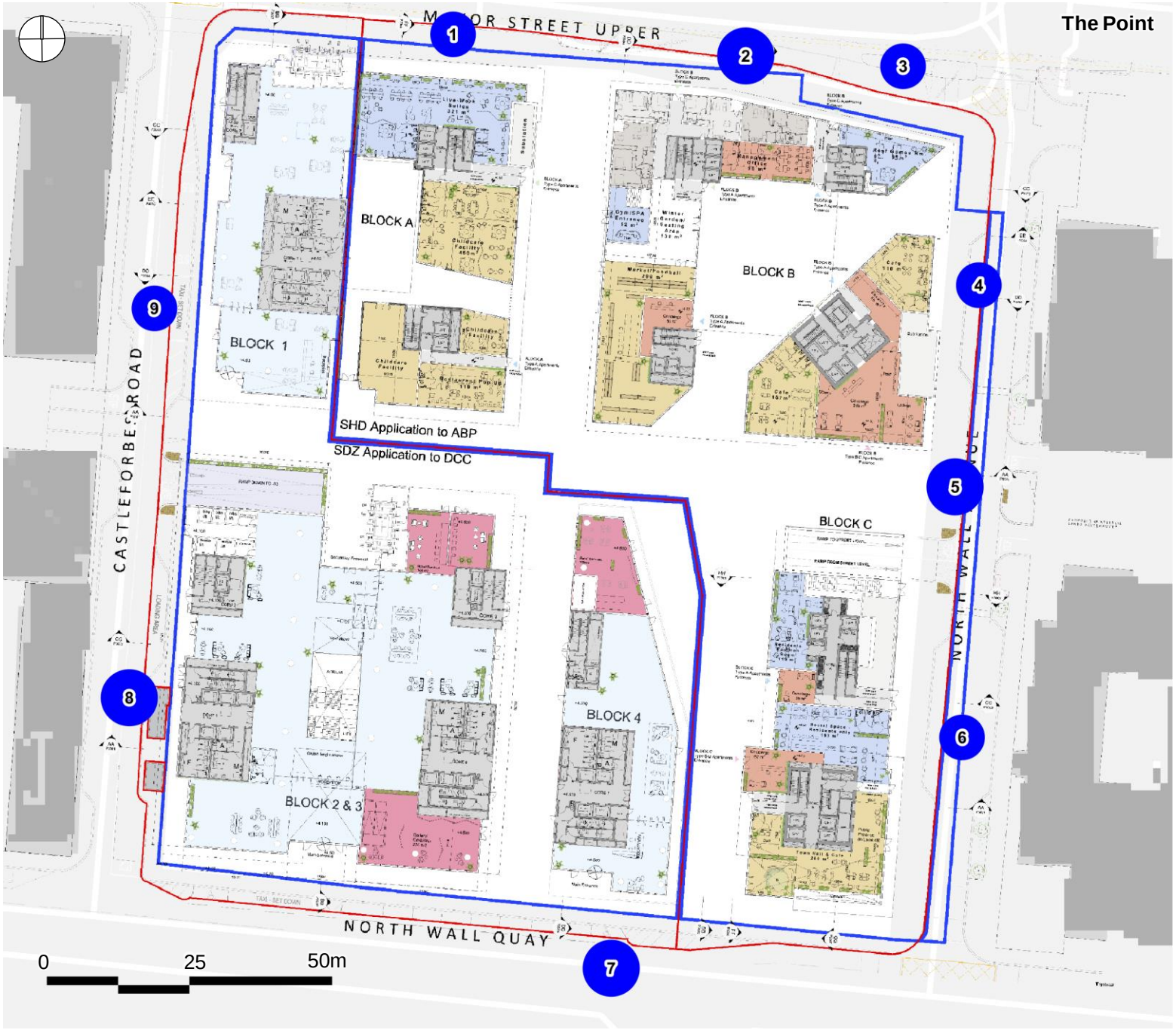


Movement benchmark Average movement across the day London and Dublin



Street Capacity, Pedestrian Comfort and Capacity Risk Assessment

Level of Service Fruin



We have calculated the Level of Service (LoS) as per the Fruin guidelines at the location with the narrowest width along the external pavements.

The Fruin Level of Service (LoS) is an indication of the ease of movement in a pedestrian environment. LoS are classified A-F (refer pg.48). LoS A indicates sufficient space is provided for pedestrians to freely select their own walking speed, to bypass slower pedestrians and to avoid conflicts with others. For pedestrian movement in typical city environment the Level of Service should ideally not exceed B.

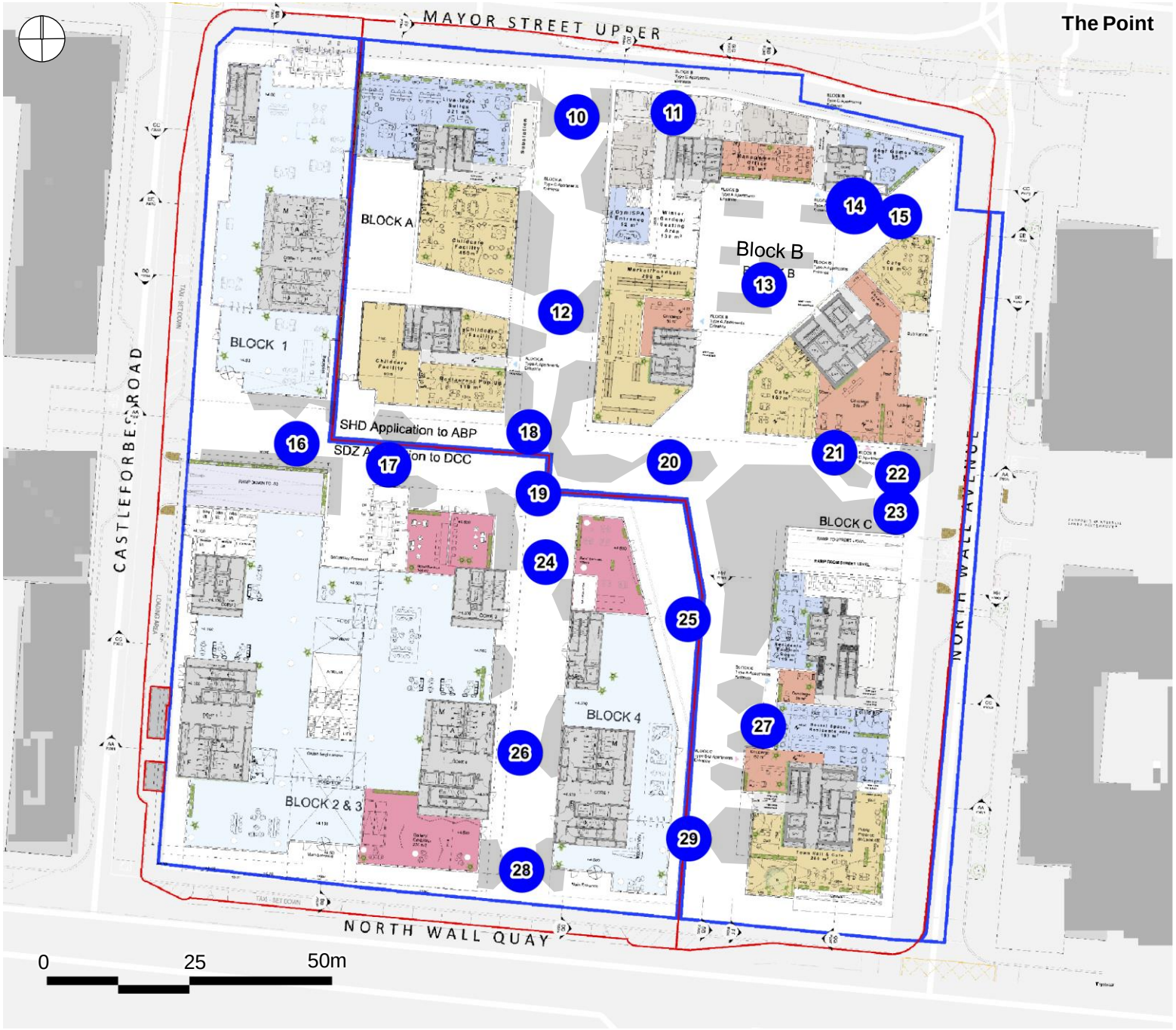
Location	Width(m)	Effective width (m)	5 min PM peak demand	Resulting flow density (pppm)	Fruin LoS
1	2.33	1.93	50	5.22	A
2	2.03	1.63	55	6.73	A
3	4.13	3.73	55	2.94	A
4	3.38	2.98	89	6.00	A
5	1.91	1.51	81	10.78	A
6	3.31	2.91	79	5.45	A
7	2.63	2.23	108	9.71	A
8	2.15	1.75	57	6.50	A
9	2.81	2.41	62	5.15	A

Area under Assessment

Pedestrian density for footways
People per metre per minute

A	< 23	excellent
B	23–32	
C	32–49	
D	49–66	
E	66–82	
F	> 82	worst

Level of Service Fruin



We have calculated the Level of Service (LoS) as per the Fruin guidelines at the location with the narrowest width within the SDZ and SHD developments.

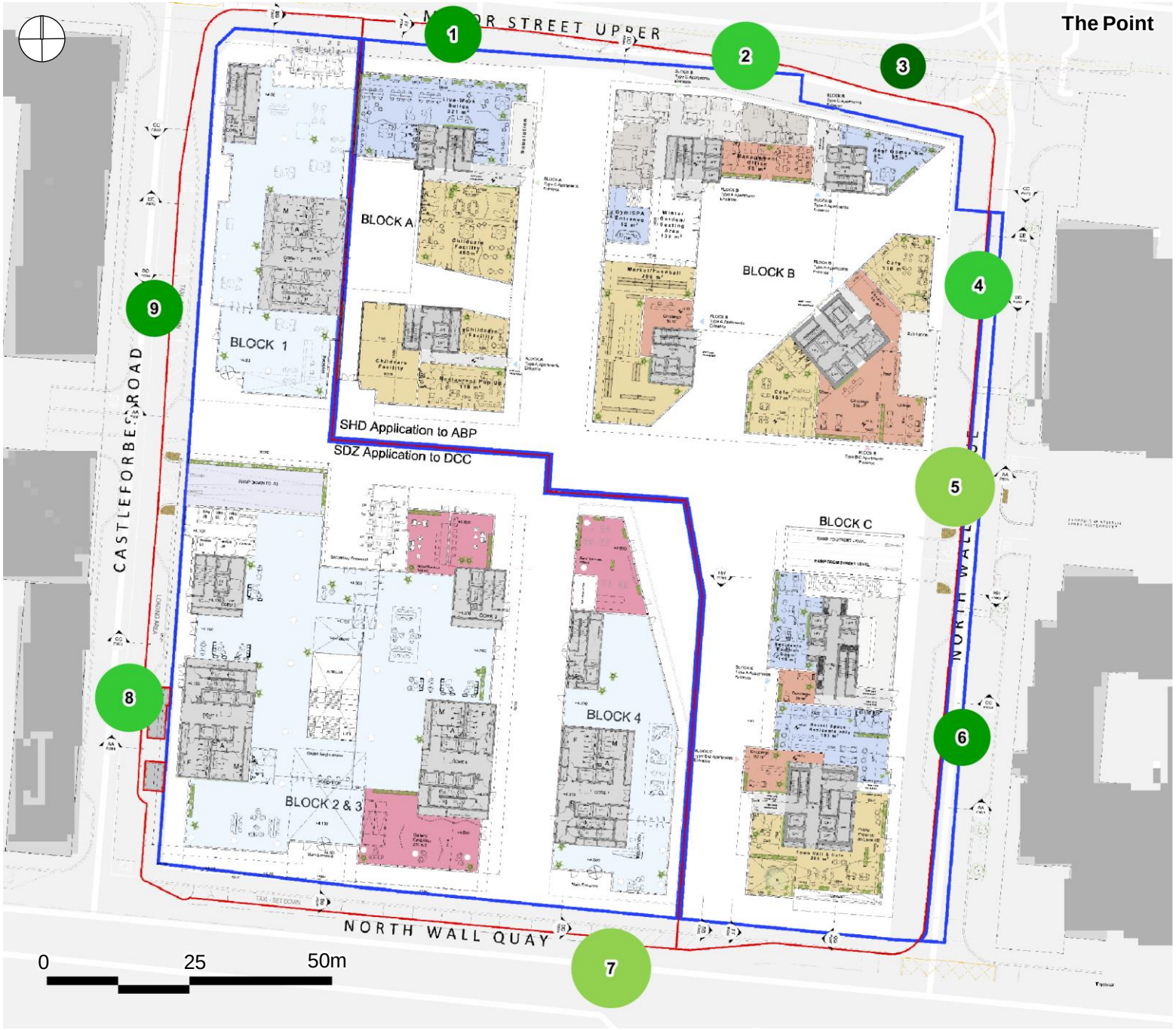
Location	Width (m)	Effective width (m)	5 min PM peak demand	Resulting flow density (pppm)	Fruin LoS
10	3.94	3.54	27	1.53	A
11	2.16	1.76	3	0.28	A
12	3.65	3.25	30	1.86	A
13	5.09	4.69	25	1.08	A
14	1.97	1.57	64	8.14	A
15	4.56	4.16	30	1.45	A
16	5.55	5.15	1	0.03	A
17	6.08	5.68	31	1.10	A
18	3.83	3.43	48	2.79	A
19	8.24	7.84	70	1.79	A
20	3.09	2.69	36	2.69	A
21	2.74	2.34	29	2.44	A
22	1.77	1.37	31	4.56	A
23	1.82	1.42	1	0.10	A
24	9.59	9.19	40	0.88	A
25	13.43	13.03	48	0.74	A
26	6.13	5.73	29	1.00	A
27	3.77	3.37	43	2.53	A
28	4.78	4.38	31	1.43	A
29	6.43	6.03	80	2.66	A

Area under Assessment

Pedestrian density for footways
People per metre per minute

A	< 23	excellent
B	23–32	
C	32–49	
D	49–66	
E	66–82	
F	> 82	worst

Pedestrian Comfort Level TfL



We have calculated the Pedestrian Comfort Levels as per the TfL guidelines at the location with the narrowest width along the external pavements.

For both residential and office/retail areas it is recommended that the Pedestrian Comfort Level (PCL) should not be below PCL B+ and B respectively.

Location	Width(m)	Effective width (m)	5 min PM peak demand	Resulting flow density (pppm)	PCL
1	2.33	1.93	50	5.22	A
2	2.03	1.63	55	6.73	A-
3	4.13	3.73	55	2.94	A+
4	3.38	2.98	89	6.00	A-
5	1.91	1.51	81	10.78	B+
6	3.31	2.91	79	5.45	A
7	2.63	2.23	108	9.71	B+
8	2.15	1.75	57	6.50	A-
9	2.81	2.41	62	5.15	A

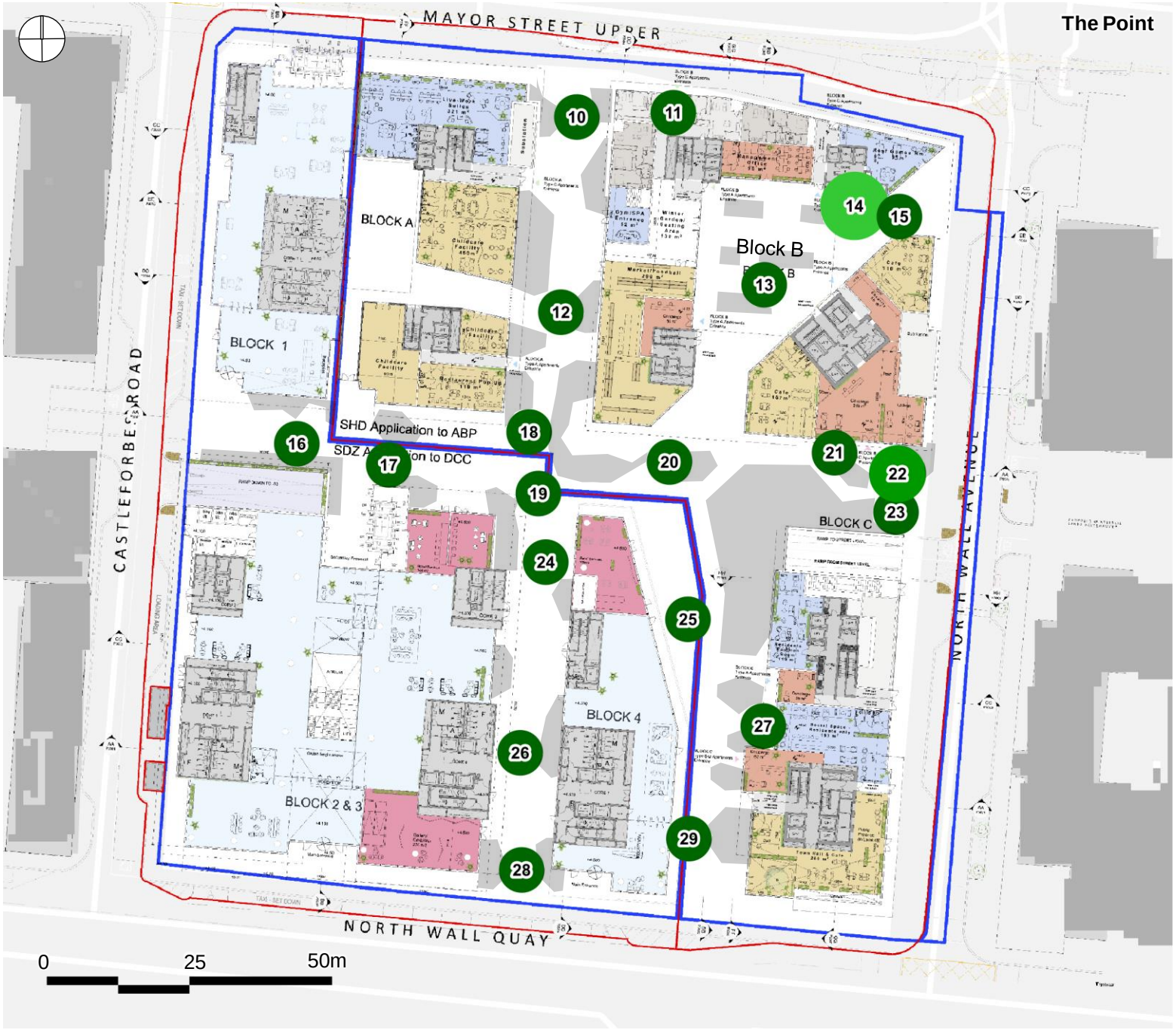
Area under Assessment

Pedestrian Comfort Levels

TfL recommended minimum

- A+ comfortable
- A
- A-
- B+
- B
- B-
- C+
- C
- C-
- D
- E very uncomfortable

Pedestrian Comfort Level TfL



We have calculated the Pedestrian Comfort Levels as per the TfL guidelines at the location with the narrowest width within the SDZ and SHD developments.

Location	Width (m)	Effective width (m)	5 min PM peak demand	Resulting flow density (pppm)	PCL
10	3.94	3.54	27	1.53	A+
11	2.16	1.76	3	0.28	A+
12	3.65	3.25	30	1.86	A+
13	5.09	4.69	25	1.08	A+
14	1.97	1.57	64	8.14	A-
15	4.56	4.16	30	1.45	A+
16	5.55	5.15	1	0.03	A+
17	6.08	5.68	31	1.10	A+
18	3.83	3.43	48	2.79	A+
19	8.24	7.84	70	1.79	A+
20	3.09	2.69	36	2.69	A+
21	2.74	2.34	29	2.44	A+
22	1.77	1.37	31	4.56	A
23	1.82	1.42	1	0.10	A+
24	9.59	9.19	40	0.88	A+
25	13.43	13.03	48	0.74	A+
26	6.13	5.73	29	1.00	A+
27	3.77	3.37	43	2.53	A+
28	4.78	4.38	31	1.43	A+
29	6.43	6.03	80	2.66	A+

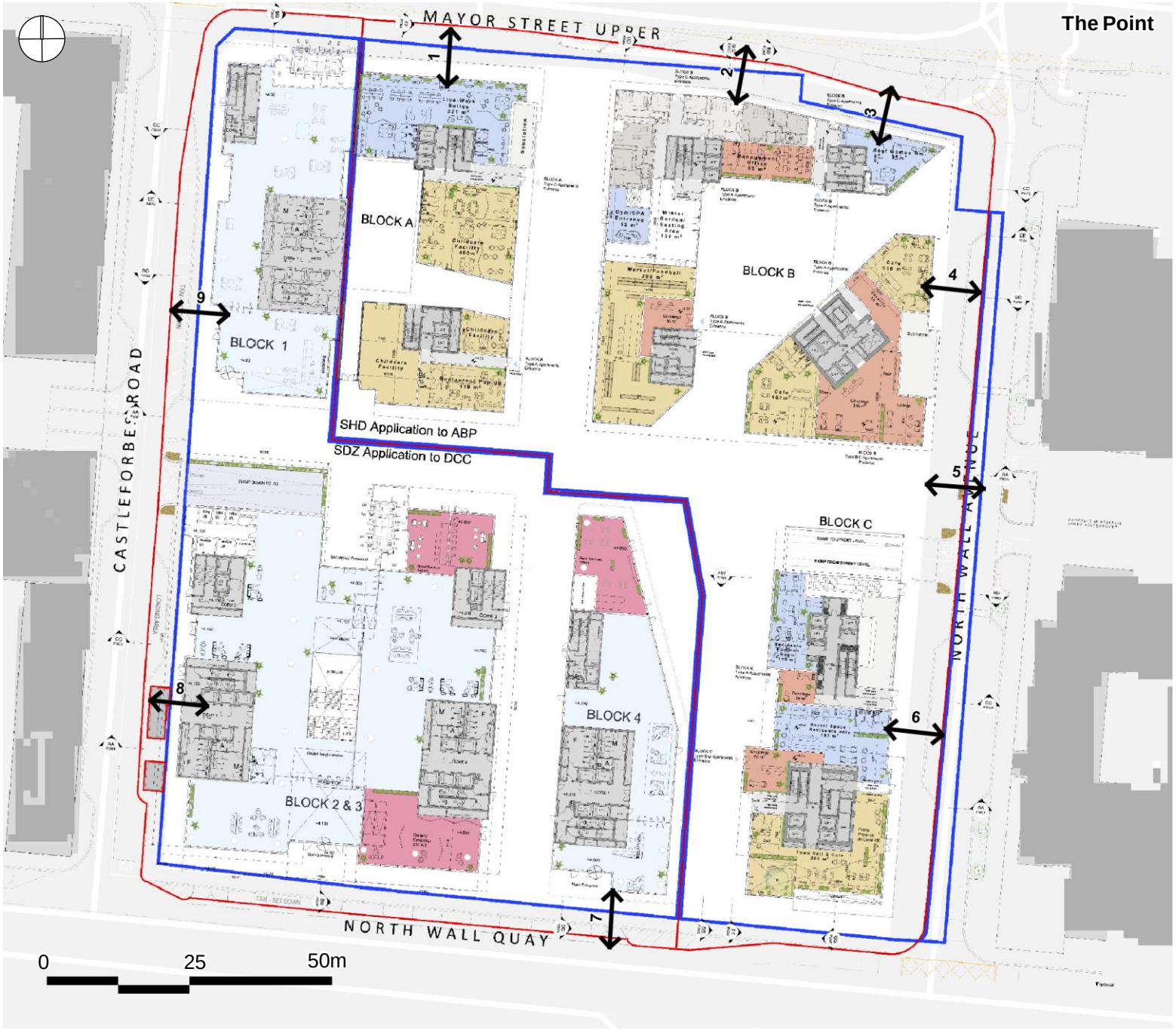
Area under Assessment

Pedestrian Comfort Levels

TfL recommended minimum

- A+ comfortable
- A
- A-
- B+
- B
- B-
- C+
- C
- C-
- D
- E very uncomfortable

Limit of number of people at PLC of B+ Location of narrowest effective width External



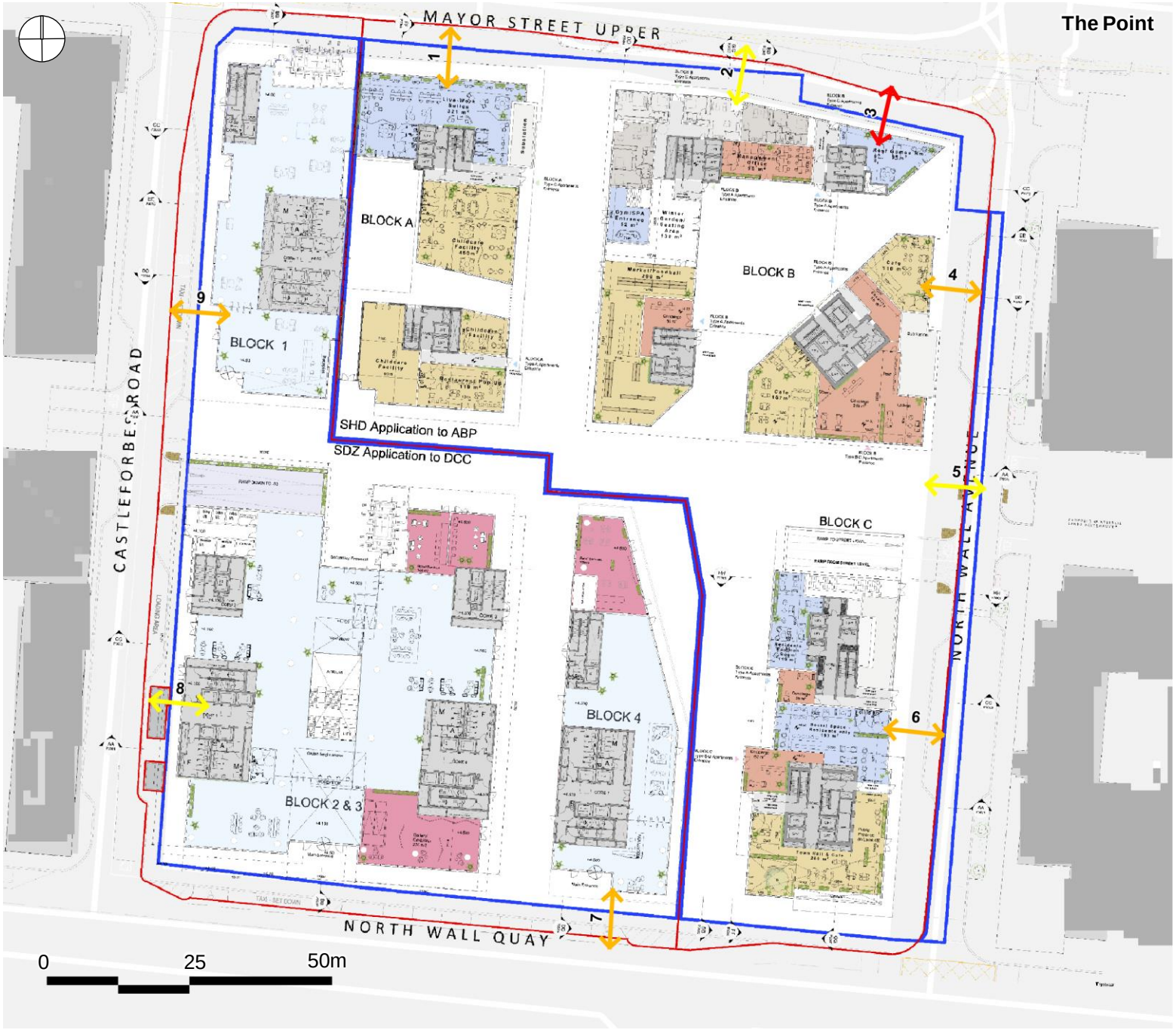
For both residential and office/retail areas it is recommended that the Pedestrian Comfort Level (PCL) should not be below TfL PCL B+ and B respectively.

Thus we have calculated the capacity of narrowest points along the external pavements at TfL PCL B+ to calculate the maximum pavement capacity to create a comfortable pedestrian environment.

Area under Assessment

Location of pavement gate

Limit of number of people at PLC of B+



The table below shows the maximum number of pedestrians that the pavements can support within the TfL PCL B+ guideline to keep the pedestrian comfort within the comfortable range.

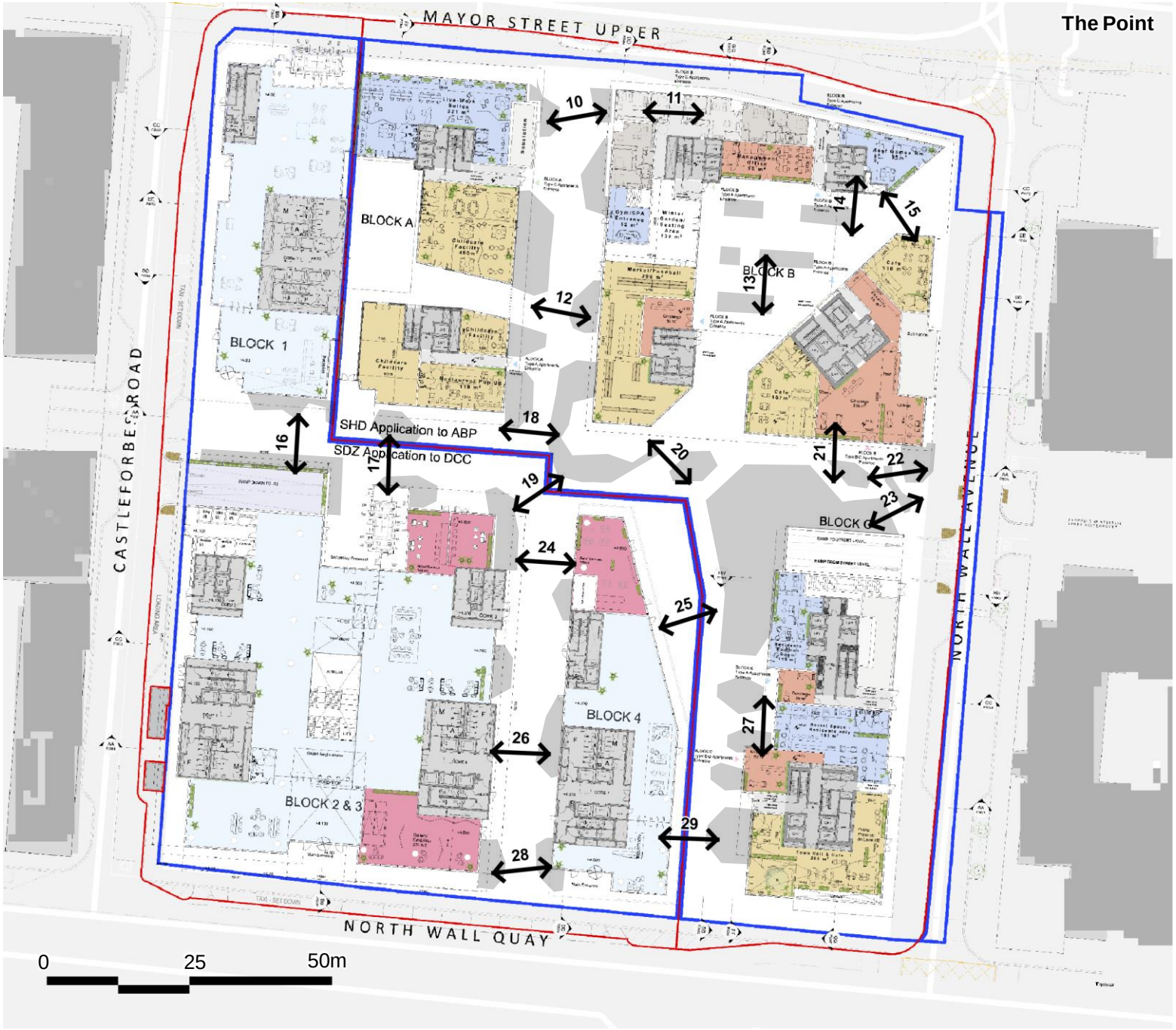
Pedestrian movement
People per hour

- 2,000 – above
- 1,000 – 2,000
- 500 – 1,000
- 250 – 500
- 100 – 250
- 0 – 100

Area under Assessment

Location	Capacity (pph)	Proposed design	
		Width (m)	Effective width (m)
1	1,042	2.33	1.93
2	879	2.03	1.63
3	2,013	4.13	3.73
4	1,609	3.38	2.98
5	815	1.91	1.51
6	1,569	3.31	2.91
7	1,202	2.63	2.23
8	946	2.15	1.75
9	1,304	2.81	2.41

Limit of number of people at PLC of B+ Location of narrowest effective width Internal



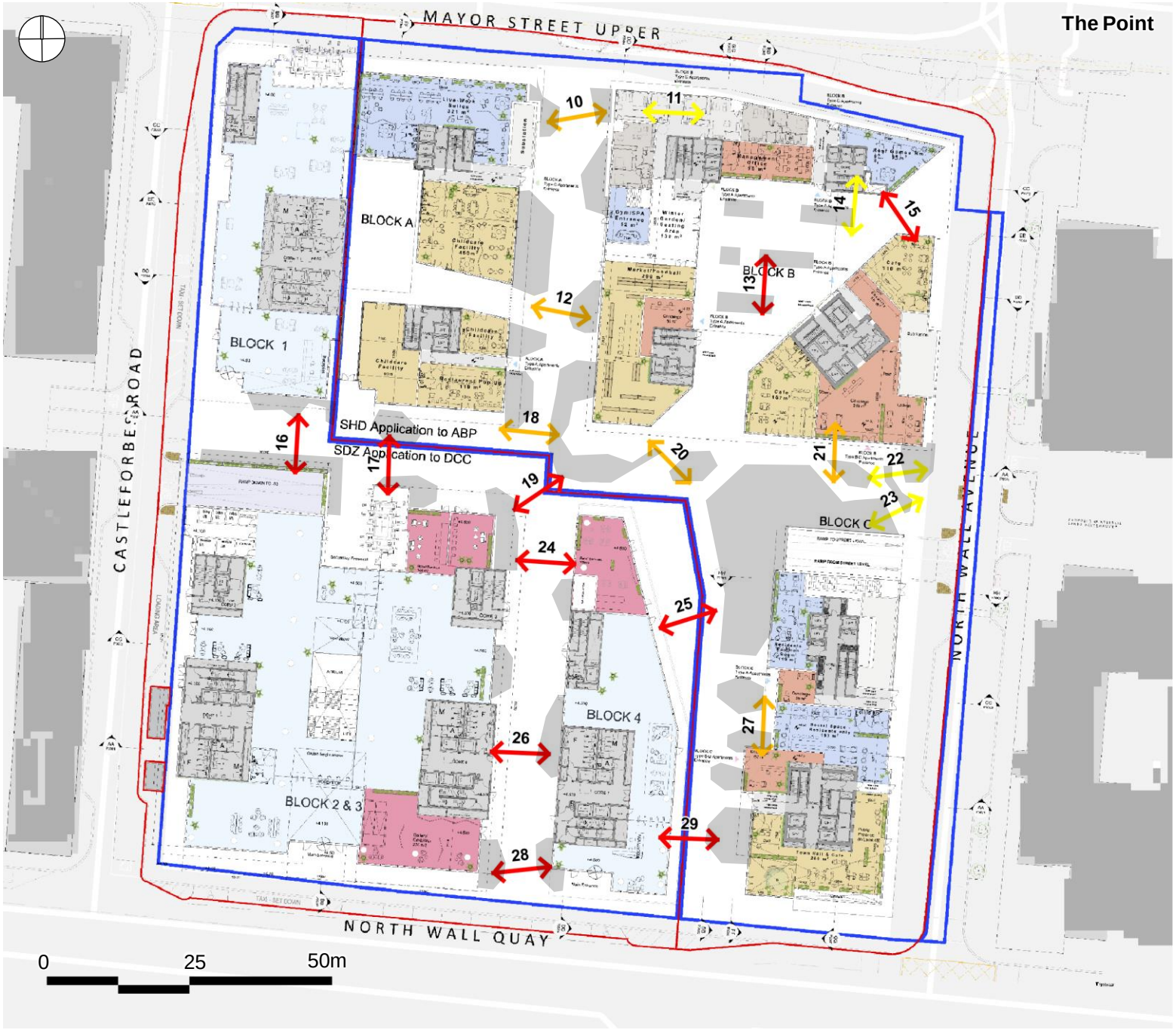
For both residential and office/retail areas it is recommended that the Pedestrian Comfort Level (PCL) should not be below TfL PCL B+ and B respectively.

Thus we have calculated the capacity of narrowest points within the SDZ and SHD developments at TfL PCL B+ to calculate the maximum public realm capacity to create a comfortable pedestrian environment.

Area under Assessment

Location of public realm gate

Limit of number of people at PLC of B+



The table below shows the maximum number of pedestrians that the pavements can support within the TfL PCL B+ guideline to keep the pedestrian comfort within the comfortable range.

Pedestrian movement
People per hour

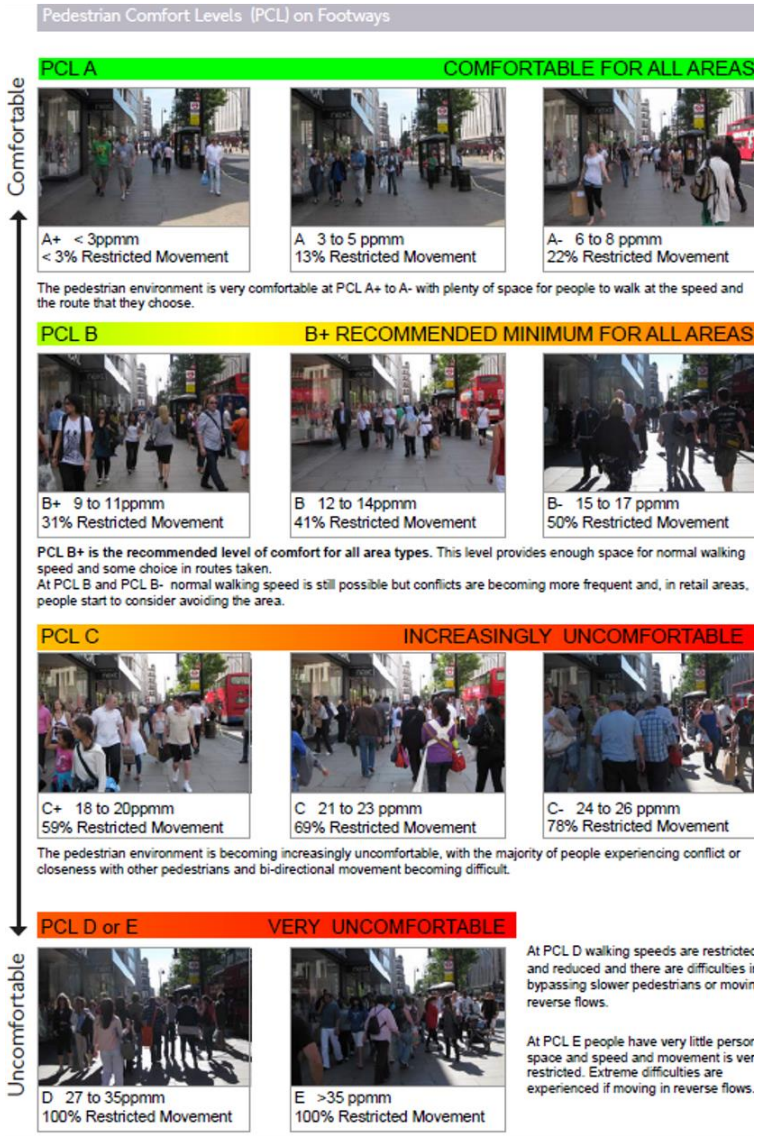
- 2,000 – above
- 1,000 – 2,000
- 500 – 1,000
- 250 – 500
- 100 – 250
- 0 – 100

Area under Assessment

Location	Capacity (pph)	Proposed design	
		Width (m)	Effective width (m)
10	1,910	3.94	3.54
11	951	2.16	1.76
12	1,755	3.65	3.25
13	2,533	5.09	4.69
14	845	1.97	1.57
15	2,248	4.56	4.16
16	2,779	5.55	5.15
17	3,065	6.08	5.68
18	1,855	3.83	3.43
19	4,236	8.24	7.84
20	1,455	3.09	2.69
21	1,265	2.74	2.34
22	741	1.77	1.37
23	765	1.82	1.42
24	4,962	9.59	9.19
25	7,037	13.43	13.03
26	3,096	6.13	5.73
27	1,818	3.77	3.37
28	2,368	4.78	4.38
29	3,255	6.43	6.03

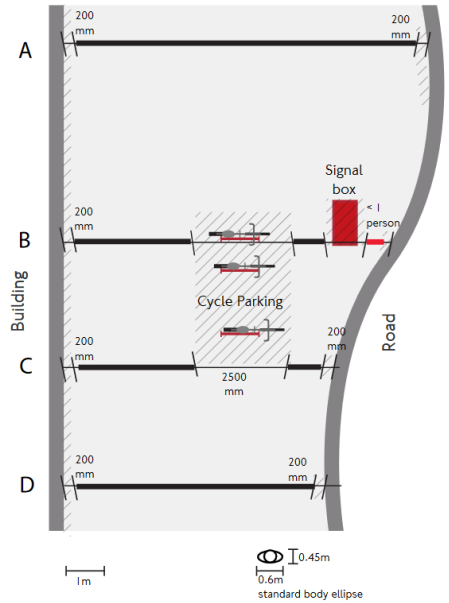
Appendix

Appendix 1 Pedestrian Comfort Level TfL



Transport for London
Pedestrian Comfort Guidance for London

	OFFICE AND RETAIL		RESIDENTIAL	
	Peak	Ave of Max	Peak	Ave of Max
A	COMFORTABLE		COMFORTABLE	
B+				
B			ACCEPTABLE	
B-	ACCEPTABLE			
C+			AT RISK	AT RISK
C-	AT RISK	AT RISK		
D			UNACCEPTABLE/ UNCOMFORTABLE	
E				
	The "at risk" level is set at a lower PCL during the Average of Maximum Activity than peak flows. This is because of the greater number of single travellers and the short duration of maximum activity.		The "at risk" level is set at a lower PCL than peak flows in Residential Areas to reflect the short time this is likely to occur. A site visit to Residential sites is particularly important to check if there is school activity or a bus stand in the area.	

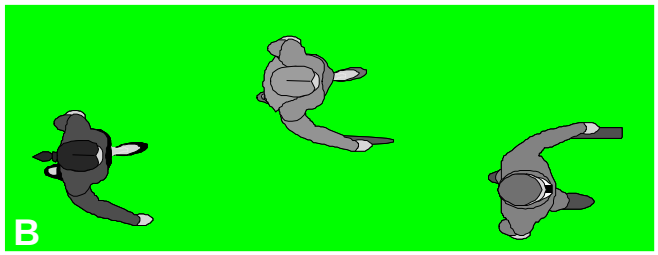


Effective width calculation example

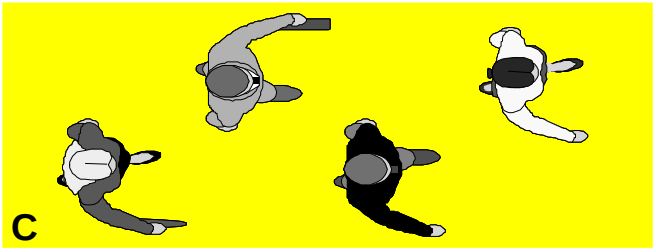
Source: Transport for London Pedestrian Comfort Guidance for London, Guidance Document, version 2 (2019)

Appendix 2 Flow capacity assessment Fruin standard

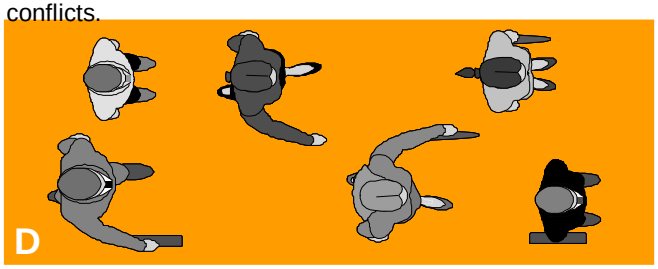
At this level sufficient space is provided for pedestrians to freely select their own walking speed, to bypass slower pedestrians and to avoid conflicts with others.



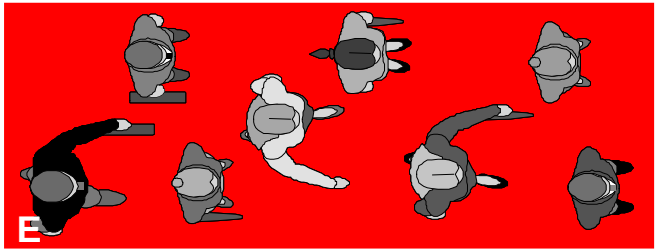
Sufficient space is available to select normal walking speed and to bypass other pedestrians in primarily one-directional flows. Where reverse-direction or pedestrian crossing movement exists, minor conflicts will occur, slightly reducing mean pedestrian speeds and potential conflicts.



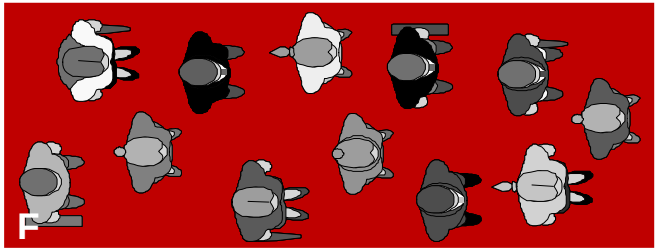
Freedom to select individual walking speed and freely pass others is restricted. Where pedestrian cross movement and reverse flows exist, there is a high probability of conflict requiring frequent adjustment of speed and direction to avoid contact.



The majority of people would have their normal walking speeds restricted and reduced, due to difficulties in bypassing slower-moving pedestrians and avoiding conflicts. Pedestrians involved in reverse-flow and crossing movements would be severely restricted, with the occurrence of multiple conflicts with others.



Almost all pedestrians would have their walking speed restricted, requiring frequent adjustments of gait. At the lower end of the range, forward progress would only be made by shuffling. There would be insufficient space to bypass slower-moving pedestrians. Extreme difficulties would be experienced by pedestrians attempting reverse-flow and cross-flow movements.



All pedestrian walking speeds are extremely restricted and forward progress can only be made by shuffling. There would be frequent, unavoidable contact with other pedestrians and reverse or crossing movements would be almost impossible. This level of service is representative of a loss of control and a complete breakdown in traffic flow.

Pedestrian density for footways
People per metre per minute

A	< 23	excellent
B	23–32	
C	32–49	
D	49–66	
E	66–82	
F	> 82	worst

Pedestrian density for staircase
People per metre per minute

A	< 16	excellent
B	16–23	
C	23–33	
D	33–43	
E	43–56	
F	> 56	worst

Appendix 3 Urban form analysis Methodology

Space Syntax and urban design

Overview

Over the last twenty years, Space Syntax has pioneered a unique, space-based approach to the modelling of human activity patterns in buildings and urban systems. Our models integrate multiple influences on behaviour including:

a) spatial layout hierarchy, from more accessible to less accessible places

b) the distribution of object attractors and land uses

c) the location of transport nodes.

Space Syntax models simultaneously analyse pedestrian, cycle and vehicle movement networks and have been applied in planning and design projects worldwide. Applications include the creation and evaluation of proposals for urban and architectural change at every scale, from regional urban analysis and the planning of entire cities to the design of street intersections and room layouts.

Space Syntax's approach combines this extensive global experience with robust and continuously developing technologies to forecast the effects of planning and design decisions on the movement and interaction of people in buildings and urban areas. Highly graphic and capable of providing rapid feedback to planners and designers, models are used to test proposals from concept design through to delivery.

Spatial accessibility modelling

The approach works by transforming the street pattern of an area, or room layout of a building, into a network "graph". In urban systems, the road centreline map of the area is often used as a starting point, where the network is divided into individual "segments" of space, each segment being the street or path between two intersections. In buildings or convex open spaces, the network will typically be divided into individual "tiles" of space within each space.

Each segment or tile is then evaluated using a mathematical algorithm to calculate its interaccessibility within the network, ie how relatively easy or difficult it is to reach that segment from all other segments, or how likely it is that movement between different parts of the network is likely to pass along that segment. In this way, the software calculates both the "to movement" and the "through movement" characteristics of each segment.

Key feature 1: analysis of "angular movement"

Key to the success of this approach is the discovery that movement in buildings and cities often follows a "least angle" path between origins and destinations. In other words, many people minimise the angular deviation from their origin to their destination, even if this means they sometimes take a slightly longer route.

Key feature 2: evaluation of multi-scale activity

A second key aspect of the Space Syntax approach is the multi-scale analysis of spatial layouts, allowing short- and long-distance journeys to be simultaneously evaluated and showing how different parts of the same network are differently used, depending on the scale of journey. Frequently, the same parts of the network are used on short- and long-distance journeys. Land use analysis shows that these multi-scale places are typically successful commercial locations, thus demonstrating the importance of careful spatial layout design in creating multi-scale opportunities for shops to trade to more than one scale of movement.

Key feature 3: integration of spatial layout, land use & transport factors

The simultaneous analysis of spatial layout, land use and transport factors is a third key factor in the uniqueness and success of Space Syntax models. By demonstrating the fundamental role of space in determining land use potentials, then showing how the specific location of individual land use attractors and transport attractors exploits these potentials or not, Space Syntax models make it possible to integrate the three essential aspects of planning and design: spatial, land use and transport.

1. Example of an unprocessed spatial accessibility map
2. Example of a processed spatial accessibility map, after values are assigned to each line