0129 City Quay

Pedestrian realm people flow study

November 2022

Revision 00

Revision	Description	Issued by	Date	Checked
00	Final	CB	**04/11/22**	OZ

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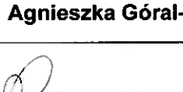

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1. Executive summary

A new landmark tall building is proposed for a site at the corner of City Quay and Moss Street, Dublin 2. The building will accommodate offices, an arts centre, and ancillary accommodation.

The Draft Dublin City Development Plan 2022-2028 includes performance criteria for the assessment of proposals for landmark tall buildings in the City Centre, and among these is a criterion which states: "Entrances, access routes, and ground floor uses should be designed and placed to allow for peak time use and to ensure there is no unacceptable overcrowding in the surrounding areas."

This report has been prepared to examine the pedestrian realm in the vicinity of the proposed building to ensure there is no unacceptable overcrowding in the surrounding areas in the context of the completed development. The scope of this report is restricted to pedestrian access in and around the building during peak periods of pedestrian flow. The study area includes the network of footpaths surrounding the building and extends into the ground floor level of the building to the passenger lifts. This report does not address vehicular access for occupants arriving by other modes of transport (who do not utilize the footpaths), nor to vehicular access, matters which are addressed in separate study reports.

This study includes quantitative and qualitative aspects of the pedestrian realm. Section 4 outlines results of quantitative computer-based simulation of pedestrian movement based on actual measurements of people movement in the area of the site, as well as projected movement patterns for the additional population present post-development. Section 5 addresses qualitative aspects of the pedestrian realm for the present condition and future scenario.

The simulations carried out using an agent-based computer model demonstrated that the additional traffic generated by the proposed development **will not lead to unacceptable overcrowding in the surrounding areas**. The results of the simulations do not indicate excessive densities of pedestrians on the pavements immediately adjacent to the proposed development or any other areas within the computational domain.

The results suggest that with the future increase of pedestrian traffic in the area – resulting both from the proposed building and other similar developments – there is a potential for high pedestrian density on the corner of George's Quay at the pedestrian crossing at the north end of Moss Street. Additional simulations carried out indicate that this condition can be improved by relatively simple modifications to the road markings and safety railing to increase the width of the existing pedestrian crossing through Moss Street from the current 2 m to 3 m.

Results of the qualitative analysis indicate that pedestrian comfort may be improved by reducing the length of safety railing at two locations to enhance the width of the circulation area of the pavement.

2. Scope and aim of the study

2.1 Purpose of this report

The Draft Dublin City Development Plan 2022-2028 contains subjective and objective performance criteria for the assessment of proposals for landmark tall buildings in the City Centre. Among the assessment criteria are public safety and functional aspects which include the requirement to ensure there is no unacceptable overcrowding in the surrounding areas.

This report has been prepared to verify that the main entrance and surrounding areas of the proposed development may be designed to ensure no overcrowding in the pedestrian realm during peak hours, in response to Objective number 5 of Table 4 of Section 4.0 of Appendix 3 of the draft development plan; an excerpt of which is presented in Fig. 2.1 below. The larger objective, as stated in the draft development plan, is to achieve sustainable height and density in line with a sustainable compact growth policy for density and building height in the City of Dublin.

5	**Public Safety and Functional Impacts**	• Landmark/tall building proposals must demonstrate that the development creates a pleasant, safe and healthy environment for its future occupants. The design of the building should follow best practice to minimise the threats from fire, flood and other hazards. • All applications must be accompanied by an assessment on potential interference with aviation, navigation and telecommunications. • It must be demonstrated that buildings can be serviced, maintained and managed in a manner that will not cause disturbance or inconvenience to surrounding public realm. • Entrances, access routes, and ground floor uses should be designed and placed to allow for peak time use and to ensure there is no unacceptable overcrowding in the surrounding areas. • All tall building proposals must be accompanied by a full transport capacity assessment. The intensity of use associated with tall buildings will only be appropriate if it is supported by an appropriate level of transport capacity to ensure good pedestrian and public transport access.

Fig 2.1 Excerpt from Table 4 of Appendix 3 of the Draft Dublin City Development Plan 2022-2028

2.1 Scope of analysis

The analysis covers pedestrian flows in the immediate vicinity of the proposed building, as indicated in Fig. 2.2. Particular attention is given to the junction located in front of the main entrance to the proposed building at Moss Street / City Quay, as this is a junction of streets with medium to high intensity of vehicular traffic and an area of highest pedestrian flows.

The aim of the analysis is to investigate current pedestrian flows and to verify if the additional pedestrian traffic generated by the proposed building will not cause unacceptable overcrowding in the surrounding areas.

Fig 2.2 Extent of pedestrian realm analysis for this study

2.2 Limitations and exclusions

The analysis does not extend to emergency scenarios such as evacuation of the proposed building or of any adjoining properties. It also does not cover unusual pedestrian flow situations such as parades, sport events, protest marches, etc.

3. Assessment criteria and methodology of the study

3.1 Reference standards

The following standards have informed the analysis and assessment of the pedestrian realm in the study area.

- *The Heart of Dublin, City Centre Public Realm Masterplan*, Dublin City Council, 2016
- *Design Manual for Urban Roads and Streets*, Government of Ireland, 2019
- *Pedestrian Comfort Guidance for London, version 2*, Transport for London, 2019
- *Designing for Pedestrians: a Level-of-Service Concept*, John J. Fruin, The Port of New York Authority, 1971
- *Guide D, Transportation systems in Buildings,* CIBSE, 2020

3.2 General context

The site lies within the central financial district of Dublin in an area envisioned to become a pedestrian-friendly core in *City Centre Public Realm Masterplan*. The masterplan notes that whilst some areas of the core, e.g. O'Connell Street, are already pedestrian-friendly, these areas are fragmented, and continuity of a high quality pedestrian experience is a work in progress that will occur over the course of many years.

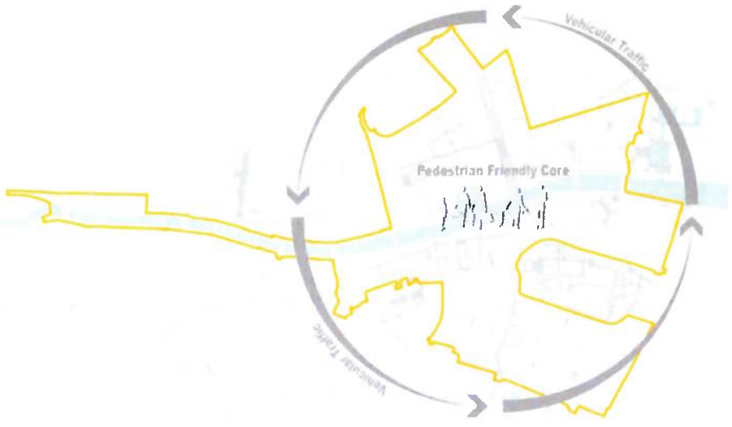

Fig 3.1 **Excerpt from** *The Heart of Dublin, City Centre Public Realm Masterplan*, **illustrating the area envisaged for a pedestrian-friendly core**

Because the site is located in a long-established urban core, the pedestrian environment is already defined by existing spaces between the buildings, carriageways, and cycle routes. Existing traffic signals control and restrict the movements of pedestrians, cycles and vehicles. Existing kerbs, railings and street furniture constrain the movements of pedestrians.

3.3 General approach to the study

In light of the context, this study has been approached from two directions:

- An agent-based computer simulation of pedestrian movement in the current condition and in the context of the completed development has been carried out to examine real-time crowd formation and dissipation during peak times, as described in Section 4 of this report;
- An assessment of pedestrian comfort level [PCL] based on Transport for London [TFL] guidance has been carried out to measure conditions at present and in the context of the completed development, as described in Section 5 of this report.

Both approaches rely upon real time survey of actual measured pedestrian movements in the vicinity of the site.

3.4 Pedestrian traffic surveys

Observations of the existing pedestrian flow patterns in the vicinity of the proposed development were carried out on several dates in the period from August to November 2022. Pedestrian counts were carried out at five "gateways" to assess the total quantum of traffic entering and exiting the domain surrounding the site; refer to Fig. 3.2. A sixth gateway to the domain exists at the Moss Street entrance to the George's Quay development where pedestrian traffic across the gateway was observed to be negligible. The numerical pedestrian counts were augmented with video recordings of the major junctions to obtain further nuance in respect of:

- Persons changing direction at the junction;
- Persons jay walking against the traffic signal and in the wrong direction;
- The interaction of motor vehicles, bicycles and pedestrians at Moss Street, City Quay, and the intersection at George's Quay

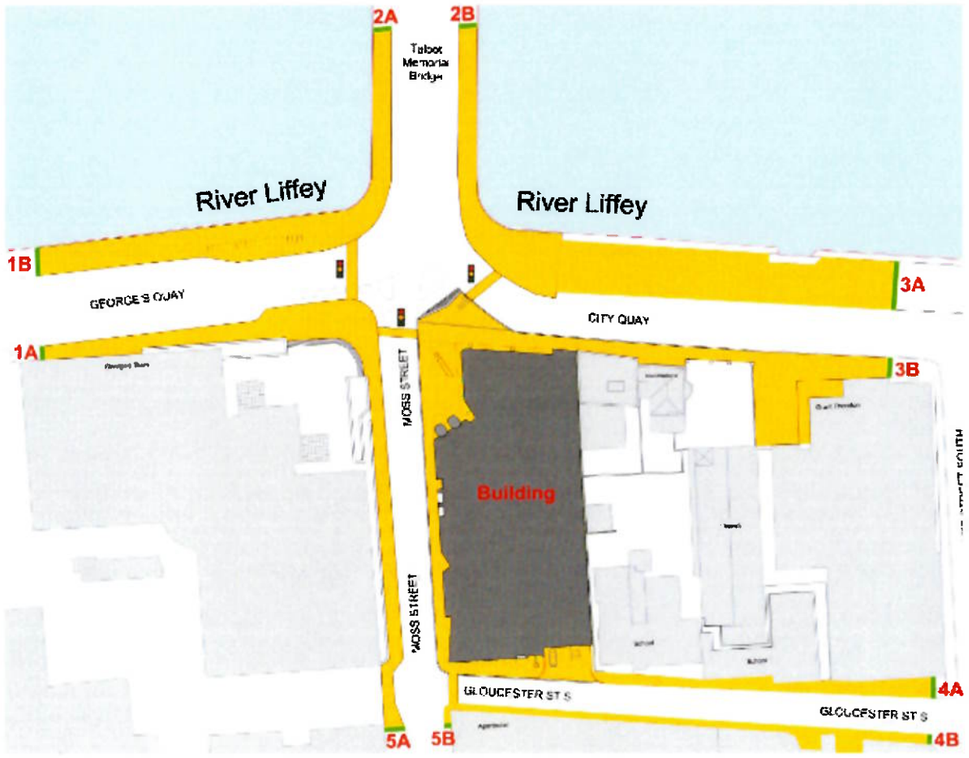

Fig 3.2 Pedestrian gateways bounding the survey domain, excluding the east entrance of George's Quay Plaza

The manual counts and video recordings surveys were focused on the morning peak time (7:30-9:30) as the most relevant to the analysis but some additional observations for mid-day and evening times were also carried out.

The summary of the results of the existing pedestrian traffic survey is included in Appendix 1 of this report. From the observations undertaken the following trends emerge:

1) During the morning hours pedestrian flow through the area in front of main entrance of the proposed building is primarily from west to east, along the southern pavements of Georges Quay and City Quay. The maximum observed flows in this direction were around 40 persons per 5 minutes;

2) On the north-south axis the flow from the north dominates;

3) It is apparent that the direction and intensity of pedestrian flows in the vicinity of the site are to a large extent governed by location of nearby public transport hubs such as Busáras, Connolly Station, Tara Street Station, as well as Luas and Dublin Bus stops. The location of popular destinations, e.g. the nearby school, large commercial and office clusters is also relevant.

The flow of pedestrians through the main junction of Moss Street and Georges Quay / City Quay is also influenced by existing traffic lights. While significant jaywalking was observed during all site visits, it must be stressed that the presence of pedestrian crossing with traffic lights, particularly a relatively narrow one across Moss Street constitutes a constraint to pedestrian flow.

3.5 Post-development pedestrian traffic

The proposed development is designed for a resident population of approximately 2071 persons. As an office development, peak traffic to and from the building will tend to be tidal in nature: peak arrivals will be in the morning at the beginning of the work day, and peak departures will be in the evening at the end of the work day. At these peak periods, the preponderance of flow will be in one direction. During the working day, the direction of traffic will be mixed, flowing in both directions, such as during the lunchtime period. Fig.3.3 illustrates a general shape of this people flow during a typical work day. The sloping red line annotations of the figure refer

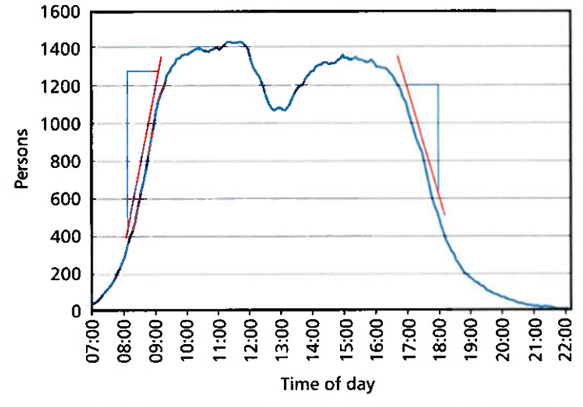

Figure 14.2 Observed building occupancy for sample traffic survey

Fig. 3.3 Annotated extract of Fig.14.2 of CIBSE Guide D illustrating a sample traffic pattern for vertical transportation systems for a tall office building in London

to the vertical transportation during the morning "up-peak" and the evening "down-peak". Of note is the steeper slope of the diagram during the morning compared to the slope of the curve in the evening. The steeper slope of the morning arrivals is indicative of a more intense people flow as people arrive to work for a 9am start, while the shallower slope of the evening down-peak reflects the tendency of people to conclude work at different times, resulting in less demand on the vertical transportation system, and on the pedestrian realm at ground level. Such a pattern is typical of high rise office buildings and is the reason why this study has focused on the morning up-peak period.

Arrival of the occupants of the building to their final destinations from street level will be constrained by certain features of the proposed development, including the two main entrance doors to the building, stairs located in the main lobby, 5 card-reader security turnstile, and the elevators. Each of these impediments is assigned a handling capacity, expressed as persons per minute. The handling capacity of the elevators is taken as 70% of their nominal handling capacity in consideration of European norms for comfortable personal space within the confines of the lift. The building impediments and their handling capacity is illustrated in Fig.3.4.

Fig 3.4 **Pedestrian impediments in the main building lobby which constrain their movement off the footway and into the building**

4. Agent-based people flow modelling

4.1 Estimation of pedestrian movement during the morning 'up-peak'

As described in the previous section, the morning up-peak rush hour traffic is the focus of our quantitative analysis as this is the time with the highest potential for overcrowding in the pedestrian realm. In order to assess the potential impact of the proposed development on pedestrian flows in the vicinity of the site it is first necessary to estimate the arrival and departure rates of the occupants during peak times.

The total expected occupancy of the building is approximately 2070 persons. This occupancy consists mainly of employees working within office floors (22,587m^2 area / 12 m^2/person=1882p). The arrival of occupants in the morning is not a constant stream over a couple of hours but a changing one. Based on CIBSE Guide D and consultations with the lift consultant for the project we have assumed for the analysis that the arrivals in the busiest 5 minutes of the morning peak can range from 10% to 14% of the total building population (in our case 207 to 290 persons). In order to include some safety margin the simulations are based on the assumption that 300 persons can be arriving at the main entrance of the building in the busiest 5 minutes. In the simulation this is preceded and followed by 5 minute periods of less intense pedestrian flow (200 persons per 5 minutes each) – resulting in a total simulation time of 15 minutes.

It should be noted that not all building occupants will in fact be arriving on foot or by public transport and hence contributing to the increase in pedestrian traffic in the surrounding area. The proposal allows for 11 car parking spaces, 22 motorbike spaces, 412 standard bike parking spaces, 12 cargo bike spaces and 36 e-scooter spaces. Based on the above figures it can be safely assumed that at least 10% of the total population will be arriving be means other than on foot, and hence it will be entering the building through entrances to the underground parking areas rather than through the main entrances. This factor is not taken into account in the analysis thus providing and additional safety margin.

The impact of the additional people arriving into the area in the morning is also dependent on the direction from which they originate. It is not realistic to assume that arriving people will be shared equally between all "entrances" into the computational domain i.e. into the area of analysis. Based on the location of public transport hubs and the current prevailing pedestrian flows in the morning it is assumed that the largest portion of people heading to the building will arrive from the east along Georges Quay (35% in total) and from the north via Matt Talbot bridge (30% in total). The rest will arrive from the south along Moss Street (20%) and the east (City Quay 10% and Gloucester Street 5%). Detailed breakdown of arrivals through the individual "entrances" into the domain is presented in Table 4.1 below. Numbering of the individual entrances is shown in Fig.3.2 in the previous section of this report.

Table 4.1 Distribution of arrivals heading for the building through main gateways to the domain

Possible directions to the building	distribution %	Time interval		
		0 - 300 s	300 - 600 s	600 -900 s
		The number of people		
1A_building	30%	60	90	60
1B_building	5%	10	15	10
2A_building	5%	10	15	10
2B_building	25%	50	75	50
3B_building	10%	20	30	20
4A_building	5%	10	15	10
5A_building	5%	10	15	10
5B_building	15%	30	45	30

4.2 Background pedestrian flow

In order to provide a meaningful comparison of the future and current situation, the predicted additional flow of pedestrians into the proposed building must be superimposed on the existing pattern of pedestrian traffic. For this reason two principal simulations were performed: one aimed at replicating the current situation (i.e. existing pedestrian traffic) called the "background" simulation and one representing the future situation (i.e. incorporating the additional pedestrian traffic resulting from the new building). In order to account for the uncertainties of the pedestrian flow survey and also to allow for future increases of the traffic which may be unrelated to the proposed development (e.g. due to other residential or commercial developments in the neighbourhood or improvements in public transport facilities) the number of pedestrians incorporated in the simulations to represent the background pedestrian flow is approx. 50% higher than the average numbers observed during the survey, as referred to in section 3.4 and

detailed in Appendix 1. The total number of "agents" representing individual pedestrians which are introduced into the computational domain in the 15 minutes covered by the simulation is 585, or approximately 195 persons per every 5 minutes.

4.3 Assumptions regarding ingress into the building

Occupants arriving on foot will enter the building through two sets of automatic sliding doors located off a small plaza in the north-west corner of the site. Each sliding door will have a clear opening width of 1,10 m. Inside the building at the ground floor level will be a large entrance lobby with reception. People heading for the office floors will progress from the entrance lobby into lift lobby area, through security gates located between them (5 gates, each 0,75 m wide + extra oversized gate for people with disabilities etc.). In the computer model the agents representing the individual people "disappear" from the computational domain once they enter one of the lifts. The model is set up in such a way that the efficiency of the vertical transportation system does not exceed 70% of its nominal handling capacity specified by the lift consultant.

The combined area of the ground floor entrance lobby and lift lobby is over 350 m2 – this provides significant buffer space inside the building which can comfortably accommodate arriving occupants who may need to wait for their lift during the most intense influx of people in the morning peak.

4.4 Software

Computer simulation of pedestrian flow on the pavements surrounding the building, at the entrance doors and within the ground floor lobby was carried out using software called Pathfinder (ver. 2022-2). Pathfinder is an agent-based egress and human movement simulator. It provides a graphical user interface for simulation design and execution as well as visualization tools for results analysis.

The movement environment is a 3D triangulated mesh, created designed to match the real dimensions of a building model and/or external environment. Walls, railings and other impassable areas are represented as gaps in the navigation mesh. These objects are not actually passed along to the simulator, but are represented implicitly because occupants cannot move in places where no navigation mesh has been created.

Doors are represented as special navigation mesh edges. In all simulations, doors provide a mechanism for joining rooms or areas and tracking occupant flow. Depending on the specific selection of simulation options, doors may also be used to explicitly control occupant flow.

Each occupant is defined by position, a profile that specifies size, speed, etc., and a behaviour that defines goals for the occupant. The behaviour allows scripting so that, for example, an occupant may wait at a location for a specified time and then proceed to an elevator. The occupant is represented as an upright cylinder on the movement mesh and movement uses an agent-based technique called inverse steering. Each occupant calculates movements independently.

Pathfinder supports two movement simulation modes. In "Steering" mode, occupants use a steering system to move and interact with others. This mode tries to emulate human behaviour and movement as much as possible. SFPE mode uses a set of assumptions and hand-calculations as defined in the Engineering Guide to Human Behavior in Fire (SFPE 2019).

The steering mode was used in all simulations performed as part of the subject analysis.

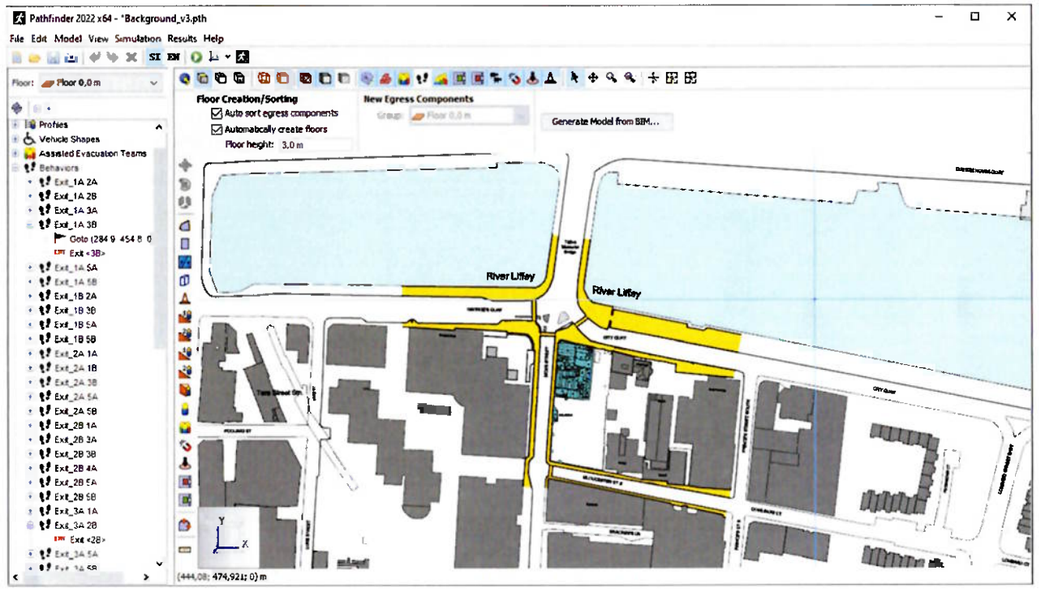

Fig 4.1 General view of Pathfinder graphical user interface

References:

[1] Pathfinder User Manual Version: 2022-2, Thunderhead Engineering 2022

[2] Pathfinder Technical Reference Manual Version: 2022-2, Thunderhead Engineering 2022

[3] Pathfinder Verification and Validation Version: 2022-2, Thunderhead Engineering 2022

4.5 Results

4.5.1. Scenario 1 - Background flow (top view)

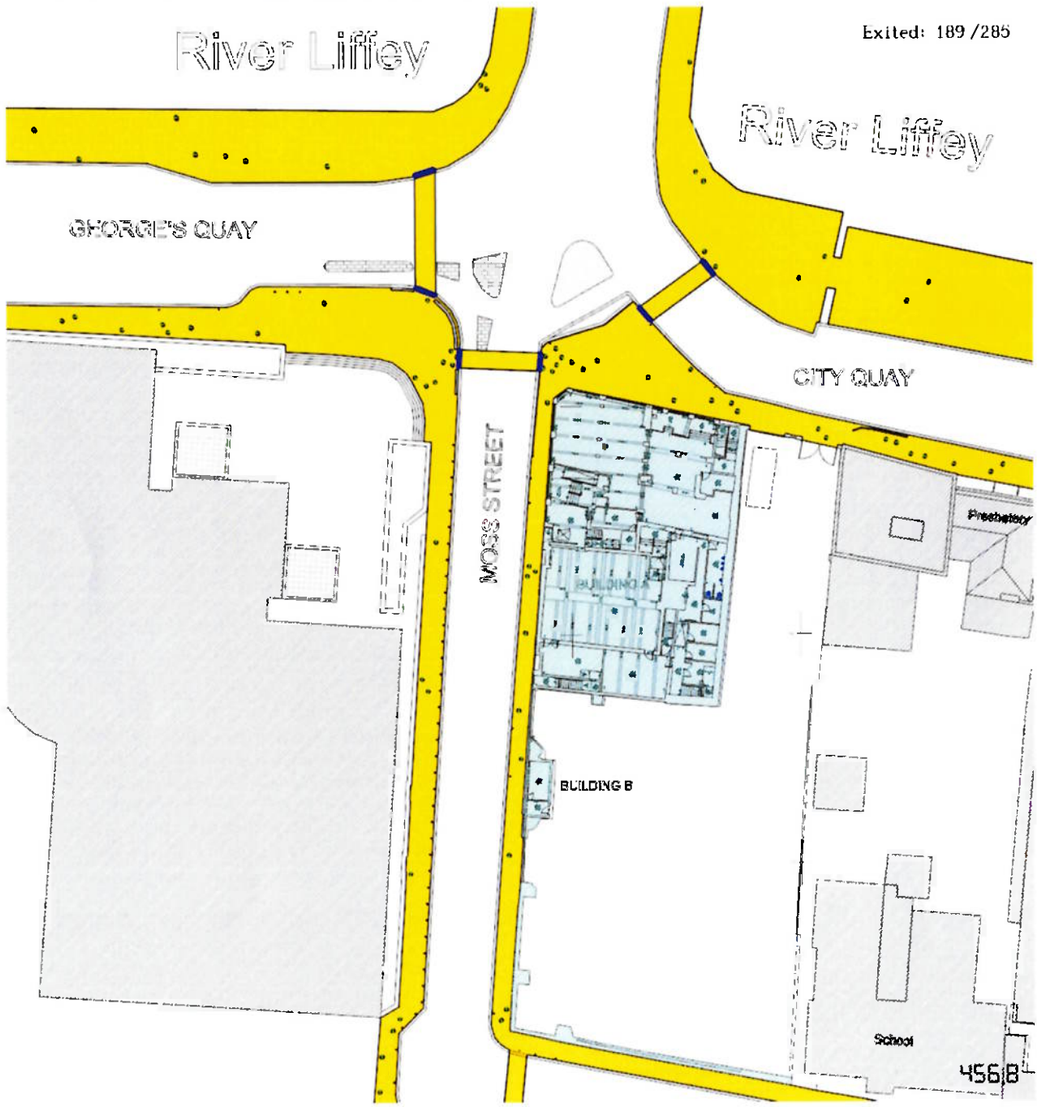

Fig 4.2 Simulation results for scenario 1 (457 seconds into simulation)

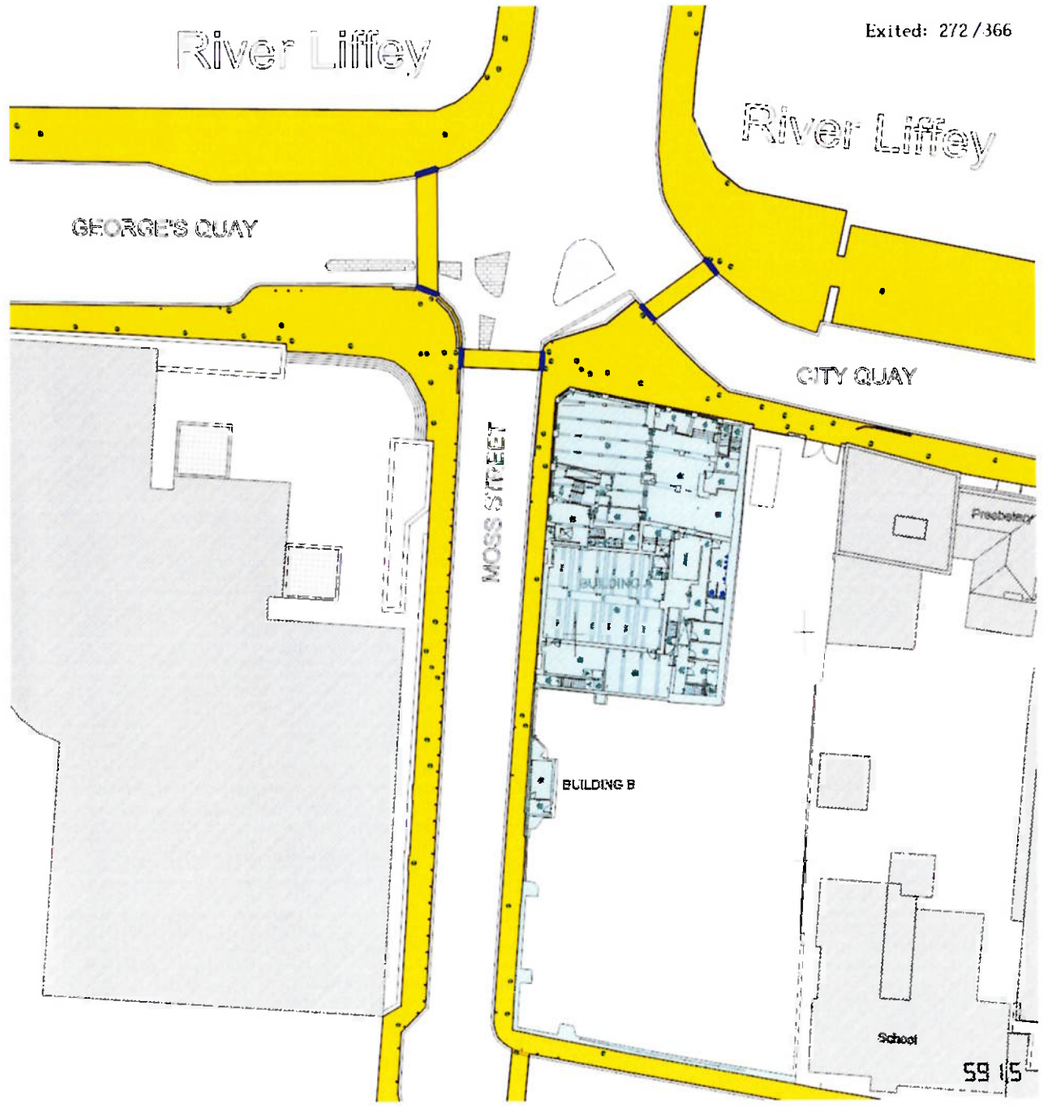

Fig 4.3 Simulation results for scenario 1 (592 seconds into simulation)

4.5.2. Scenario 2 - Predicted future flow with 2 m wide pedestrian crossing @ Moss Street

(top view)

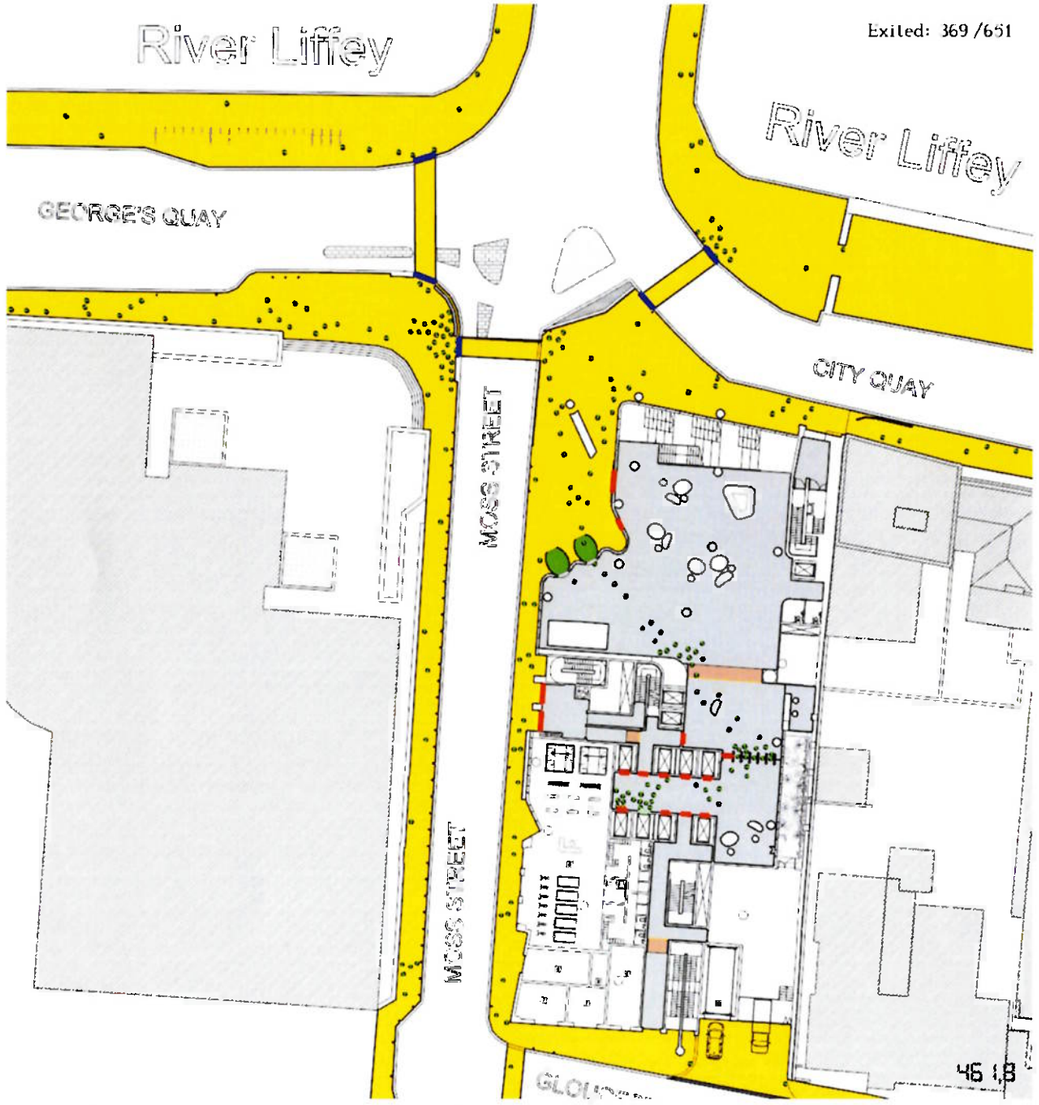

Fig 4.4 Simulation results for scenario 2 (462 seconds into simulation)

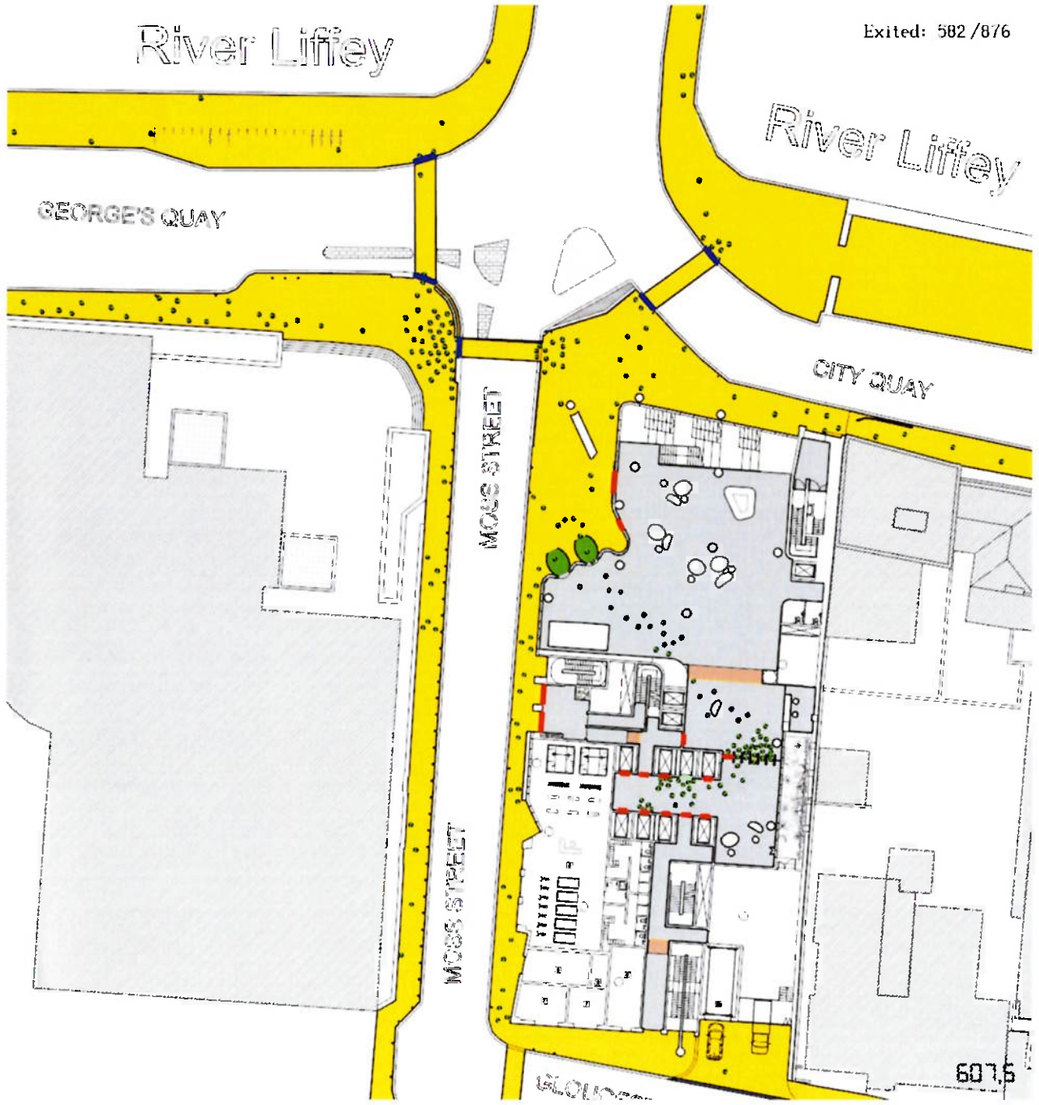

Fig 4.5 Simulation results for scenario 2 (608 seconds into simulation)

4.5.3. Scenario 3 - Predicted future flow with improved 3 m wide pedestrian crossing @ Moss Street (top view)

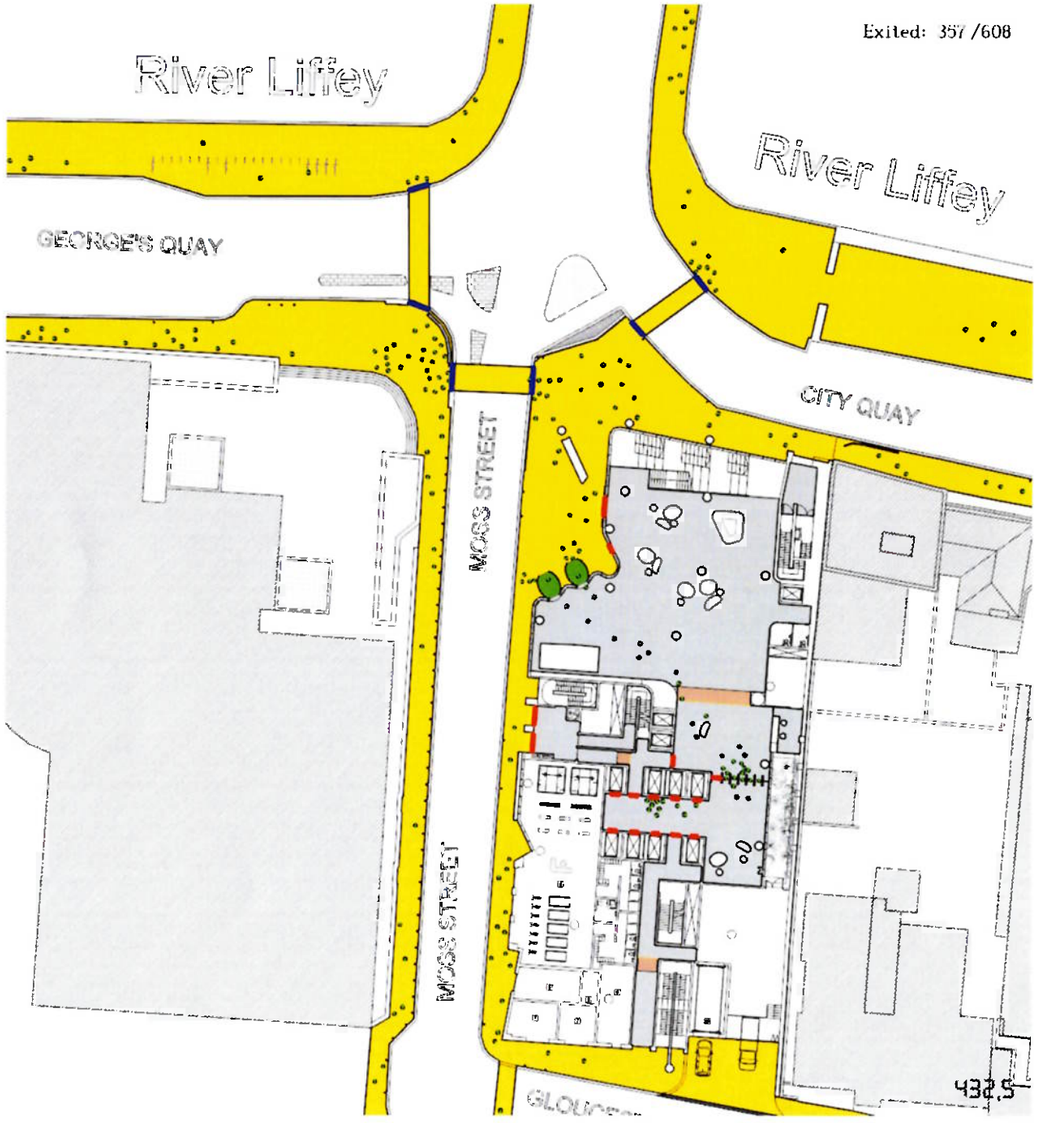

Fig 4.6 Simulation results for scenario 3 (432 seconds into simulation)

Fig 4.7 Simulation results for scenario 3 (588 seconds into simulation)

4.5.4. Close-up of occupant density in the plaza, the main lobby and the lift lobby

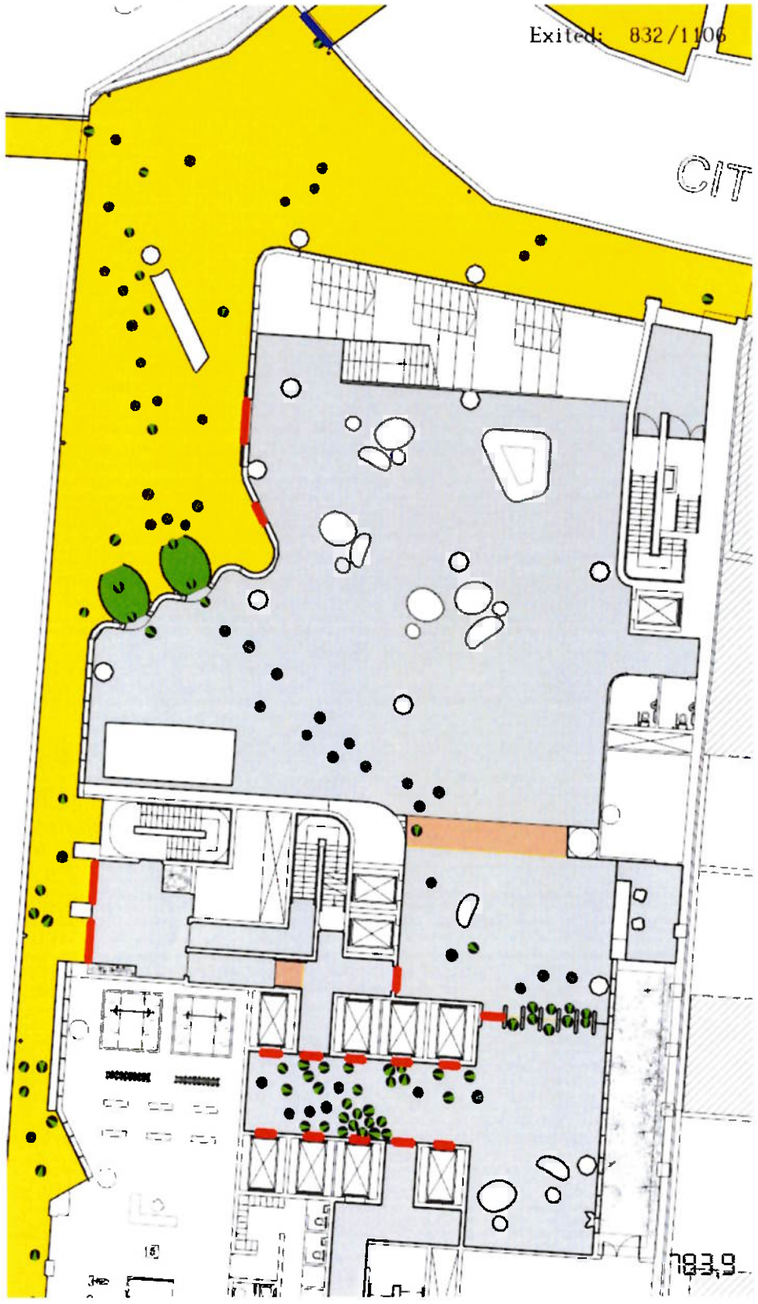

Fig 4.8 Occupants entering the building during peak time (Scenario 2)

4.5.5. Qualitative comparison of pedestrian levels at the main junction

Fig 4.9 General view of the road junction (scenario 1 – background flow)

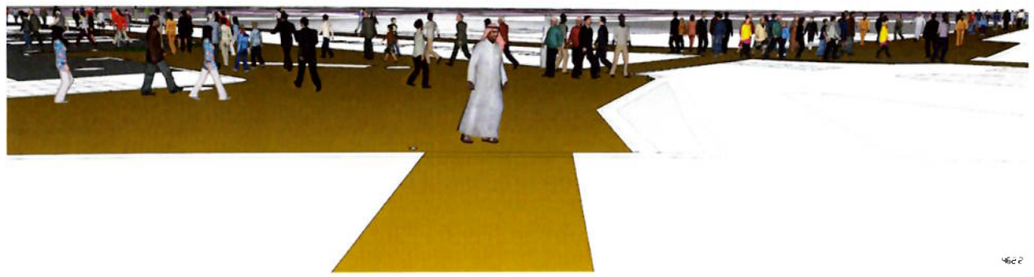

Fig 4.10 General view of the road junction (scenario 2 – future, pedestrian crossing 2 m)

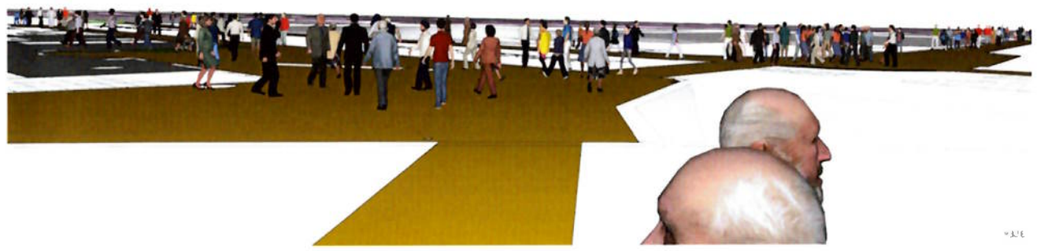

Fig 4.11 General view of the road junction (scenario 2 – future, pedestrian crossing 2 m)

4.5.6. Number of people aggregating on the south-west corner of George's Quay / Moss Street

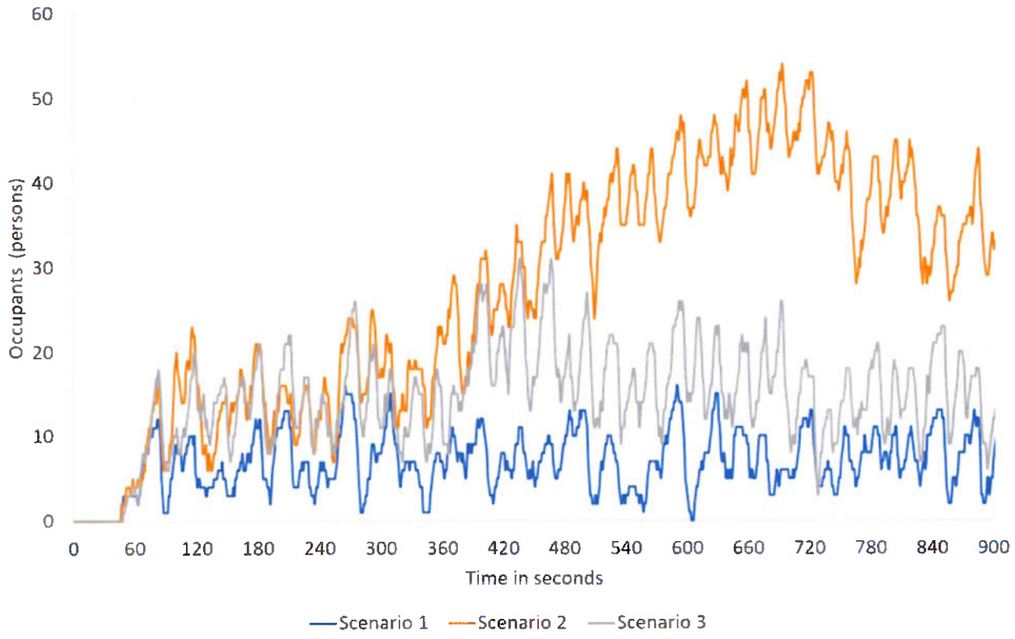

Fig 4.12 Occupant count for the representative area (180 m²) on the south-west corner of George's Quay / Moss Street

For scenario 2, the number of pedestrians aggregating to the west of pedestrian crossing through Moss Street reached a peak of 55 persons. The resulting average occupant density in this area is 3,3 m² / person, however the actual density is much higher close to the crossing. For scenario 3 (increased width of pedestrian crossing) the maximum number of persons in the same area is much lower (31 persons).

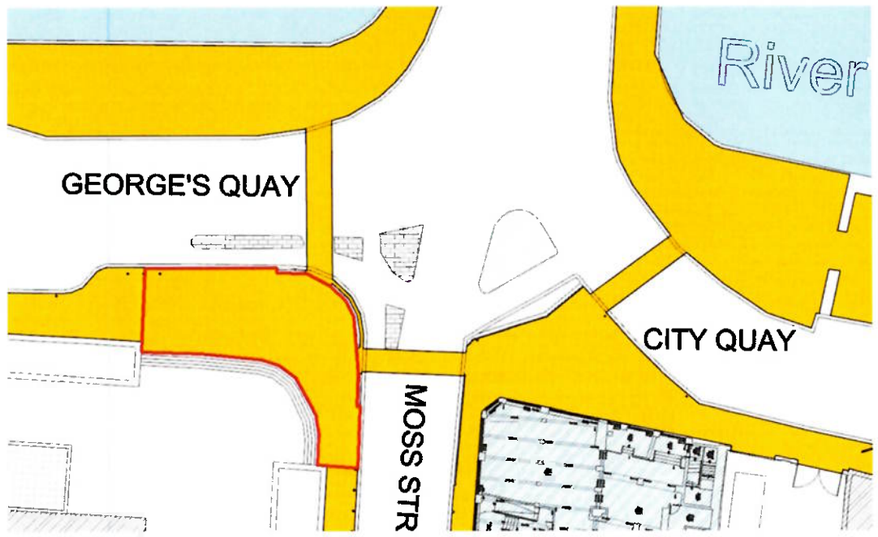

Fig 4.13 Area of the occupant count at George's Quay / Moss St.

5. Pedestrian comfort level study

5.1 Basis of comfort measurement

TFL's *Pedestrian Guidance for London* provides guidance for measuring the quality of footpaths for pedestrian movement. The footpath is divided into three zones: an 'inner edge' that borders the line of buildings fronting onto the footpath, a 'kerbside edge' adjacent to the vehicular carriageway, and a circulation zone located between the edges which is considered to be the comfortably useable portion of the footpath.

Dublin's *City Centre Public Realm Masterplan* refers to the TFL guidance, and relies upon the same design parameters plus the addition of Dublin-specific criteria of:

- Kerb-side bus stops and taxi ranks and
- Closely spaced street furniture located to the inside of the traditional wide stone kerb

The Government of Ireland's *Design Manual for Urban Roads and Streets* also refers designers to the TFL guidance for recommended footpath widths with the additional caveat that the width of footpath should "...not fall below the thresholds in Figure 4.34" of the manual.

5.2 Net circulation zone of the footpaths

Application of the design guidance to the actual arrangement of the footpaths in the vicinity of the site results in a net circulation zone for the footways highlighted in yellow in Fig. 5.2. Pinch points to the circulation zone are apparent at the bus stops at Moss Street and at George's Quay which are significantly narrower than the minimum required for people to comfortably pass through the static activities of people waiting for buses along the building edge and kerbside.

Using the comfort calculator of the TFL guidance, and applying Dublin-specific edge criteria of the DCC Masterplan, footpath comfort is estimated at the locations indicated in Fig.5.2 for both the existing condition and for the post-development pedestrian traffic flows, and graded in accordance with figure 9 of the TFL guidance, reproduced here as Fig. 5.3.

Results are obtained for the seven locations identified in Fig.5.2 which are presented in Appendix 2. The results indicate an A+ comfort rating for the existing conditions at all locations except the bus stop locations, and the railing pinch point along City Quay, all of which achieve a comfort rating of "F", which is below the comfort scale range of the TFL guidance. For such a condition, TFL guidance indicates: "Although in practice it may be possible to walk along the street, the clear footway width is insufficient for comfortable movement."

For the post-development condition, the resulting quality grade of the bus stops remains unchanged, at "F", and the results for all other locations reduce from A+ to A, indicating comfortable conditions.

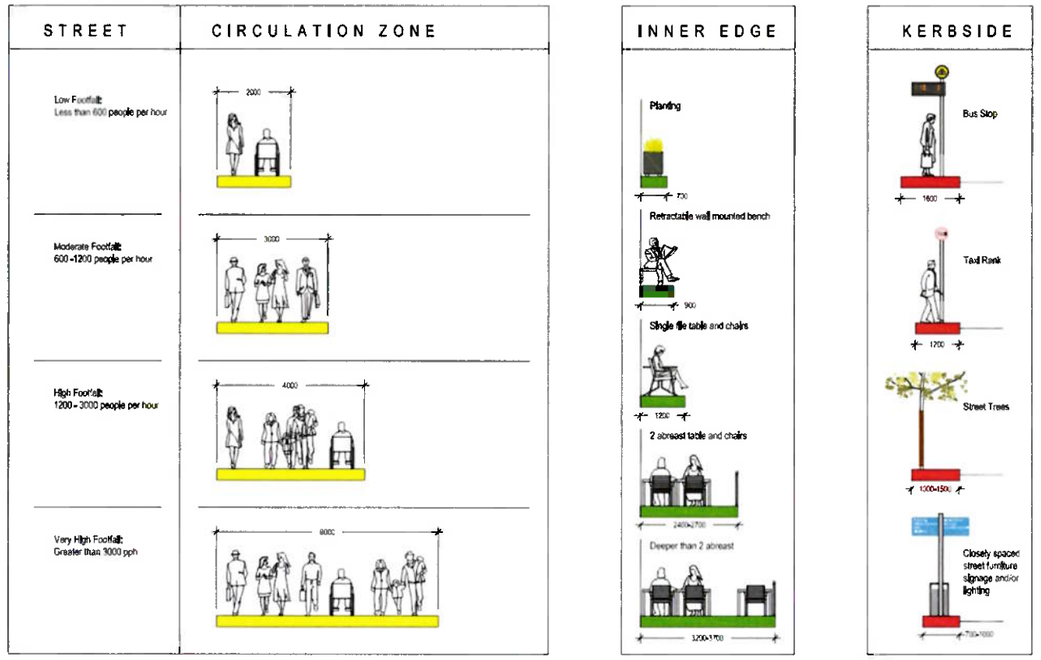

Fig 5.1 Footpath edges and circulation zone of the DCC masterplan

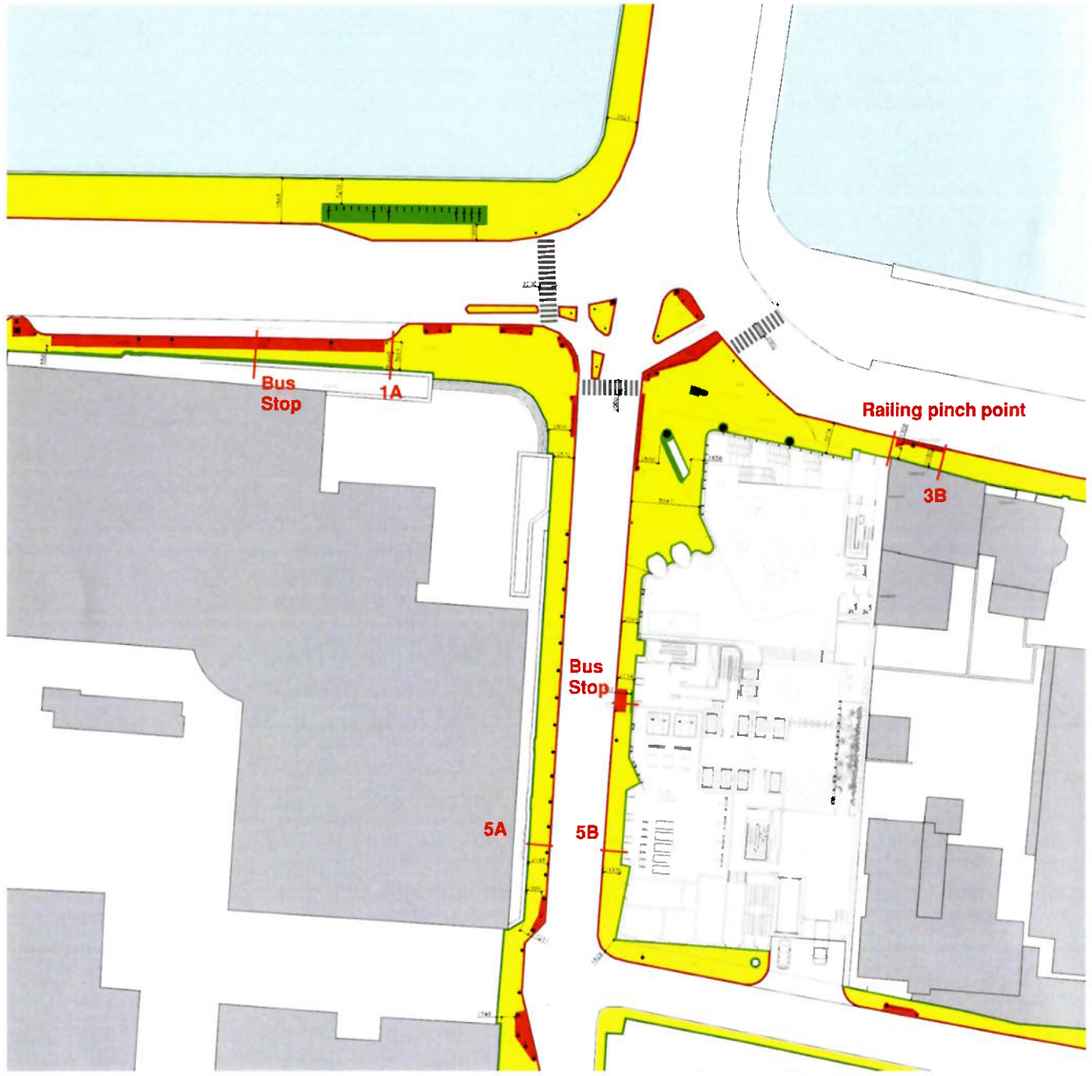

Fig 5.2 Footpath circulation zones and locations of comfort checks

	HIGH STREET	OFFICE AND RETAIL	RESIDENTIAL	TOURIST ATTRACTION	TRANSPORT INTERCHANGE
	Peak / Ave of Max	Peak / Ave of Max	Peak / Ave of Max	Peak / Ave of Max	Peak / Ave of Max
A	COMFORTABLE	COMFORTABLE	COMFORTABLE	COMFORTABLE	COMFORTABLE
B+					
B	ACCEPTABLE		ACCEPTABLE	ACCEPTABLE	
B-	AT RISK	ACCEPTABLE		AT RISK	ACCEPTABLE
C+	UNACCEPTABLE/ UNCOMFORTABLE		AT RISK / AT RISK	UNACCEPTABLE/ UNCOMFORTABLE	
C-		AT RISK / AT RISK			AT RISK / AT RISK
D			UNACCEPTABLE/ UNCOMFORTABLE		
E					
	Peak and Average of Maximum Activity levels have similar guidance as people visiting retail areas stated they were particularly sensitive to crowding.	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.	Peak and Average of Maximum Activity levels have similar guidance as people visiting tourist areas are likely to be particularly sensitive to crowding	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.

Figure 9 Guidance for different area types

Fig 5.3 Figure 9 of the TFL guidance illustrating comfort grade ratings

6. Conclusions and recommendations

6.1 Conclusions

Based on the results of agent-based computer simulations of pedestrian flows in the vicinity of the proposed development it is clear that the additional foot traffic generated by the scheme **will not lead to unacceptable overcrowding in the surrounding areas**.

Even allowing for possible future increase in pedestrian traffic through the area unrelated to subject building and conservatively estimating the peak arrival rate in the morning we do not see excessive densities of pedestrians on the pavements immediately adjacent to the proposed development or any other areas within the computational domain.

The computer analysis for the baseline future scenario (scenario #2 of Section 4 above) indicates that the highest potential for increased density is not immediately in front of the proposed building but rather on the south-west corner of George's Quay / Moss Street junction. The increased density in this location, predicted for the future situation, is due to the prevailing direction of pedestrian flow in the morning and the constraints of the existing narrow pedestrian crossing. This crossing – in its current form - constitutes a potential bottleneck with increased pedestrian flows through the area. This effect is compounded by the timing of the traffic lights, which significantly prioritize vehicular movements, and thereby reduce the actual flow capacity of the crossing.

For this reason it was decided to carry out an additional simulation of the future flow, with an increased width of pedestrian crossing across Moss Street from 2m to 3m (Scenario #3). In this simulation the density of pedestrians on the south-west corner of George's Quay / Moss Street junction is visibly reduced compared to scenario #2. Such a change to the width of the crossing would not necessitate changes to the existing traffic signal cycle time.

6.2 Further conclusions from pedestrian comfort level study

The existing railing at the Northeast corner of the site currently serves as a protective buffer between pedestrians and vehicles at a vehicular entrance to the project site which will be extinguished in the context of the new development. It also constitutes an impediment to pedestrian flows that will become redundant post, development.

6.3 Recommendations

In order to increase the comfort of pedestrians travelling through the junction of George's Quay and Moss Street it is recommended that in the future the width of the crossing is increased, preferably to not less than 3 m. The railing at the northeast corner of Moss Street immediately south of the crossing would be reduced in length to match the width of the crossing. A second railing located near the northeast corner of the site, which will become redundant post-development, should be reduced in length to remove the pinch point, or removed entirely since the remaining extent of railing will no longer serve a useful purpose. Refer to Fig.6.1 for a diagram summary of recommendations.

Fig 6.1 Recommendations summary

APPENDIX 1

Pedestrian flow survey data

Date	Start	End	Duration	Location	Direction of flow	Persons counted	No. per 5 min.	Notes
04.08.2022	08:59:23	09:04:39	00:05:16	Georges Quay Sth. Pavement	Ariving from the west	30	30	2 turned sth. into Moss St. (w), 1 enetered Georges Quay building, all arrived in less than 4 minutes, then 1,5 min gap!
				Georges Quay Sth. Pavement	Heading west towards O'Connel	11	10	2 came from Moss St., 1 came from the bridge
				Moss St. west pavement	Heading south	14	13	Most arrived from the north, the rest came from Georges Quay
				Moss St. west pavement	Heading north	4	4	3 turned left towards west
04.08.2022	09:07:28	09:10:56	00:03:28	Moss St. pedestian crossing	Going east	19	27	1 person in an electric wheelchair
				Moss St. pedestian crossing	Going west	16	23	2 people passed outside the designated crossing, 7 people turned from Moss St.
				Moss St. east pavement	Heading south	2	3	Both came from the bridge
				Moss St. east pavement	Heading north	13	19	7 turned left to Georges Quay, 1 turned fight, the rest went straight on
05.08.2022	08:50:20	08:55:51	00:05:31	Moss St. pedestian crossing	Going east	30	27	
				Moss St. pedestian crossing	Going west	10	9	
				Moss St. east pavement	Heading south	8	7	1 kid on a bike, 3 people passed outside designated pavement
				Moss St. east pavement	Heading north	8	7	
08.08.2022	08:17:25	08:23:31	00:06:06	Georges Quay Sth. Pavement	Ariving from the west	16	13	1 turned sth. Into Moss St. (w) 2 turned north onto bridge (e)
				Georges Quay Sth. Pavement	Heading west towards O'Connel	10	8	5 came from east, 5 came from the bridge (4e/1w)
				Moss St. west pavement	Heading south	3	3	All came from the bridge
				Moss St. west pavement	Heading north	2	2	All went straight onto the bridge
25.10.2022	07:31:00	07:38:00	00:07:00	Matt Talbot bridge	Total count	10	7	
					Going south	9	8	90% (estimate)
					Going north	1	1	10% (estimate)
25.10.2022	07:44:00	07:55:00	00:11:00	Matt Talbot bridge	Total count	62	28	
					Going south	56	25	90% (estimate)
					Going north	6	3	10% (estimate)
25.10.2022	08:00:00	08:14:00	00:14:00	Georges Quay	Total count	140	50	
					Going east	*105*	*38*	*75% (Corrected estimate)*
					Going west	*35*	*12*	*25% (Corrected estimate)*
25.10.2022	08:20:00	08:35:00	00:15:00	Moss St.	Total count	99	33	
					Going south	79	26	80% (estimate)
					Going north	20	7	20% (estimate)
25.10.2022	08:41:00	08:55:00	00:14:00	City Quay	Total count	204	73	
					Going east	122	44	60% (estimate)
					Going west	82	29	40% (estimate)
25.10.2022	09:01:00	09:07:00	00:06:00	Gloucester St	Total count	23	19	
25.10.2022	09:08:00	09:11:00	00:03:00	Gloucester St	Total count	5	8	
27.10.2022	08:09:00	08:19:00	00:10:00	Georges Quay	Going east	67	33	10 turned north onto bridge, 1 turned south, the rest continued east
				South pavement	Going east	60	30	90% (estimate)
				North	Going east	7	3	10% (estimate)
02.11.2022			00:04:09	Matt Talbot bridge east side	Total count	37	45	
					Going south	31	37	
					Going north	6	7	
02.11.2022			00:05:00	Matt Talbot bridge east side	Total count	43	43	
					Going south	28	28	
					Going north	15	15	
02.11.2022			00:05:04	City Quay south pavement	Total count	40	40	
					Going east	31	31	
					Going west	9	9	
02.11.2022	09:10:00	09:20:00	00:10:00	Moss St. west pavement	Going south	19	10	
				Moss St. west pavement	Going north	8	4	
				Moss St. east pavement	Going south	12	6	
				Moss St. east pavement	Going north	14	7	
02.11.2022	09:22:00	09:32:00	00:10:00	City Quay south pavement	Going east	31	16	
				City Quay south pavement	Going west	7	3	
				City Quay north pavement	Going east	8	4	
				City Quay north pavement	Going west	1	1	

APPENDIX 2

MAYOR OF LONDON

PEDESTRIAN COMFORT: FOOTWAY EXISTING CONDITION

Transport for London

Sign Off	**Assessed By**	CB	**Date**	04/11/2022
	Reviewed By	PS	**Date**	04/11/2022

Summary Info	**Location Name**	**George's Quay, 1A**	**George's Quay, Bus Stop**	**Moss Street, 5A**	**Moss Street, 5B**	**Moss Street, Bus Stop**
	Location Type	**Full Footway Width**	**Static Activity**	**Full Footway Width**	**Full Footway Width**	**Static Activity**
	Area Type	**Office Retail**	**Office Retail**	**Office Retail**	**Office Retail**	**Office Retail**
	Average Flow (PPH)	**132**	**132**	**42**	**31**	**36**
	Peak Hour Flow (PPH)	**540**	**540**	**208**	**188**	**312**
	Total Footway Width	**3.3m**	**2.9m**	**2.95m**	**2.58m**	**2.49m**
	Clear Footway Width	**2.9m**	**1.24m**	**2.55m**	**2.18m**	**0.45m**
	Total Street Furniture Impact	**0m**	**1.26m**	**0m**	**0m**	**1.64m**
Pedestrian Comfort (At peak hour flow levels)	**Pedestrian Comfort Level (PCL)**	**A : 3 ppmm**	**F : 7 ppmm**	**A+ : 1 ppmm**	**A+ : 1 ppmm**	**F : 12 ppmm**
	Total Width Required for PCL B+	1.90	3.16	1.90	1.90	3.54
	Clear Width Required For PCL B+	1.50	1.50	1.50	1.50	1.50
Pedestrian Comfort (Average of Maximum Activity)	**Pedestrian Comfort Level (PCL)**	**A+ : 2 ppmm**	**F : 5 ppmm**	**A+ : 1 ppmm**	**A+ : 1 ppmm**	**F : 4 ppmm**
	Total Width Required for PCL B+	1.90	3.16	1.90	1.90	3.54
	Clear Width Required For PCL B+	1.50	1.50	1.50	1.50	1.50
Impact	**Pedestrian Comfort at Peak Hour Flow**	The footway on this site should be comfortable for its intended use at most times. However, you may need to reassess the site in future.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.	The footway on this site should be comfortable for its intended use at most times. However, you may need to reassess the site in future.	The footway on this site should be comfortable for its intended use at most times. However, you may need to reassess the site in future.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.
Impact	**Pedestrian Comfort at Average of Maximum Activity**	Even when under additional stress, the footway on this site should be comfortable.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.	Even when under additional stress, the footway on this site should be comfortable.	Even when under additional stress, the footway on this site should be comfortable.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.
Impact	**Notes**					
Impact	**Mitigation**					

MAYOR OF LONDON PEDESTRIAN COMFORT : FOOTWAY EXISTING CONDITION

Transport for London

Sign Off	Assessed By	CB	Date	04/11/2022
	Reviewed By	PS	Date	04/11/2022

Summary Info	Location Name	City Quay	City Quay, railing pinch point
	Location Type	Street Furniture (Single)	Full Footway Width
	Area Type	Office Retail	Office Retail
	Average Flow (PPH)	79	79
	Peak Hour Flow (PPH)	408	408
	Total Footway Width	2.78m	2.78m
	Clear Footway Width	2.18m	1.31m
	Total Street Furniture Impact	0.4m	1.27m
Pedestrian Comfort (At peak hour flow levels)	Pedestrian Comfort Level (PCL)	A : 3 ppmm	F : 5 ppmm
	Total Width Required for PCL B+	2.10	2.97
	Clear Width Required For PCL B+	1.50	1.50
Pedestrian Comfort (Average of Maximum Activity)	Pedestrian Comfort Level (PCL)	A+ : 2 ppmm	F : 3 ppmm
	Total Width Required for PCL B+	2.10	2.97
	Clear Width Required For PCL B+	1.50	1.50
Impact	Pedestrian Comfort at Peak Hour Flow	The footway on this site should be comfortable for its intended use at most times. However, you may need to reassess the site in future.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.
Impact	Pedestrian Comfort at Average of Maximum Activity	Even when under additional stress, the footway on this site should be comfortable.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.
Impact	Notes		
Impact	Mitigation		

MAYOR OF LONDON

PEDESTRIAN COMFORT: FOOTWAY POST-DEVELOPMENT

Transport for London

Sign Off	**Assessed By**	CB	**Date**	04/11/2022
	Reviewed By	PS	**Date**	04/11/2022

Summary Info	**Location Name**	**George's Quay, 1A**	**George's Quay, Bus Stop**	**Moss Street, 5A**	**Moss Street, 5B**	**Moss Street, Bus Stop**
	Location Type	**Full Footway Width**	**Static Activity**	**Full Footway Width**	**Full Footway Width**	**Static Activity**
	Area Type	**Office Retail**	**Office Retail**	**Office Retail**	**Office Retail**	**Office Retail**
	Average Flow (PPH)	**183**	**183**	**56**	**99**	**108**
	Peak Hour Flow (PPH)	**1,380**	**1,380**	**348**	**608**	**720**
	Total Footway Width	**3.3m**	**2.9m**	**2.95m**	**2.58m**	**2.49m**
	Clear Footway Width	**2.9m**	**1.24m**	**2.55m**	**2.18m**	**0.45m**
	Total Street Furniture Impact	**0m**	**1.26m**	**0m**	**0m**	**1.64m**
Pedestrian Comfort (At peak hour flow levels)	**Pedestrian Comfort Level (PCL)**	**A- : 8 ppmm**	**F : 19 ppmm**	**A+ : 2 ppmm**	**A : 5 ppmm**	**F : 27 ppmm**
	Total Width Required for PCL B+	2.32	3.58	1.90	1.90	3.54
	Clear Width Required For PCL B+	1.92	1.92	1.50	1.50	1.50
Pedestrian Comfort (Average of Maximum Activity)	**Pedestrian Comfort Level (PCL)**	**A : 3 ppmm**	**F : 7 ppmm**	**A+ : 1 ppmm**	**A+ : 2 ppmm**	**F : 12 ppmm**
	Total Width Required for PCL B+	1.90	3.16	1.90	1.90	3.54
	Clear Width Required For PCL B+	1.50	1.50	1.50	1.50	1.50
Impact	**Pedestrian Comfort at Peak Hour Flow**	The footway on this site should be comfortable for its intended use at most times. However, you may need to reassess the site in future.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.	The footway on this site should be comfortable for its intended use at most times. However, you may need to reassess the site in future.	The footway on this site should be comfortable for its intended use at most times. However, you may need to reassess the site in future.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.
Impact	**Pedestrian Comfort at Average of Maximum Activity**	Even when under additional stress, the footway on this site should be comfortable.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.	Even when under additional stress, the footway on this site should be comfortable.	Even when under additional stress, the footway on this site should be comfortable.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.
Impact	**Notes**					
Impact	**Mitigation**					

MAYOR OF LONDON PEDESTRIAN COMFORT: FOOTWAY POST-DEVELOPMENT

Transport for London

Sign Off	Assessed By	CB	Date	04/11/2022
	Reviewed By	PS	Date	04/11/2022

Summary Info	Location Name	City Quay	City Quay, railing pinch point
	Location Type	Street Furniture (Single)	Full Footway Width
	Area Type	Office Retail	Office Retail
	Average Flow (PPH)	110	110
	Peak Hour Flow (PPH)	688	688
	Total Footway Width	2.78m	2.78m
	Clear Footway Width	2.18m	1.31m
	Total Street Furniture Impact	0.4m	1.27m
Pedestrian Comfort (At peak hour flow levels)	Pedestrian Comfort Level (PCL)	A : 5 ppmm	F : 9 ppmm
	Total Width Required for PCL B+	2.10	2.97
	Clear Width Required For PCL B+	1.50	1.50
Pedestrian Comfort (Average of Maximum Activity)	Pedestrian Comfort Level (PCL)	A : 3 ppmm	F : 4 ppmm
	Total Width Required for PCL B+	2.10	2.97
	Clear Width Required For PCL B+	1.50	1.50
Impact	Pedestrian Comfort at Peak Hour Flow	The footway on this site should be comfortable for its intended use at most times. However, you may need to reassess the site in future.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.
Impact	Pedestrian Comfort at Average of Maximum Activity	Even when under additional stress, the footway on this site should be comfortable.	Although in practice it may be possible to walk along the street, the clear footway width is insuffcient for comfortable movement.
Impact	Notes		
Impact	Mitigation		