4-6 Bligh Street

Pedestrian Assessment Study

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Pedestrian Assessment Study

Client: One Investment Management

Co No.: 139 693 271

Prepared by

AECOM Australia Pty Ltd
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

01-Feb-2018

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Quality Information

Document 4-6 Bligh Street

Ref 60550858

Date 01-Feb-2018

Prepared by Koren Fang

Reviewed by Sarah Zhang

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	1 Sep 2017	Draft report.	Sarah Zhang	
A	1 Feb 2018	Final report	Sarah Zhang	

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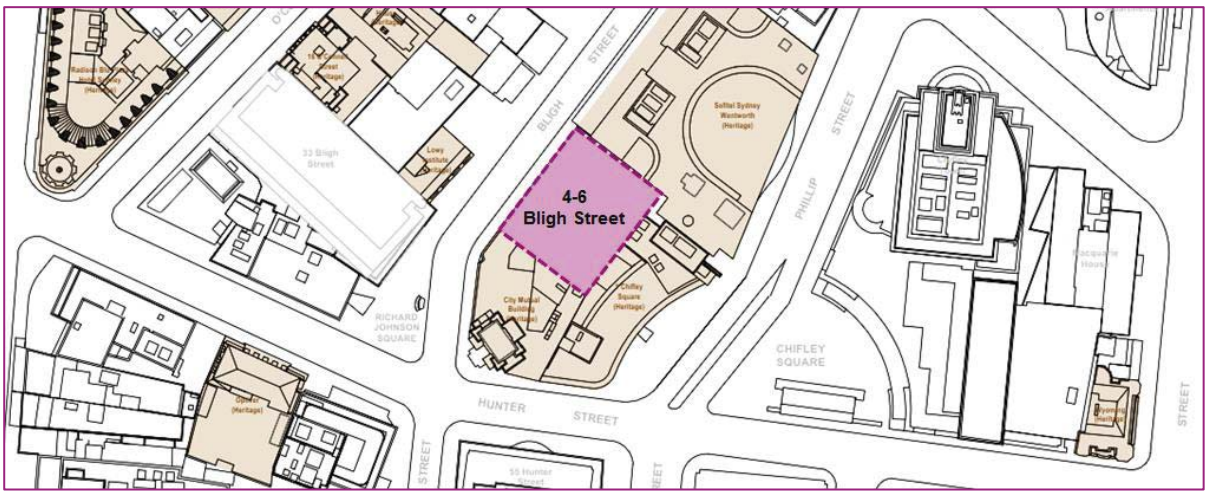
Executive Summary

One Investment Management Pty Limited as trustee for Recap IV Management No. 4 Trust, owners of the property at 4-6 Bligh Street, Sydney (the site), are proposing to develop a 51 level mixed-use high rise commercial and hotel building at 4-6 Bligh Street, site boundary shown in **Figure 1**.

Figure 1 Site Area at 4-6 Bligh Street



The potential impact of additional pedestrian demand generated by the proposed building has been assessed for the following scenarios, during the AM Peak, Midday Peak and PM Peak hours:

- **2017 Existing** – Current day demand based on surveys conducted on 2 August 2017.
- **2026 No Development** – Future 2026 demand including background growth due to employment and the impact of a future Sydney Metro Station at Martin Place.
- **2026 With Development** – Includes the net impact of developing 4-6 Bligh Street.

A comparison of the walking performance and comfort levels experienced by pedestrians on the eastern side of the Bligh Street footpath and at the adjoining intersection crossings has been assessed using both Fruin Walkways and TfL PCL guidelines. An assessment of queuing space at the intersection crossings was assessed using Fruin Queuing metrics.

Key findings from the pedestrian study include:

- In 2026, the pedestrian demand introduced onto Bligh Street and adjoining intersections is primarily due to the introduction of future Sydney Metro, with approximately 13,350 pedestrians entering and exiting Martin Place Station during the AM peak.
- The net increase in pedestrian demand generated by the proposed 4-6 Bligh Street development is low, based on the current F&B, hotel and commercial configuration. The pedestrian demand generated by the proposed development will have minimal net effects on the performance of the existing street footpaths and at the two key intersection crossings.
- The pedestrian assessment shows significant deterioration in pedestrian conditions at the Bligh Street / Hunter Street intersection, near the proposed northern entrance to Martin Place Station. This suggests that the intersection capacity is insufficient to accommodate the predicted 2026 future Sydney Metro demand.
- The proposal for a pedestrian plaza along Hunter Street at the north entrance to Martin Place Station may improve the pedestrian performance of Bligh Street / Hunter Street in 2026.
- The proposal for an underground pedestrian link from Martin Place Station to 33 Bligh Street may improve the performance of the street level pedestrian network in 2026.
- Reconfiguring the intersection phase timings and increasing the crossing widths may help improve the pedestrian waiting and walking environments at the two key intersections in 2026.

1.0 Introduction

1.1 Background

One Investment Management Pty Limited as trustee for Recap IV Management No. 4 Trust, owners of the property at 4-6 Bligh Street, Sydney (the site), have proposed a mixed-use high rise commercial and hotel development spanning 55 storeys is proposed at 4-6 Bligh Street, located in the heart of Sydney CBD. The hotel will comprise a total of 407 rooms across 37 stories. Internal building amenities include a gym, pool, hotel rooftop and lounge, function rooms, and a mixture of retail and food and beverage stores located on the ground floor. Designated hotel and commercial office parking will be provided in the four level basement carpark.

Figure 2 Site Area at 4-6 Bligh Street

Table 1 Existing and Proposed building at 4-6 Bligh Street

Existing Building	Proposed Building
	

1.2 Study Area

The proposed development at 4-6 Bligh Street is located within a busy area of the Sydney CBD, between Hunter Street and Bent Street. Land uses surrounding the site is high density. The site occupies a highly accessible and well serviced central location within the Sydney CBD.

The site is located in close proximity to three existing train stations within walking distance which are Martin Place Station, Wynyard Station and Circular Quay Station. The site is approximately 200 metres walking distance to Martin Place Station, approximately 450 metres walking distance to Wynyard Station, and approximately 500 metres to Circular Quay transport interchange.

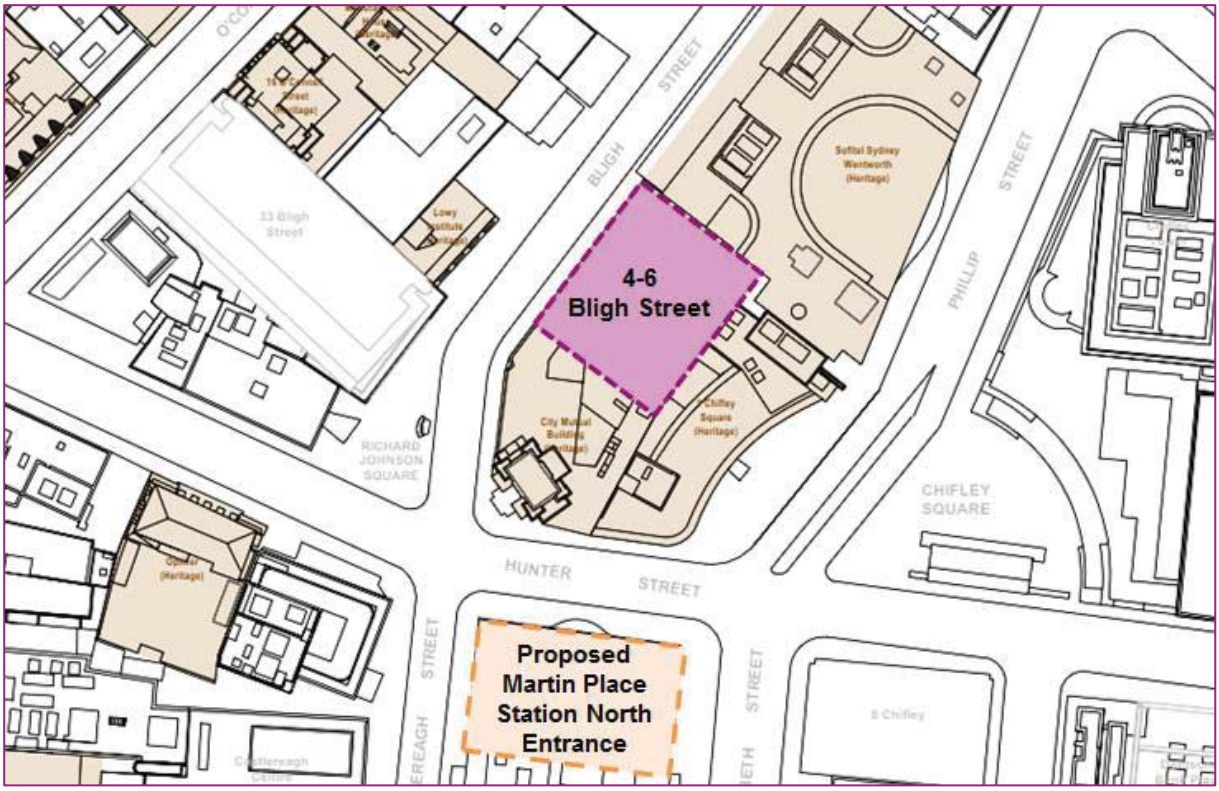
The surrounding area includes major public attractors such as Circular Quay, the Opera House, the Royal Botanic Gardens, and Darling Harbour. As such, the local public transportation network is highly accessible and well used by commuters and tourists alike. **Figure 3** shows some of the key attractors near 4-6 Bligh Street.

Figure 3 Key attractors near 4-6 Bligh Street

Source: AECOM

To support the growth of Sydney CBD, Sydney Metro will provide additional rail capacity to the region. Sydney Metro City and Southwest is planned to begin operations between 2024 and 2026. This will include a metro connection at Martin Place Station. In order to cater for the additional demand at Martin Place, the existing Martin Place Train Station will be upgraded with a new northern and southern entrance. The new northern entrance will be located to the south of Hunter Street, between Castlereagh Street and Elizabeth Street.

Figure 4 The new entrance of Martin Place Train Station



1.3 Scope of Study

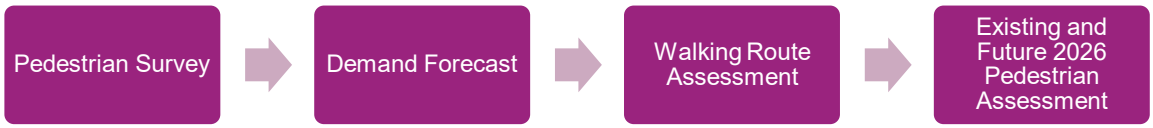
This pedestrian study has been undertaken to assess the effect of additional pedestrian demand due to the proposed development on the pedestrian comfort levels in the surrounding footpath network. The key locations of interest are along Bligh Street and at the intersection with adjacent streets such as Hunter and Bent Street. The following objectives have been addressed in this pedestrian study:

- Understand existing conditions by undertaking a pedestrian survey along Bligh Street and adjacent pedestrian crossings at Bent Street / Bligh Street and Hunter Street / Bligh Street.
- Develop forecast pedestrian demands based on the pedestrian predicted volume generated by the proposed development, and take into consideration publicly acknowledged infrastructure developments within the area.
- Develop a realistic walking route for new movements associated with the introduction of future Sydney Metro and the proposed development.
- Conduct a strategic spreadsheet based analysis to evaluate the future impact to pedestrian footpath comfort and pedestrian movement along Bligh Street once the proposed mixed use commercial and hotel development is built and open. Impact on the pedestrian crossings at Bent Street / Bligh Street and Hunter Street / Bligh Street will also be assessed.
- Provide design recommendations on the proposed streetscape outside the proposed development.

2.0 Modelling Methodology

The static pedestrian assessment methodology for this study consists of the following steps:

Figure 5 Modelling methodology steps



2.1 Pedestrian Survey

A pedestrian survey was conducted on 2 August 2017 by Austraffic along Bligh Street and at the intersections of Bligh Street / Bent Street and Bligh Street / Hunter Street. This data was used to inform the existing pedestrian assessment and to provide background movements for the future demand forecasting. The survey captured the following weekday peak periods:

- AM Peak – 07:00-10:00
- Midday Peak – 12:00-15:00
- PM Peak – 16:00-19:00

The locations and movements captured in the surveys are highlighted in **Figure 6**. Additionally, the signal timings at the intersections were also captured. Detailed survey requirements are attached in **Appendix A**.

Figure 6 Surveyed locations and movements

Source: AECOM

2.2 Demand Forecast

In the demand forecast stage, the expected pedestrian peak hour demands for each of the periods listed above was developed. The pedestrian demand was forecasted for the following scenarios during all three peaks:

- **2017 Existing** – Current day demand based on surveys conducted on Wednesday, 2 August 2017.
- **2026 No Development** – Future 2026 demand including background growth due to employment and the impact of a future Sydney Metro Station at Martin Place. This scenario looks at the impact of the future Sydney Metro commuter demand around the site area.
- **2026 With Development** – Similar to 2026 No Development, but includes the net impact of developing 4-6 Bligh Street.

The following methods and assumptions were used for these demand forecasts:

- For the 2026 scenarios, the uplift factor for existing pedestrian movements along Bligh Street is 1.105, (10.5% increase). This factor is based on the employment growth in the immediate vicinity from 2016 to 2026 taken from the Bureau of Transport Statistics (BTS) Travel Zone Explorer.
- For the 2026 No Development scenarios, the uplift factor for existing pedestrian movements was not applied to movements into and out of 4-6 Bligh Street, which is assumed to operate as existing.
- The 2026 AM Peak pedestrian demand due to the operation of Sydney Metro City and Southwest is based on the 2036 AM demand provided in *Sydney Metro Chatswood to Sydenham Environmental Impact Assessment Technical Paper 1: Traffic and Transport* (Jacobs, 2016) and backcast by a factor of 0.872. This factor is derived from the forecast growth in rail patronage between 2026 and 2036 presented in *Sydney Metro Chatswood to Sydenham Environmental Impact Assessment* (Jacobs, 2016).
- The 2026 Midday Peak pedestrian demand due to the operation of Sydney Metro City and Southwest uses a factor of 0.203 on the total AM station demand. This factor is derived from Opal tap on and tap off data at Martin Place Station over 9-11 August 2016, which is available publicly from TfNSW's Open Data Portal. The station entry and exit proportion has also been derived from the same dataset.
- In line with *Sydney Metro Chatswood to Sydenham Environmental Impact Assessment Technical Paper 1: Traffic and Transport* (Jacobs, 2016), the 2026 PM Peak pedestrian demand due to the operation of Sydney Metro City and Southwest is the reverse of the AM demand with a PM peak factor of 0.91.
- The arrival and departure trip rates provided per 100 square metres GFA in **Table 2** were used to calculate the pedestrian peak hour demands due to the proposed 4-6 Bligh Street development. The food and beverage (F&B) and hotel trip rates are based on TRICS surveys from inner London. The commercial trip rates are derived from Roads and Maritime Service (RMS) office block surveys conducted in 2010.

Table 2 Development trip rates

Peak Period	F&B Trip Rate (trips/100 m^2 GFA)		Hotel Trip Rate (trips/100 m^2 GFA)		Commercial Trip Rate (trips/100 m^2 GFA)	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
AM Peak	29.3	28.6	0.6	0.9	1.8	0.7
Midday Peak	33.3	36.0	0.7	0.5	1.5	1.8
PM Peak	21.7	16.4	1.1	1.1	0.6	1.5

- For the trip generation from the proposed development F&B, only the GFA from the ground floor F&B space was counted. It is assumed that the F&B spaces are also provided at the hotel lobby and roof levels primarily serve hotel customers, whose movements into and out of 4-6 Bligh Street are already counted in the hotel trip rate. In addition, a proportion of the demand for the ground floor F&B space is likely to be from hotel customers and commercial

workers within the building. This has not been considered in the analysis and would reduce the trip rate which was applied.

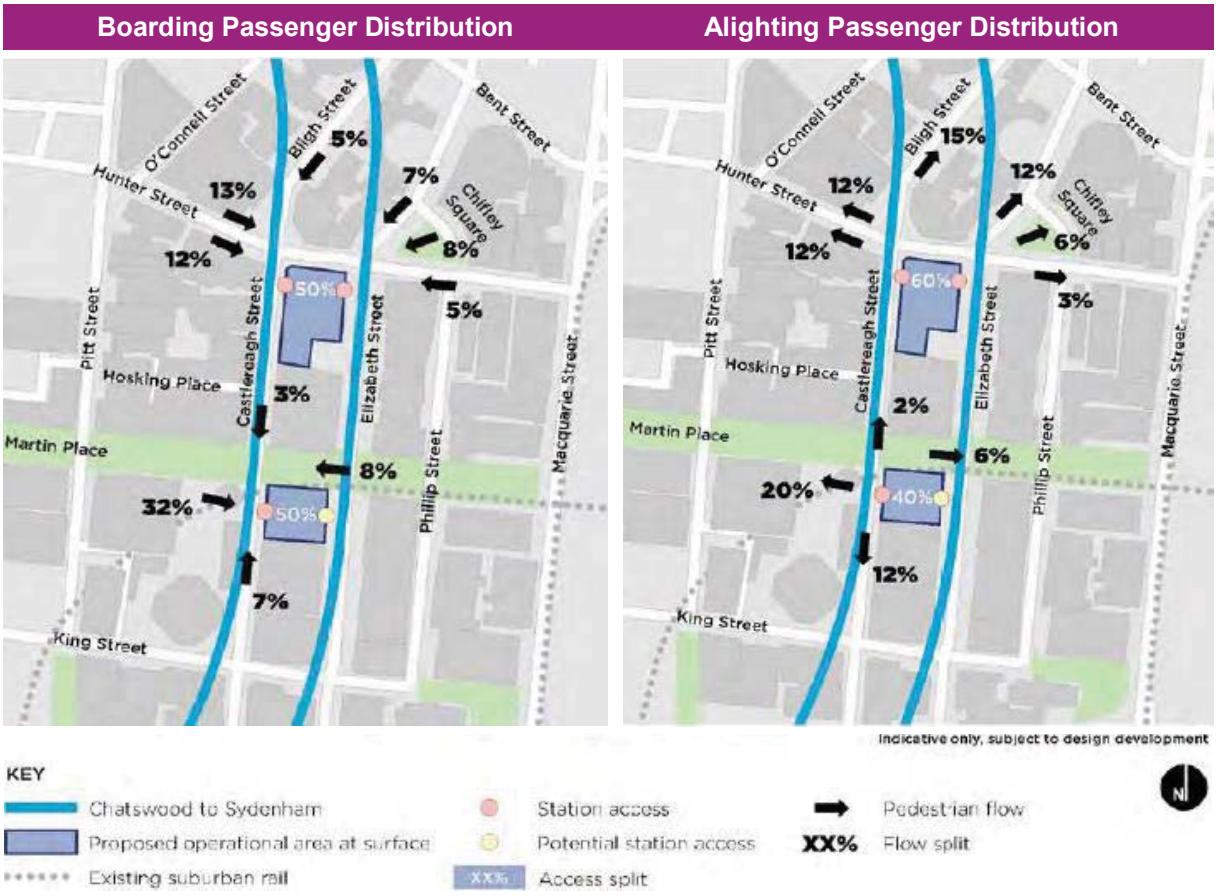
- The gym in the proposed development is assumed to predominately serve customers who have also been attracted to the building due to F&B, hotel or commercial purposes. As such, no external trip rate has been used for the gym.
- The GFA of the proposed development used for trip generation is as follows:
  - F&B – 526 square metres.
  - Hotel – 15,731 square metres.
  - Commercial – 5,004 square metres.

2.3 Walking Route Assessment

A high level walking route assessment was undertaken to determine the routing that would be used by pedestrians due to the proposed 4-6 Bligh Street building and the future Martin Place North Station. The following methods and assumptions were used in the routing assessment:

- For the 2026 scenarios, there is no change in the routing of background pedestrian traffic.
- The AM Peak boarding and alighting distribution splits for the additional Sydney Metro demand is based on the distributions provided in *Sydney Metro Chatswood to Sydenham Environmental Impact Assessment Technical Paper 1: Traffic and Transport* (Jacobs, 2016) and is shown in the figure below.

Figure 7 AM Peak passenger distribution at future Sydney Metro Martin Place Station



Source: Jacobs, 2016

- To reflect the bi-directionality of the period, the Midday Peak boarding and alighting distribution splits for the additional Sydney Metro demand is the average of the AM and PM Peak distributions.
- The PM Peak boarding and alighting distribution splits for the additional Sydney Metro demand is the reverse of the AM distributions, as assumed in *Sydney Metro Chatswood to Sydenham Environmental Impact Assessment Technical Paper 1: Traffic and Transport* (Jacobs, 2016).
- The proportions of additional future Sydney Metro demand walking along the east and west sides of Bligh Street are identical to the surveyed proportions for all peaks.
- For the proposed development, the distributional splits to and from the north and south directions is assumed to be 50/50 in all peaks for demand generated by the F&B and hotel spaces.
- For the proposed development, the distributional splits to and from the north and south directions is assumed to be identical to the survey distributions during each peak period for demand generated by the commercial spaces.
- Pedestrians entering and exiting the proposed development use the eastern footpath on Bligh Street to reach the building. For modelling purposes, it is assumed no jay-walking occurs midblock.
- At the Bligh Street / Bent Street intersection, additional demand associated with future Sydney Metro and the proposed development is proportionally distributed based on the survey data.
- At the Bligh Street / Hunter Street intersection, additional demand due to future Sydney Metro is distributed in line with *Sydney Metro Chatswood to Sydenham Environmental Impact Assessment Technical Paper 1: Traffic and Transport* (Jacobs, 2016). For movements crossing diagonally, it is assumed that they are split evenly between the two route options.
- At the Bligh Street / Hunter Street intersection, additional demand due to the proposed development is proportionally distributed based on the survey data.

2.4 Existing and Future 2026 Pedestrian Assessment

The existing and future pedestrian assessment follows a methodology comparable to that set out in *Pedestrian Comfort Guidance for London* (TfL, 2010). This guidance document provides information on assessing the walking comfort for footpaths and crossings. However, this document does not provide a methodology for assessing the comfort level of footpath storage space at the crossings. For queuing, the document only contains guidance on the comfort of midblock pedestrian islands.

Based on the demand forecasts and walking route assessment, three demand scenarios were assessed for each peak hour period:

- **2017 Existing** – Current day demand based on surveys conducted on Wednesday, 2 August 2017.
- **2026 No Development** – Future 2026 demand including background growth due to employment and the impact of future Sydney Metro at Martin Place.
- **2026 With Development** – Similar to 2026 No Development, but includes the net impact of developing 4-6 Bligh Street.

In line with the surveyed locations, the static spreadsheet assessment evaluated the performance of the following pedestrian infrastructure along Bligh Street:

- The Bligh Street / Bent Street intersection.
- The Bligh Street / Hunter Street intersection.
- The eastern Bligh Street footpath, north of the proposed 4-6 Bligh Street development.
- The eastern Bligh Street footpath, south of the proposed 4-6 Bligh Street development.

2.4.1 Street Layout

The street dimensions used to inform the pedestrian assessment has been taken from the CAD drawing *PP0002 - Site Plan [1].dwg* received 26 July 2017 from Architectus. All street dimensions used in this assessment have been based upon the CAD.

A desktop study and site investigation of Bligh Street was undertaken to verify the dimensions provided in the CAD. From this, it was identified that the dimension of the southern corner at the Bligh Street / Bent Street intersection was not representative of existing conditions. This area was revised so that the eastern Bligh Street footpath has a width of 6.5 metres at the intersection, as shown in **Figure 8**. Note that this change only affects the performance of the pedestrian crossing storage space.

The width of the pedestrian crossing at the intersections was not provided in the CAD and is assumed to be 3.2 metres for all crossings. The Bligh Street north footpath is measured to be 3.5 metres and the south footpath is measured at 3.2 metres, as shown in

Figure 9. The indicative pedestrian storage space assumed for each crossing arm and direction is provided in **Table 3**. This area provides for a 1.5 metre corridor for non-crossing pedestrians to pass.

It is acknowledged that the southeast corner of the Bligh Street / Hunter Street intersection will change due to the introduction of a northern entrance to Martin Place Station. However, no future plans of this area were received and thus for the purpose of this analysis, the existing street dimensions are assumed to remain the same in the future.

Figure 8 Bligh Street / Bent Street southern corner dimensions

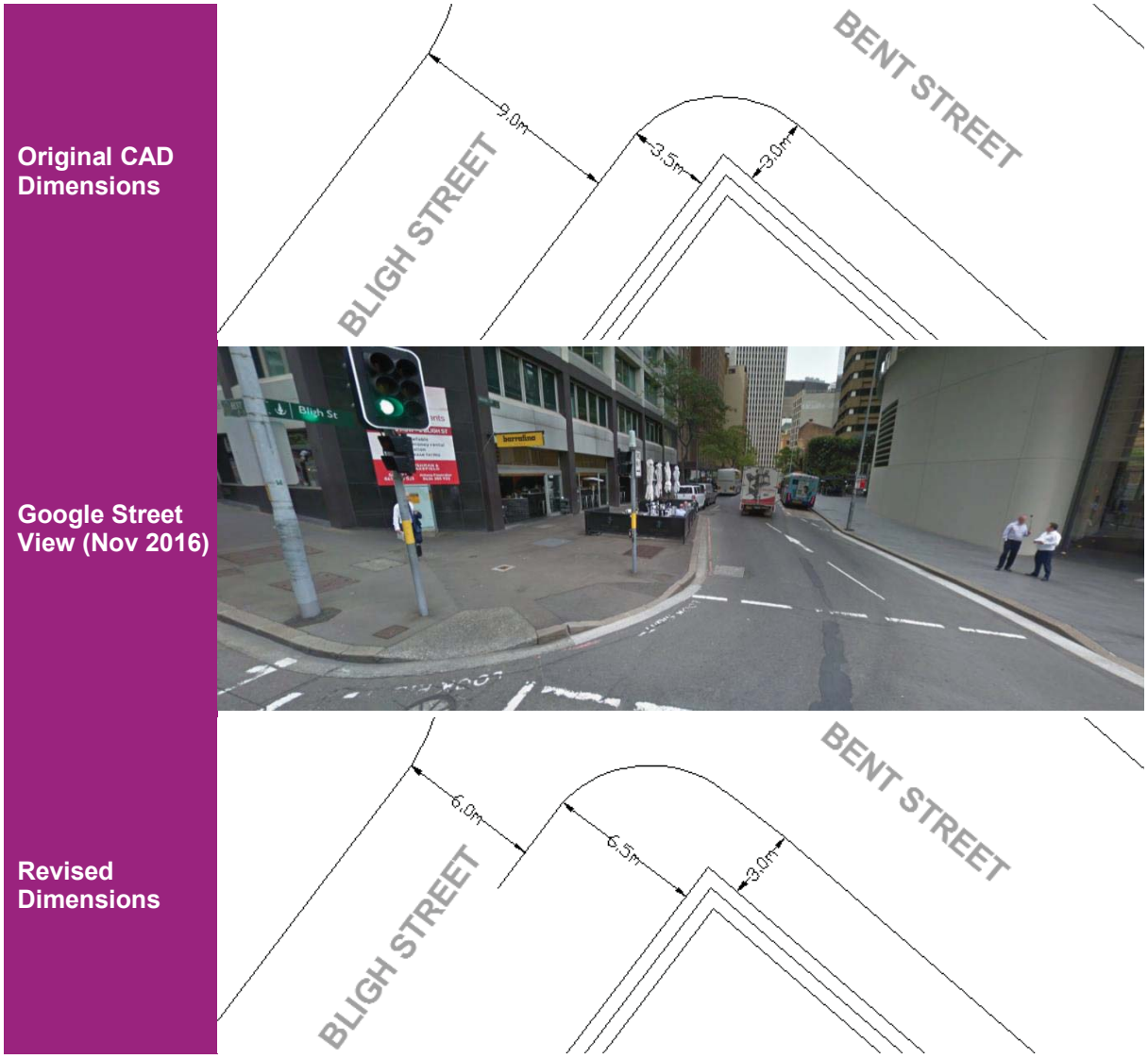


Figure 9 Bligh Street footpath width measurements

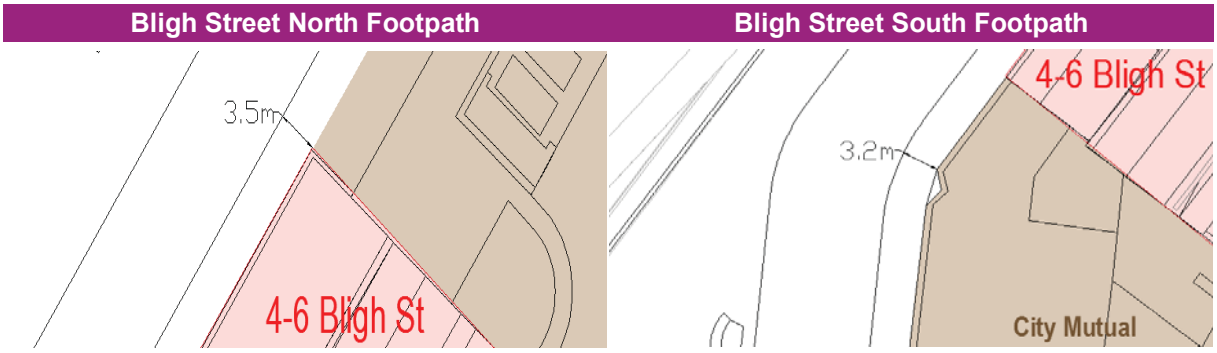


Table 3 Pedestrian crossing indicative storage area

Crossing Arm	Pedestrian Storage Area (m^2)	
	Northbound / Eastbound	Southbound / Westbound
Bligh Street / Bent Street Intersection		
East Arm	15	40
South Arm	45	29
West Arm	45	40
Bligh Street / Hunter Street Intersection		
North Arm	19	19
East Arm	25	23
South Arm	24	23
West Arm	20	22

2.4.2 Additional Assumptions

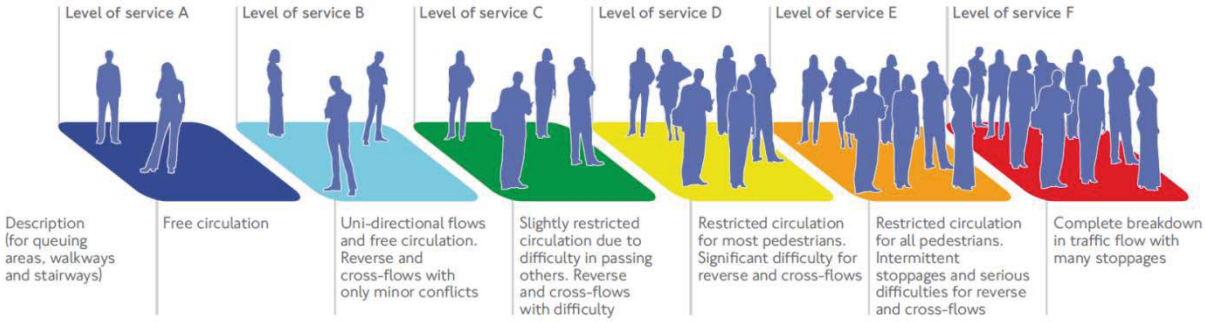
Additional assumptions used in the pedestrian assessment and not covered in previous parts of **Section 2.0** include:

- The average phase timings at the two intersections assessed in this report is based on the collected survey data and is assumed to be the same for the future year analysis.
- At pedestrian crossings, it is assumed that there is a uniform arrival profile and that no pedestrians will jaywalk.
- In line with the *Pedestrian Comfort Guidance for London* (TfL, 2010), a 0.2 metre buffer is used to account for the edge effect of buildings and kerbs.
- A 0.6 metre buffer is used to account for street furniture observed on the kerbside of the footpath. This includes trees, light poles, signposts and parking metres.
- The effect of additional portable street furniture such as F&B seating which may be placed along the footpath is not considered for the purpose of this analysis. Whilst these items may cause the footpath comfort level to drop to undesirable levels, this assessment aims to identify whether the footpath infrastructure itself is capable of catering for future demands. The additional portable street furniture can be more easily reduced or removed to cater for higher pedestrian demands.
- The future expansion of pedestrian space along the southeast corner of Bligh Street / Hunter Street due to the introduction of a northern entrance to Martin Place Station is not included in the assessment due to a lack of detailed plans and drawings.

2.4.3 Assessment Criteria

John J. Fruin's concept of Level of Service (LoS) was developed in his book *Pedestrian Planning and Design* (Fruin, 1987) and has been adopted as the global industry standard approach to planning for pedestrians. Fruin's LoS can be used to interpret the performance of space and how people move and interact under certain conditions. The Levels of Service are categorised into six bands, with LoS A representing free-flow conditions while LoS F represents a complete breakdown in flow.

Figure 10 Fruin LoS description



The Fruin Walkways LoS is typically applied to areas where pedestrians are traversing, such as footpaths. The values presented by different colour bands are shown in **Figure 11**.

Fruin Walkways LoS will be used to assess pedestrian walking comfort along the eastern footpath of Bligh Street, to the north and south of the proposed development. It is also used to assess the crossing arms at the intersections of Bligh Street / Bent Street and Bligh Street / Hunter Street.

Figure 11 Fruin Walkways LoS thresholds

Fruin LoS Criteria for Walkways

A	B	C	D	E	F	
∞	3.25	2.32	1.39	0.93	0.46	m^2/ped
0	23	33	49	66	82	ped/min/m

The Fruin Queuing LoS is typically applied to areas where pedestrians queue or wait. The values presented by different colour bands are shown in **Figure 12**. The thresholds are more relaxed than Fruin Walkways, reflecting that pedestrians will accept being in closer proximity with others when they are standing still and expect queuing conditions. In an open street environment with a Fruin Queuing LoS C or worse, some pedestrians can be expected to spread out further than the allocated 'queuing space' due to perceived discomfort. Additionally, LoS E-F is unlikely to occur in an open street environment and is reflective of conditions in a crush loaded train or lift.

Fruin Queuing LoS will be used to assess the comfort of pedestrian storage space at the intersections of Bligh Street / Bent Street and Bligh Street / Hunter Street.

Figure 12 Fruin Queuing LoS thresholds

Fruin LoS Criteria for Queuing

A	B	C	D	E	F	
∞	1.21	0.93	0.65	0.28	0.19	m^2/ped

In recognising the importance of footpath design in fostering a positive walking culture, Transport for London (TfL) created the *Pedestrian Comfort Guidance for London* (TfL, 2010). This guidance is tailored for pedestrian behaviour and perception within London and used to identify issues at existing sites and schemes in development in London. This guide provides an alternative Level of Service range for walkways, referred to as the Pedestrian Comfort Level (PCL). As with Fruin LoS, the TfL PCL uses an A to F range. However, the thresholds are stricter than Fruin Walkways LoS and PCL A-C are further split into subcategories. The values presented by different colour bands are shown in **Figure 13**.

Note that PCL F is reserved for walkway widths under 1.5 metres. Additionally, in an open street environment with footpaths which experience PCL B or worse, pedestrians will begin considering avoiding the footpath if alternative routes are available. Similarly, crossing arms which experience PCL B or worse will have an increased likelihood of pedestrians crossing outside of the marked crossing lines due to perceived comfort.

The TfL PCL will be used to assess pedestrian walking comfort along the eastern footpath of Bligh Street, to the north and south of the proposed development. It is also used to assess the crossing arms at the intersections of Bligh Street / Bent Street and Bligh Street / Hunter Street.

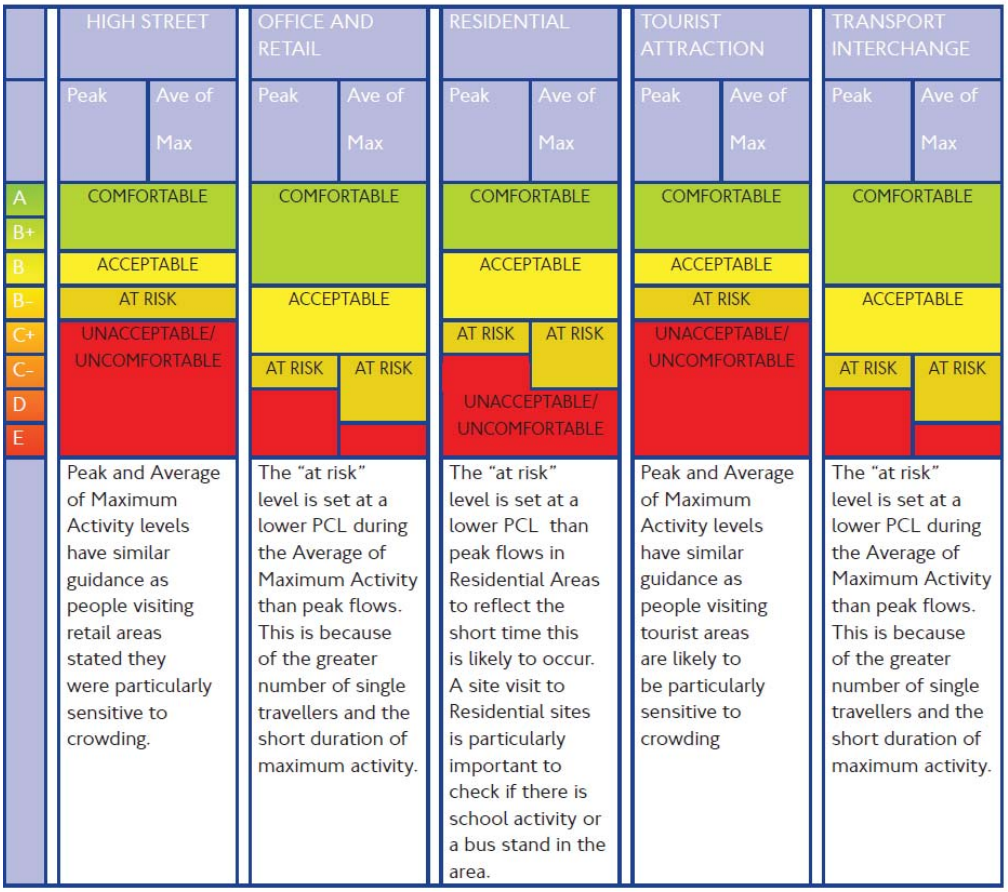
Figure 13 TfL Walkway PCL thresholds

TfL PCL Criteria for Walkways

A+	A	A-	B+	B	B-	C+	C	C-	D	E	
0	3	6	9	12	15	18	21	24	27	35	ped/min/m
<3%	13%	22%	31%	41%	50%	59%	69%	78%	100%	100%	Restricted movement

The TfL guidance document provides an indication of the comfortability of the walkway based on the area type, average PCL during the peak hour and the PCL for the Average Maximum Activity level. The Average Maximum Activity level is the maximum flow over a short period and is thus comparable to the peak minute, which is used in this analysis for assessing walkways. This guidance is presented in **Figure 14**. The area in which the proposed 4-6 Bligh Street development lies can be considered as office and retail, which is the second column in the figure.

Figure 14 TfL pedestrian comfort guidance for different area types



For pedestrian crossings, the TfL document provides guidance on the width of the marked crossing and the width and storage space of midblock pedestrian islands. It recommends a minimum comfort of PCL B- for crossing arms. The document does not provide consideration for pedestrian crossing storage space at the footpath.

In this report, the Fruin Walkways LoS and TfL PCL are presented to highlight the walking comfort of the footpath and intersection crossing arms, while the Fruin Queuing LoS is used to assess the comfort of the storage space at intersection crossings. The guidance provided by TfL's pedestrian comfort spreadsheet is relayed in the text of **Section 3**, with the full ranges and advice presented in **Appendix C**.

3.0 Results and Analysis

The proposed development provides less space for commercial use than the existing building. Instead, the majority of floor space is used for hotel purposes. **Table 4** provides the number of pedestrians arriving at and departing from the existing 4-6 Bligh Street building and the forecast for the proposed development. As outlined in **Section 2**, these pedestrians are assumed to use the eastern footpath along Bligh Street. Due to the mixed use nature of the proposed development, the arrival and departure numbers during each of the peaks are similar. For instance, during the AM Peak, the commercial space will yield more arrivals as workers begin their day whilst the hotel yields more departures as customers check out or head to other attractions. The reverse occurs during the PM Peak.

Table 4 Existing and proposed building peak hour flows

Development	AM Peak		Midday Peak		PM Peak	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Existing Building	320	70	250	190	40	250
Proposed Building	335	320	360	365	315	330
Net Increase	+15	+250	+110	+175	+275	+80

In 2026, it is estimated that there are approximately 700 passengers entering and 12,650 passengers exiting Martin Place Station in the AM Peak due to future Sydney Metro. Based on this and the routing outlined in **Section 2**, **Table 5** presents the additional future Sydney Metro demand which affects the study area.

Table 5 Additional future Sydney Metro demand along Bligh Street

Location	AM Peak		Midday Peak		PM Peak	
	To	From	To	From	To	From
Bligh Street – East Side	790	15	30	55	10	720
Bligh Street – West Side	1,105	20	70	120	20	1,005
Hunter Street – North Side	1,520	90	120	220	85	1,380
Hunter Street – South Side	1,520	85	115	210	75	1,380

From the tables above, it is clear that the impact of future Sydney Metro on the eastern side of Bligh Street is much higher than the net impact of the proposed development for the AM and PM Peaks. However, the impact of the proposed development during the Midday Peak is expected to be higher at the eastern Bligh Street footpath. The magnitude of the additional demand in the Midday Peak is smaller than the increase seen during the AM and PM peaks.

The expected pedestrian demand at the intersections and eastern Bligh Street footpath are shown in **Figure 15** to **Figure 17**. The three demand scenarios for each peak period is as follows:

- **2017 Existing** – Current day demand based on surveys conducted on Wednesday, 2 August 2017.
- **2026 No Development** – Future 2026 demand including background growth due to employment and the impact of future Sydney Metro at Martin Place.
- **2026 With Development** – Similar to 2026 No Development, but includes the net impact of developing 4-6 Bligh Street.

In general, the flows in the 2026 With Development scenarios are marginally higher than or equal to the 2026 No Development scenarios. An exception to this occurs in the AM Peak for movements entering 4-6 Bligh Street from the south. This decreases slightly in 2026 With Development as the proposed development generates less commercial workers than the existing building. However, the total bi-directional flow along that section is still higher due to an increase in the southbound movement.

Figure 15 AM Peak Bligh Street pedestrian flows

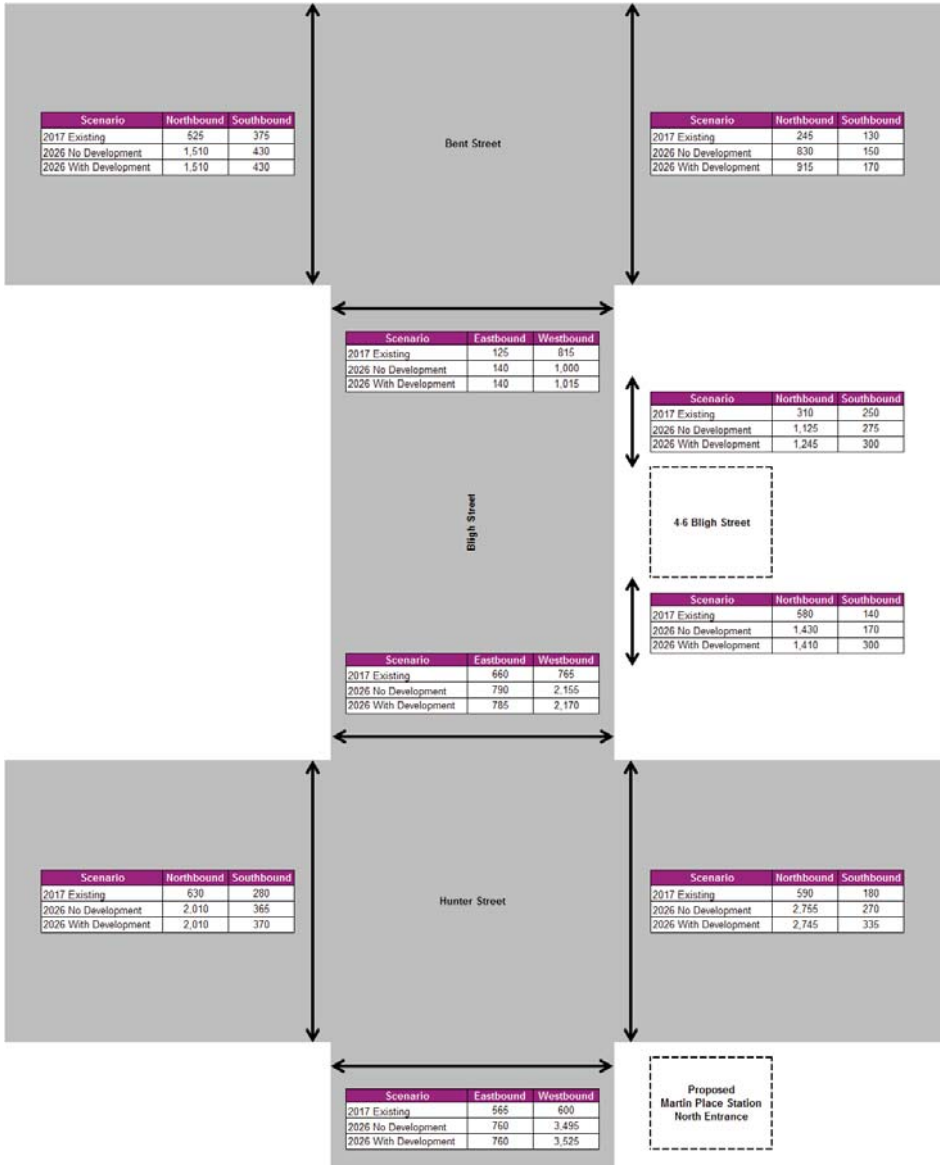


Figure 16 Midday Peak Bligh Street pedestrian flows

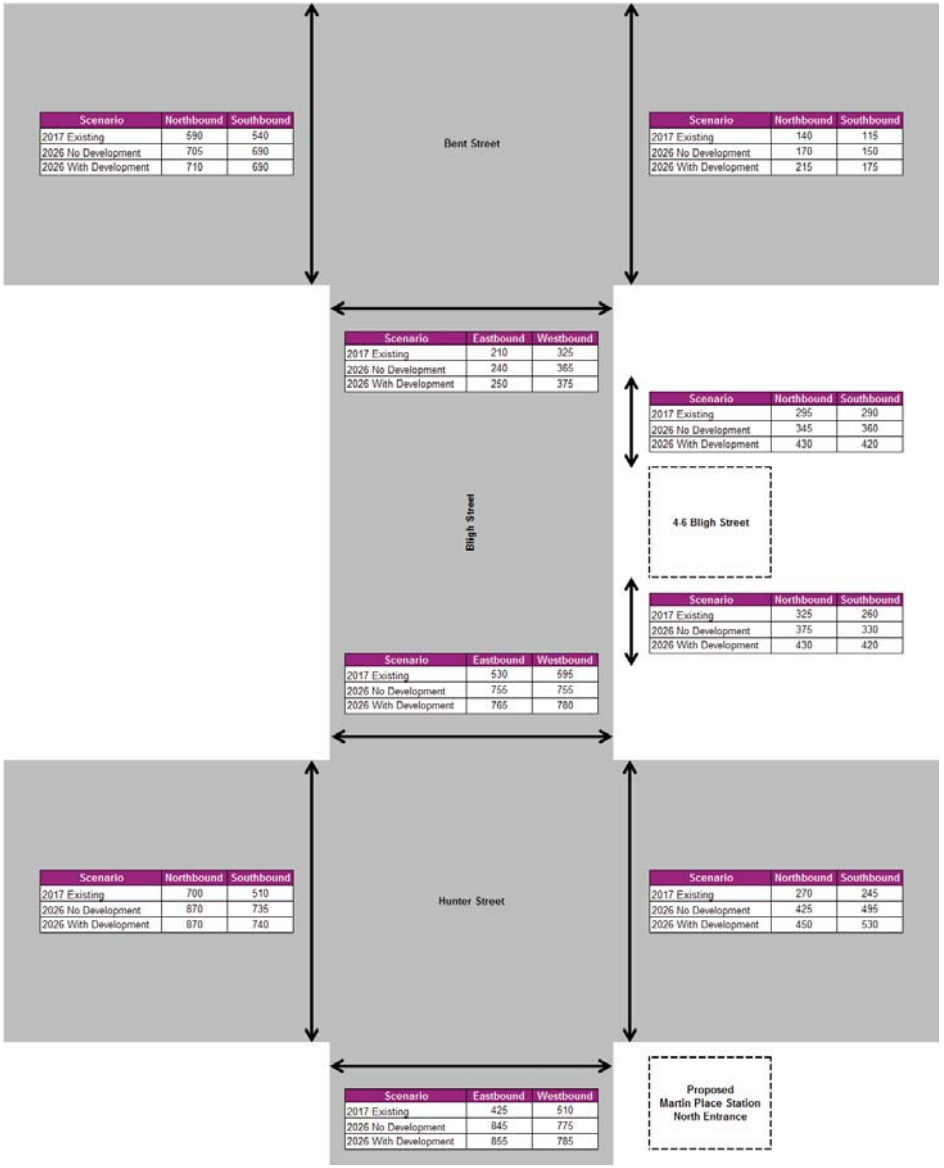
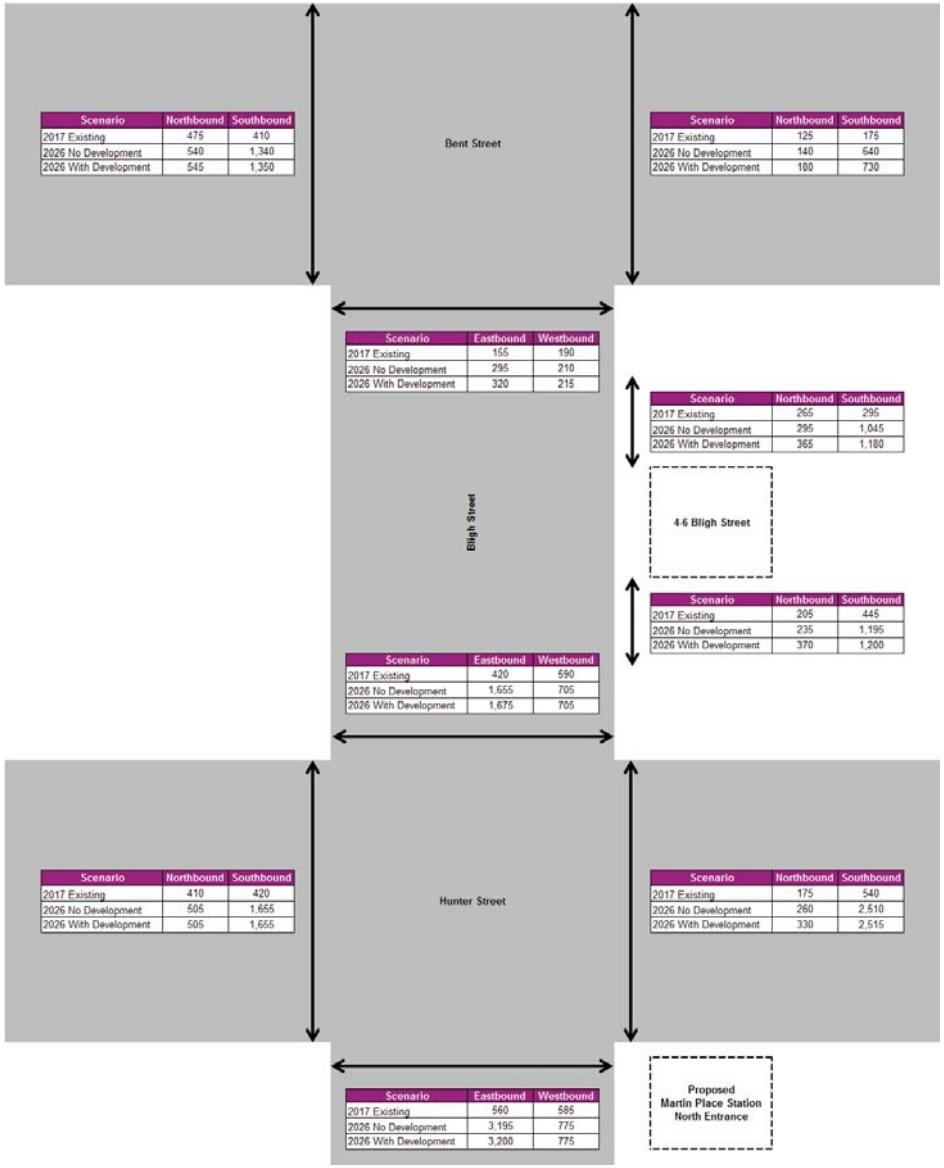


Figure 17 PM Peak Bligh Street pedestrian flows



3.1 Walking Performance – Footpaths and Crossings

To assess the performance of walkways, the total bidirectional flow at the location of interest is considered. **Figure 18** to **Figure 20** present the walkways performance for:

- The narrowest section of the footpath immediately north and south of 4-6 Bligh Street, see
- **Figure** 9.
- All crossing arms at the Bligh Street / Bent Street and Bligh Street / Hunter Street intersections.

The footpath performance presented here is for the peak minute. The average performance over the peak hour was also calculated but is not presented in this section as the peak minute performance is the predominant limiting factor. Results for the peak hour average and the in depth analysis steps can be found in **Appendix B**.

The footpaths to the immediate north and south of 4-6 Bligh Street are seen to perform at a Fruin LoS A during the peak minute across all scenarios. The southern footpath is seen to perform at a lower TfL PCL than the northern footpath. This is reflective of the higher demand for the southern section as well as the narrower footpath width. The lowest PCL obtained by the footpaths is PCL C, which is considered acceptable for short periods. The additional demand from the development is not seen to significantly affect the footpath performance.

Under the peak hour average PCL (refer to **Appendix B**), the northern footpath achieves PCL B+ or better. This is considered comfortable for the area's intended use during most times. For the southern footpath, the peak hour average reaches PCL B during the AM Peak for both 2026 scenarios. This is below the TfL recommendation of PCL B+ and the width is suggested to be increased if possible.

For the crossings, the presented performance includes the effect of signal phasing. When the crossing performs at PCL B or worse, it becomes more likely that pedestrians will spill out beyond the marked pedestrian crossing due to perceived comfort.

At the Bligh Street / Bent Street intersection, the south arm operates under a Fruin LoS A and PCL B- during the busiest period. The performance at this arm does not change much between existing and future due to the relatively low increase in demand. In comparison, the east and west arms experience a more pronounced deterioration in comfort levels. This change is mainly due to the introduction of future Sydney Metro Station. The relative impact of the proposed development is minor in comparison.

While the 2026 LoS and PCL performance is of concern, it was observed that this intersection does have an all-pedestrian phase. In this situation, pedestrians are allowed to cross diagonally and are not restricted to within the marked lines. As such, the results for the east and west arms may be taken as a 'worst case' for the intersection.

At the Bligh Street / Hunter Street intersection, the introduction of future Sydney Metro sees a marked deterioration in comfort levels. This is particularly pronounced during the AM and PM Peaks at the east and west arms, which observe Fruin LoS D-E. To cater for the additional demand due to future Sydney Metro, the signal phase timings and marked pedestrian crossing line widths should be revised. Other strategies may also be required. Although this intersection performs poorly, the impact of the proposed development on this intersection is minor, with little to no change in pedestrian comfort levels.

It is noted that the *Sydney Metro Chatswood to Sydenham Environmental Impact Assessment* (Jacobs, 2016) highlights this intersection as a location of concern due to the introduction of future Sydney Metro. The need for an increase in crossing capacity, particularly at the southeast corner is mentioned in the document. The document also suggests a potential underground link from Martin Place Station to 33 Bligh Street, located near the northwest corner of the Bligh Street / Hunter Street intersection. This connection would help in relieving the faced by the intersection.

Fruin LoS Criteria for Walkways

A	B	C	D	E	F	
∞	3.25	2.32	1.39	0.93	0.46	m^2/ped
0	23	33	49	66	82	ped/min/m

TfL PCL Criteria for Walkways

A+	A	A-	B+	B	B-	C+	C	C-	D	E	
0	3	6	9	12	15	18	21	24	27	35	ped/min/m
<3%	13%	22%	31%	41%	50%	59%	69%	78%	100%	100%	Restricted movement

Figure 18 AM Peak footpath and crossing walkway performance for the peak minute

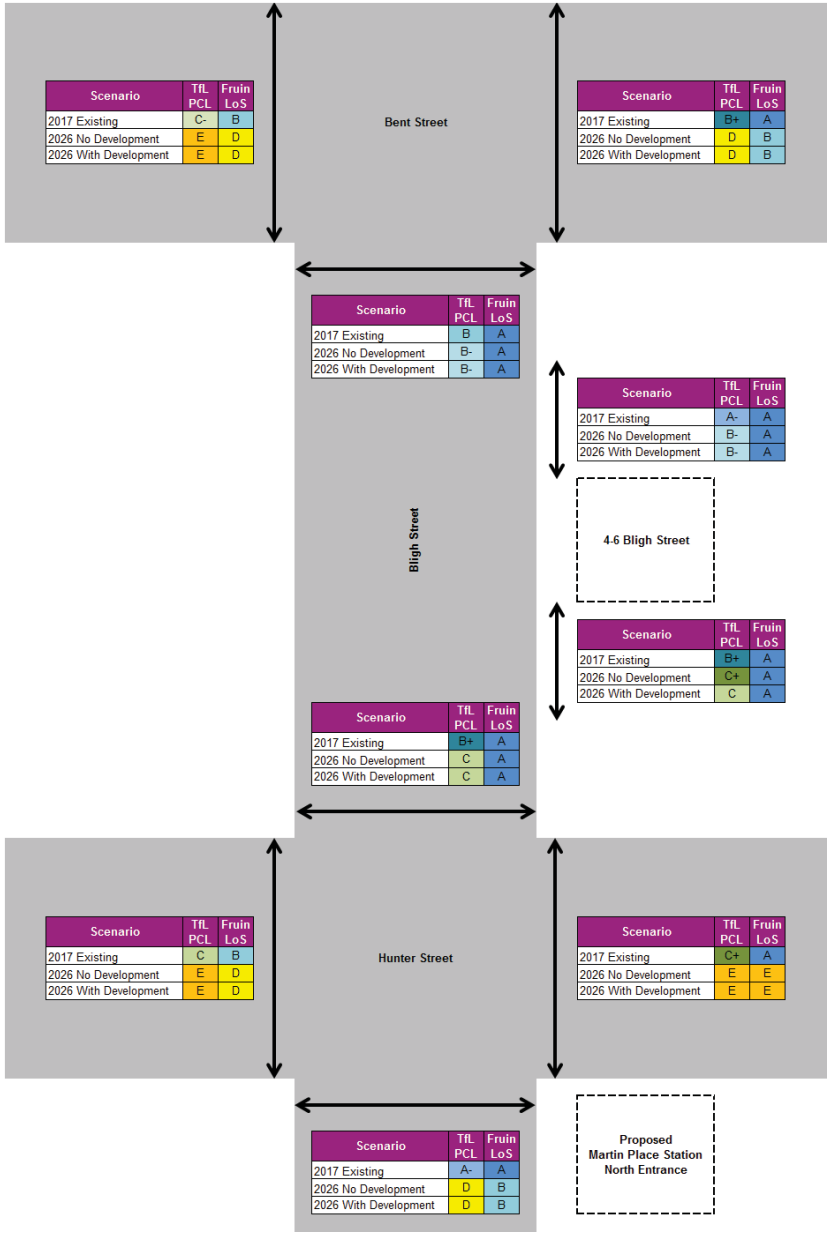


Figure 19 Midday Peak footpath and crossing walkway performance for the peak minute

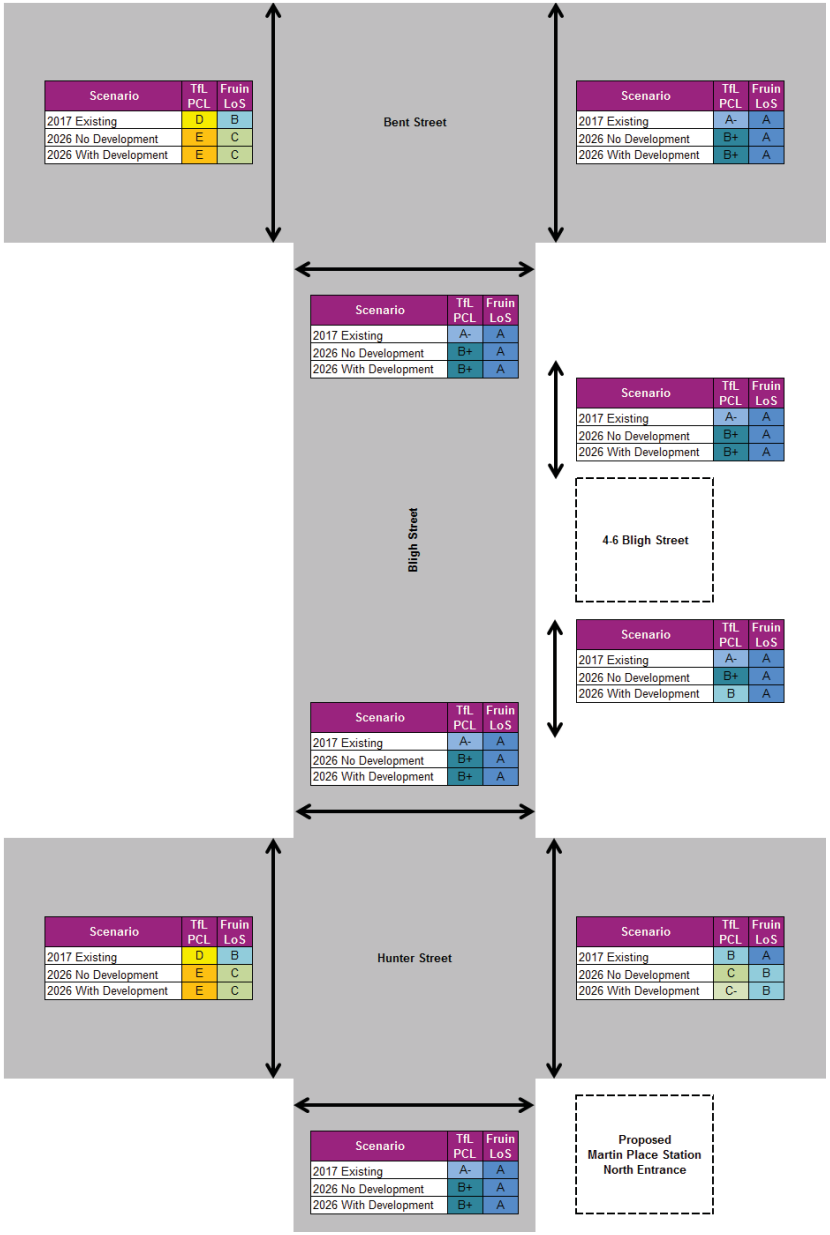
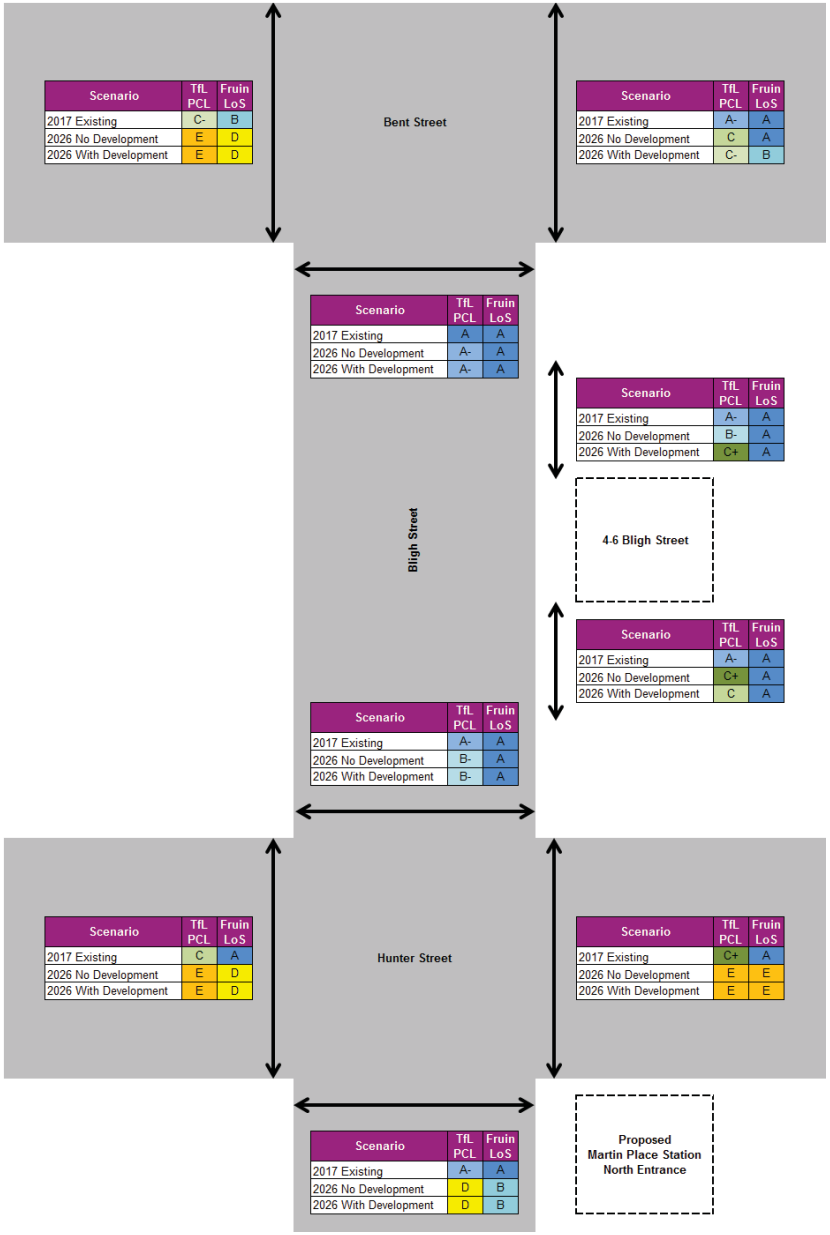


Figure 20 PM Peak footpath and crossing walkway performance for the peak minute



3.2 Queuing Performance – Crossing Storage

To assess the performance of the footpath storage space for pedestrian crossings, the directional flow at each crossing arm, footpath dimensions and signal phasing are considered. A uniform arrival at the crossings has been assumed over the peak hour. The indicative pedestrian storage space assumed for each crossing arm and direction is provided in **Table 6**. This area provides for a 1.5 metre corridor for non-crossing pedestrians to pass. **Figure 21** to **Figure 23** present the queuing performance at each intersection.

Table 6 Pedestrian crossing indicative storage area

Crossing Arm	Pedestrian Storage Area (m^2)	
	Northbound / Eastbound	Southbound / Westbound
Bligh Street / Bent Street Intersection		
East Arm	15	40
South Arm	45	29
West Arm	45	40
Bligh Street / Hunter Street Intersection		
North Arm	19	19
East Arm	25	23
South Arm	24	23
West Arm	20	22

The pedestrian storage along the Bligh Street / Bent Street intersection performs well in all scenarios for the majority of movements. This is reflective of the large space available for most crossing movements. The additional demand from the proposed development does not affect the observed crossing storage performance level.

The storage area for the northbound movement at the east arm has the lowest performance with a Fruin LoS C during the AM Peak in the 2026 scenarios. This movement has the smallest storage area provided at the intersection. At Fruin LoS C, the queuing space can still be considered comfortable. However, there is an increased likelihood for pedestrians to queue outside of the indicative storage space and obstruct other pedestrian movements.

At the Bligh Street / Hunter Street intersection, the performance of the storage spaces at the east and west arms are of particular concern during the 2026 scenarios. The storage space for the southern arm also performs sub-optimally in 2026. The additional demand from the proposed development is not seen to affect the crossing storage performance level.

At the east and west arms, Fruin LoS D is experience by the northbound movements during the AM Peak and by the southbound movements during the PM Peak. At LoS D, pedestrians can be expected to spill out of the indicative storage space and noticeably obstruct other movements at the intersection. The southern arm is also seen to experience LoS C during the AM and PM Peaks. This will result in an increased likelihood for queuing outside of the indicative storage space and obstruction to other movements.

The Richard Johnson Square is located on the northwest corner of the intersection, which provides an open public space. As such, whilst queuing may occur outside of the indicative queuing area there will still be alternatives for non-crossing pedestrians to walk unobstructed. Similarly, non-crossing pedestrians in the southwest corner are able to walk along the building façade of 1 Castlereagh Street to avoid some of the congestion. It is also understood that the southeast corner of the intersection will be turned into a plaza for the new north entrance of Martin Place Station. This will likely improve pedestrian storage situation for that corner, although no plans of the proposed design were received as for the purposes of this assessment.

Given the above, the pedestrian storage at the northeast corner of Bligh Street / Hunter Street is of most concern as there is little room for non-crossing movements to pass. The potential underground pedestrian link mentioned in **Section 3.1** would help alleviate pressure on the pedestrian storage spaces at this intersection.

Fruin LoS Criteria for Queuing

A	B	C	D	E	F	
∞	1.21	0.93	0.65	0.28	0.19	m^2/ped

Figure 21 AM Peak crossing storage queuing performance

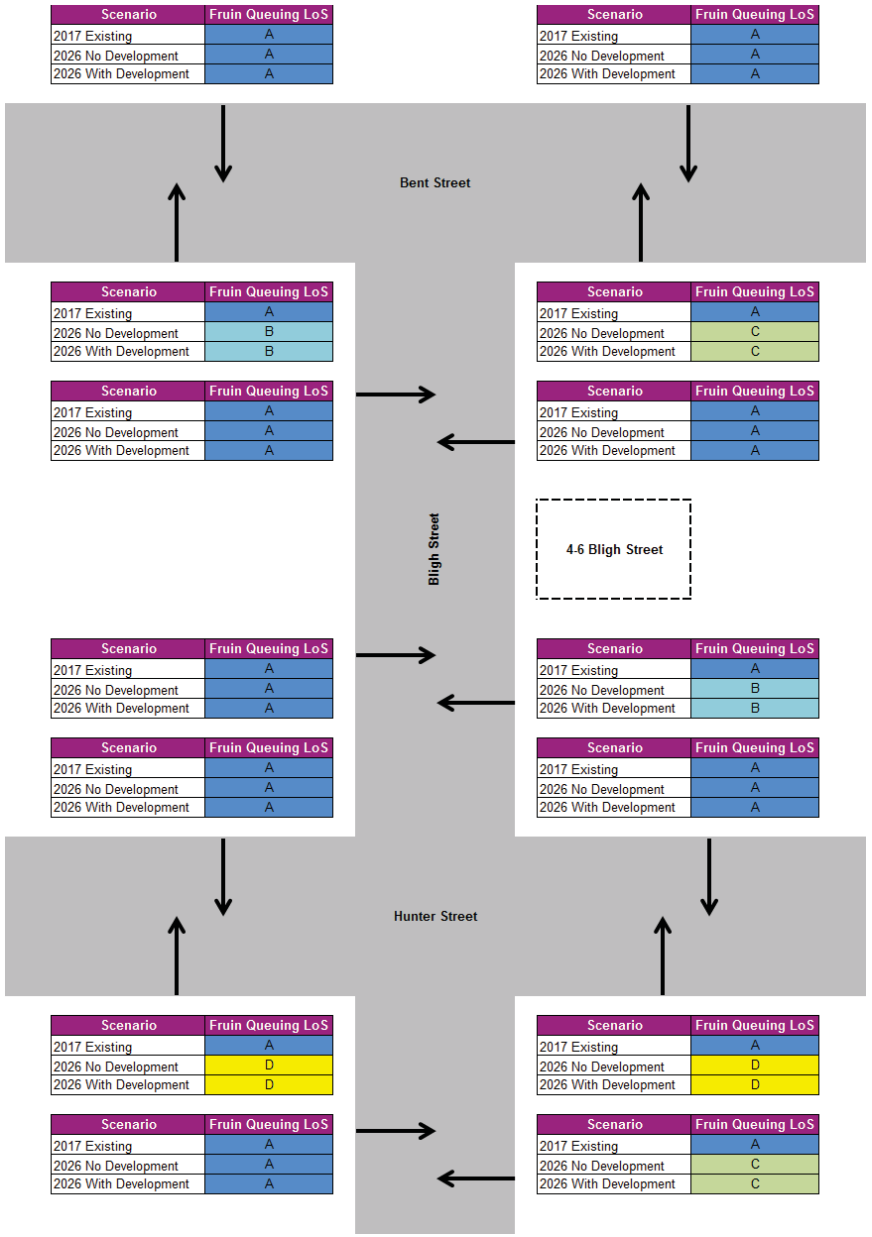


Figure 22 Midday Peak crossing storage queuing performance

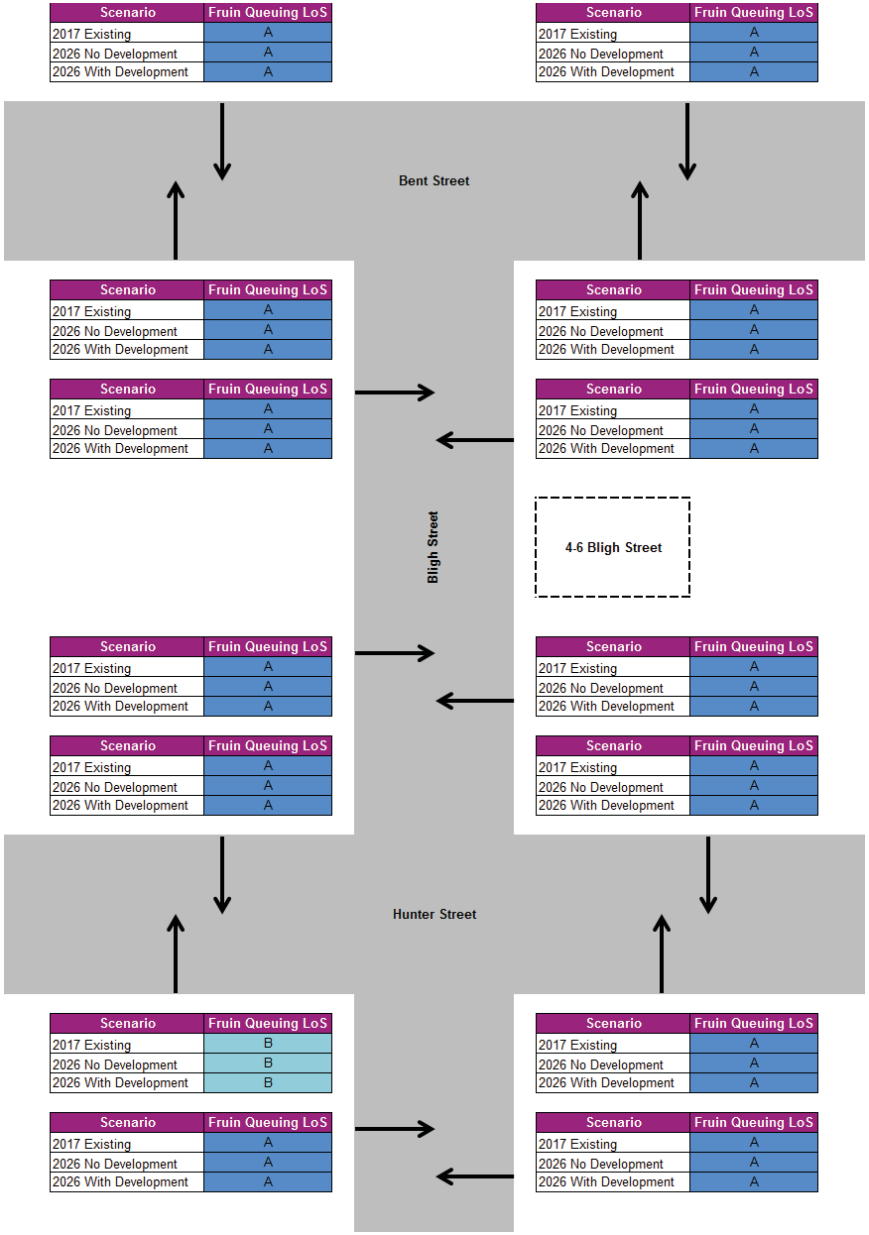
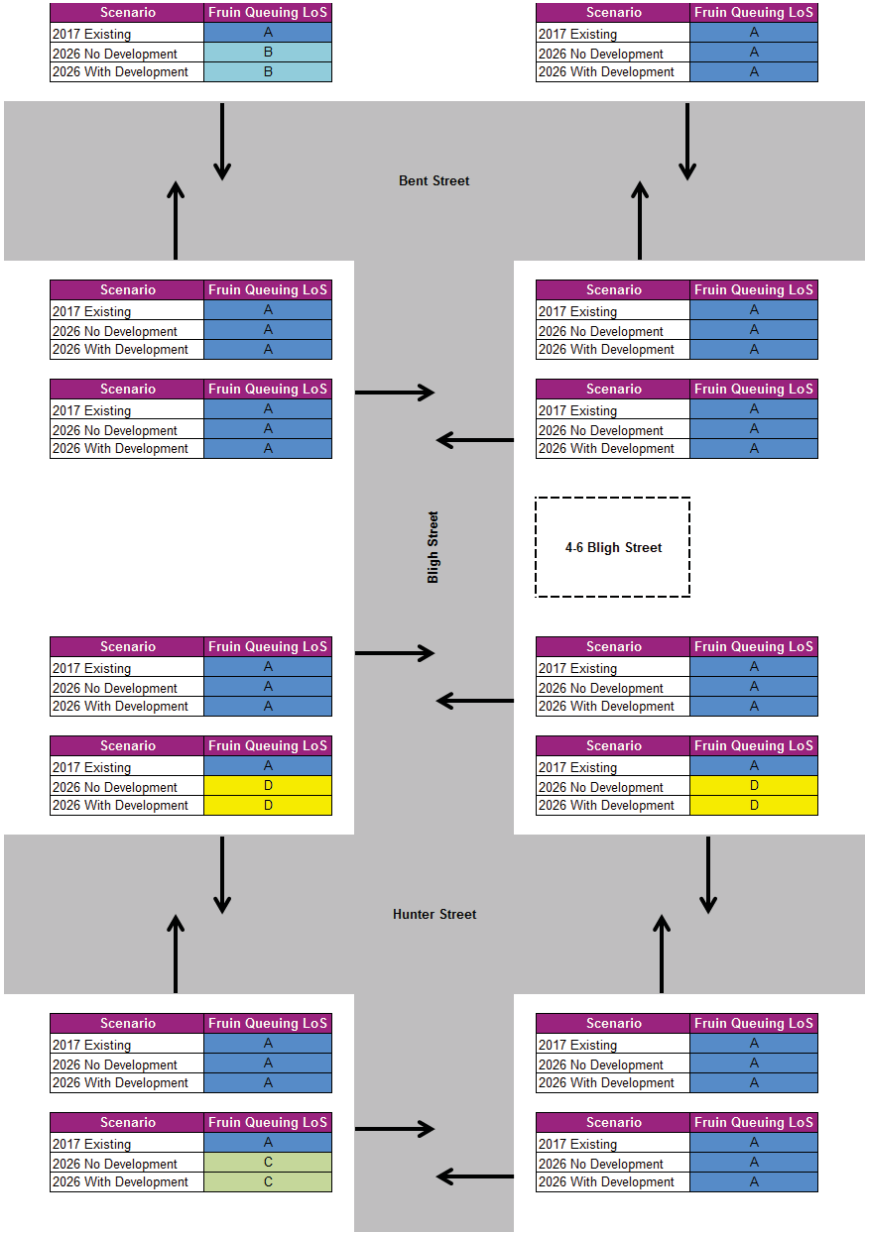


Figure 23 PM Peak crossing storage queuing performance



4.0 Conclusion

The following scenarios have been analysed as part of this study, during the AM Peak, Midday Peak and PM Peak hours:

- **2017 Existing** – Current day demand based on surveys conducted on Wednesday, 2 August 2017.
- **2026 No Development** – Future 2026 demand including background growth due to employment and the impact of future Sydney Metro at Martin Place.
- **2026 With Development** – Similar to 2026 No Development, but includes the net impact of developing 4-6 Bligh Street.

In conclusion, the analysis has shown that by 2026 an additional 13,350 passengers are expected to frequent the local pedestrian network in the AM Peak due to the introduction of a future Sydney Metro Station at Martin Place. This is expected to have a noticeable impact on the performance of pedestrian infrastructure along Bligh Street and adjoining intersections. A comparison of the 2017 Existing and 2026 No Development scenarios has shown that:

- The footpath adjacent to 4-6 Bligh Street performs at a lower Fruin Walkways LoS and TfL PCL in 2026. The footpath PCL performance during the peak minute within each peak hour is considered acceptable for office and retail areas.
- At the Bligh Street / Bent Street intersection, the east and west arms experience a noticeable deterioration in Fruin Walkways LoS and TfL PCL performance due to the introduction of future Sydney Metro. However, there the storage area for pedestrians is expected to be sufficient, with the exception of the northbound movement for the east arm in the AM Peak.
- At the Bligh Street / Hunter Street intersection, a marked deterioration in comfort levels is observed with the introduction of future Sydney Metro. This is particularly pronounced at the east and west arms during the AM and PM Peaks, where these arms experience Fruin Walkways LoS D-E and TfL PCL E. The available pedestrian storage area at this intersection is also of concern.

The following measures may assist in alleviating the pedestrian issues caused mainly by the introduction of a future Sydney Metro Station at Martin Place:

- Increasing the usable footpath width at areas of concern by widening the footpath or reducing street furniture.
- Increasing the pedestrian crossing arm widths and revising the phase timings at two key intersections.
- Constructing the proposed pedestrian plaza at the southeast corner of Bligh Street / Hunter Street. This plaza is a part of the proposed north entrance to Martin Place Station and would increase the storage space provided at this corner of the intersection.
- Constructing the proposed underground pedestrian link from Martin Place Station to 33 Bligh Street. This would reduce the demand placed upon the Bligh Street / Hunter Street intersection and associated footpaths.

By comparing the 2026 No Development and 2026 With Development scenarios, it is seen that the proposed development:

- Causes no change in the Fruin Walkways LoS performance at the footpath adjacent to 4-6 Bligh Street. A slight change in the TfL PCL performance was observed. However, the footpath continues to operate at acceptable levels for an office and retail environment.
- Causes a minor change in Fruin Walkways LoS and TfL PCL performance at the Bligh Street / Bent Street intersection. This change is limited to the east arm during the PM Peak. Additionally, no change in the performance level of the pedestrian storage space was observed at this intersection.
- Causes a minor change in Fruin Walkways LoS and TfL PCL performance at the Bligh Street / Hunter Street intersection. This change is limited to the east arm during the Midday Peak. Additionally, no change in the performance level of the pedestrian storage space was observed at this intersection.

Appendix A – Survey Specifications

AECOM Australia Pty Ltd
Level 21, 420 George Street
Sydney NSW 2000
PO Box Q410
QVB Post Office NSW 1230
Australia
www.aecom.com

+61 2 8934 0000 tel
+61 2 8934 0001 fax
ABN 20 093 846 925

Memorandum

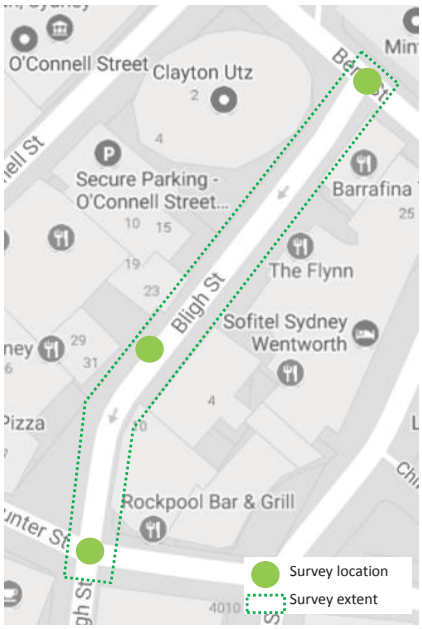
To	Austraffic	Page	1
Subject	4-6 Bligh Street Survey Quote		
From	AECOM		
File/Ref No.		Date	31-Jul-2017

This memo outlines the details of the pedestrian survey to be undertaken, and the pedestrian movements required to be captured. A quotation for survey cost is requested, based from the survey details outlined below.

The survey requested is along Blight Street, Sydney, including the signalised intersections of Bligh/ Bent Street and Bligh/ Hunter Street, survey extent shown below.

Three separate survey periods are required to gather pedestrian information. The survey will be undertaken over one full day.

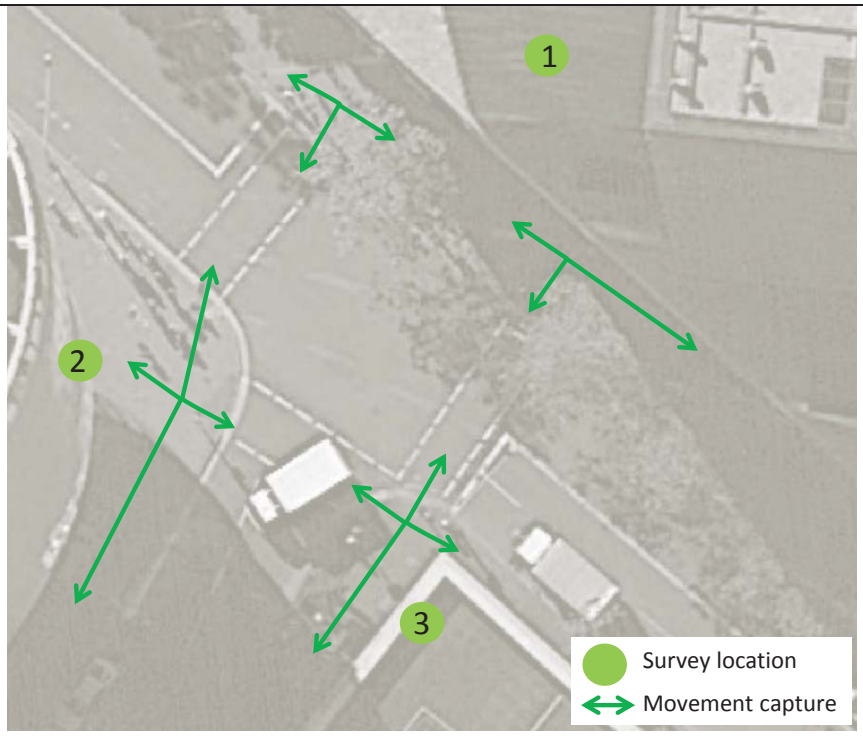
- AM period: 7am – 10:00am
- Midday period: 12:00 – 3:00pm
- PM period: 4:00 – 7:00pm



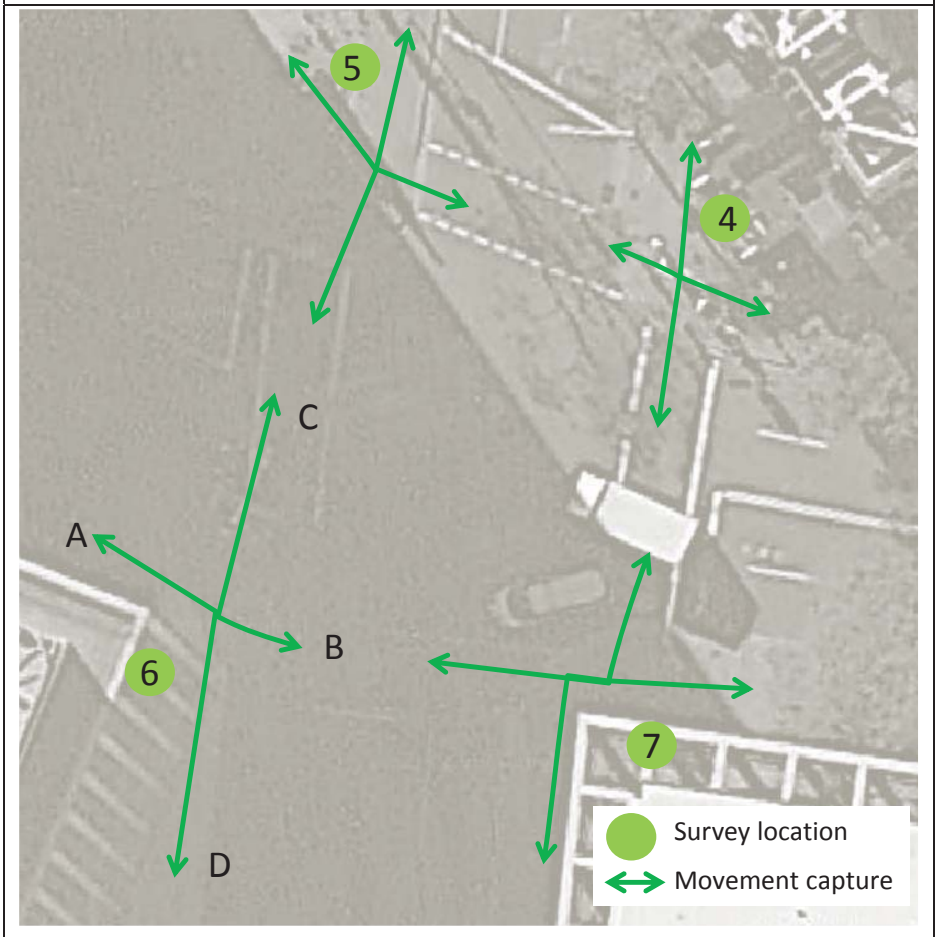
The surveys will primarily provide pedestrian count information and directionality, broken down to one minute periods, if possible, or 5 minute period.

At the signalised intersections, the red and green pedestrian crossing times will need to be captured. I.e. we need to know how long a pedestrian is able to cross from one side of the street to another, the red flashing time, the red time, and the green walk time. This is required for all legs of the intersection, during all three survey periods, in case crossing times change for different peak periods.

The number of pedestrians approaching each leg of the intersection, and the direction the pedestrian decides to take at the signalised intersection is required. Information required for capture is shown in the images below.



Bligh/ Bent Street intersection



Bligh/ Hunter Street intersection

An example survey count of pedestrians at Location 6, the south west corner of Bligh and Hunter Street, would include these movements, per survey period, broken down to 1 minute intervals:

- Movement A to B
- Movement A to C
- Movement A to D
- Movement B to A
- Movement B to C
- Movement B to D
- Movement C to A
- Movement C to B
- Movement C to D
- Movement D to A
- Movement D to B
- Movement D to C

Directly opposite the existing 4-6 Bligh Street building, pedestrian counts of pedestrian entry and exit movements into the existing building, during the specified periods, will be required, as well as general footpath pedestrian traffic along the eastern footpath of Bligh Street, shown below.

Appendix B – Detailed Results

Criteria

TfL PCL

Lower Limit (ppl/min/m)	Upper Limit (ppl/min/m)	LoS
0	3	A+
3	6	A
6	9	A-
9	12	B+
12	15	B
15	18	B-
18	21	C+
21	24	C
24	27	C-
27	35	D
36		E

Fruin Walkways

Lower Limit (ppl/min/m)	Upper Limit (ppl/min/m)	LoS
0	23	A
23	33	B
33	49	C
49	66	D
66	82	E
82		F

Fruin Queuing

Lower Limit (ppl/sqm)	Upper Limit (ppl/sqm)	LoS
0	0.83	A
0.83	1.08	B
1.08	1.54	C
1.54	3.59	D
3.59	5.38	E
5.38		F

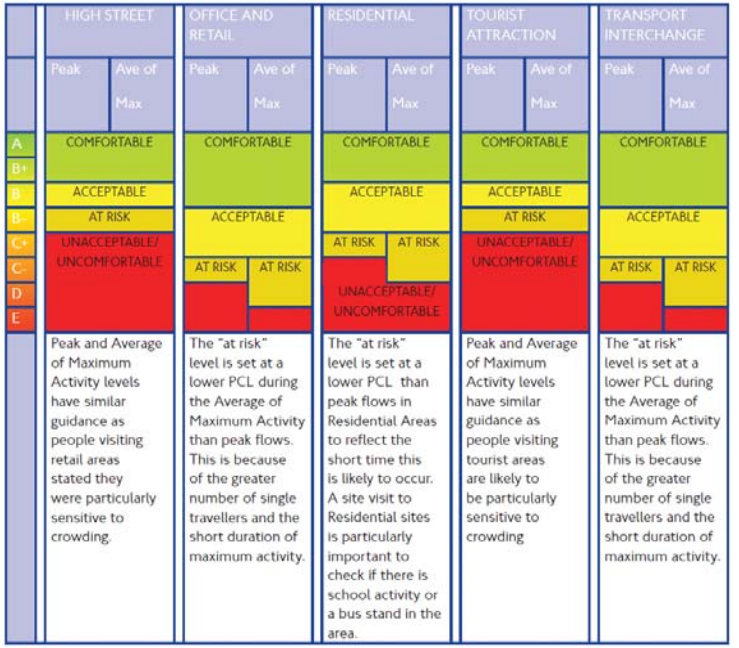
Inputs

	Footpath Width (m)	Building & Curb Edge Effect (m)	Furniture Width & Buffer (m)
Bligh St North	3.5	0.4	0.6
Bligh St South	3.2	0.4	0.6

	Crossing Arm Width (m)	Pedestrian Green Time (s)	Total Cycle Time (s)	Northbound/ Eastbound Queuing Area (sqm)	Southbound/ Westbound Queuing Area (sqm)
Bligh/Bent East Arm	3.2	20	110	15	40
Bligh/Bent South Arm	3.2	37	110	45	29
Bligh/Bent West Arm	3.2	20	110	45	40
Bligh/Hunter North Arm	3.2	80	110	19	19
Bligh/Hunter East Arm	3.2	22	110	25	23
Bligh/Hunter South Arm	3.2	80	110	24	23
Bligh/Hunter West Arm	3.2	22	110	20	22

TfL Guidance

Footpaths



Crossings

The crossing continues to be comfortable at PCL B+ to B- . **PCL B- is the recommended level of comfort for crossing arm and the space required for people to cross on an island (if present).**

Pedestrian Comfort Level on the Crossing arm is C-, D or E

The Pedestrian Comfort Level could be improved by adjusting the signal timings, increasing the width of the crossing or a combination of these two measures.

The crossing should then be re-assessed to ensure the solution will be comfortable for users.

Footpath - Bligh St North

Scenario	Peak Minute Multiplier	Peak Hour Flow (ppl/h)	Total Footpath Width (m)	Edge Effect (m)	Furniture Width & Buffer (m)	Clear Footpath Width (m)	Peak Hour Average Flow (ppl/min/m)	Peak Hour Average TfL PCL	Peak Hour Average Fuin	Peak Minute Flow (ppl/min/m)	Peak Minute TfL PCL	Peak Minute Fuin	TfL Classification (Office & Retail)
AM													
2017 Existing	1.72	548	3.5	0.4	0.6	2.5	4	A	A	6	A-	A	Comfortable
2026 No Development	1.72	1392	3.5	0.4	0.6	2.5	9	B+	A	16	B-	A	Acceptable
2026 With Development	1.72	1546	3.5	0.4	0.6	2.5	10	B+	A	18	B-	A	Acceptable
MID													
2017 Existing	2.01	584	3.5	0.4	0.6	2.5	4	A	A	8	A-	A	Comfortable
2026 No Development	2.01	704	3.5	0.4	0.6	2.5	5	A	A	9	B+	A	Comfortable
2026 With Development	2.01	849	3.5	0.4	0.6	2.5	6	A	A	11	B+	A	Comfortable
PM													
2017 Existing	1.76	559	3.5	0.4	0.6	2.5	4	A	A	7	A-	A	Comfortable
2026 No Development	1.76	1339	3.5	0.4	0.6	2.5	9	A-	A	16	B-	A	Acceptable
2026 With Development	1.76	1547	3.5	0.4	0.6	2.5	10	B+	A	18	C+	A	Acceptable

Footpath - Bligh St South

Scenario	Peak Minute Multiplier	Peak Hour Flow (ppl/h)	Total Footpath Width (m)	Edge Effect (m)	Furniture Width & Buffer (m)	Clear Footpath Width (m)	Peak Hour Average Flow (ppl/min/m)	Peak Hour Average TfL PCL	Peak Hour Average Fuin	Peak Minute Flow (ppl/min/m)	Peak Minute TfL PCL	Peak Minute Fuin	TfL Classification (Office & Retail)
AM													
2017 Existing	1.72	721	3.2	0.4	0.6	2.2	5	A	A	9	B+	A	Comfortable
2026 No Development	1.72	1601	3.2	0.4	0.6	2.2	12	B	A	21	C+	A	Acceptable
2026 With Development	1.72	1714	3.2	0.4	0.6	2.2	13	B	A	22	C	A	Acceptable
MID													
2017 Existing	2.01	586	3.2	0.4	0.6	2.2	4	A	A	9	A-	A	Comfortable
2026 No Development	2.01	706	3.2	0.4	0.6	2.2	5	A	A	11	B+	A	Comfortable
2026 With Development	2.01	848	3.2	0.4	0.6	2.2	6	A-	A	13	B	A	Comfortable
PM													
2017 Existing	1.76	646	3.2	0.4	0.6	2.2	5	A	A	9	A-	A	Comfortable
2026 No Development	1.76	1426	3.2	0.4	0.6	2.2	11	B+	A	19	C+	A	Acceptable
2026 With Development	1.76	1571	3.2	0.4	0.6	2.2	12	B+	A	21	C	A	Acceptable

Crossing Flow - Bligh/Bent St

Scenario	Peak Hour Flow (ppl/h)	Crossing Arm Width (m)	Pedestrian Green Time (s)	Total Cycle Time (s)	Pedestrian Green %	Peak Hour Average Flow (ppl/min/m)	Relative Peak Hour Average Flow (ppl/min/m)	Relative Peak Hour Average TfL PCL	Relative Peak Hour Average Fuin	Meets TfL Suggested PCL for Crossings?
East Arm - AM										
2017 Existing	374	3.2	20	110	18%	2	11	B+	A	Yes
2026 No Development	980	3.2	20	110	18%	5	28	D	B	No
2026 With Development	1084	3.2	20	110	18%	6	31	D	B	No
South Arm - AM										
2017 Existing	936	3.2	37	110	34%	5	14	B	A	Yes
2026 No Development	1138	3.2	37	110	34%	6	18	B-	A	Yes
2026 With Development	1158	3.2	37	110	34%	6	18	B-	A	Yes
West Arm - AM										
2017 Existing	900	3.2	20	110	18%	5	26	C-	B	No
2026 No Development	1940	3.2	20	110	18%	10	56	E	D	No
2026 With Development	1942	3.2	20	110	18%	10	56	E	D	No
East Arm - MID										
2017 Existing	256	3.2	20	110	18%	1	7	A-	A	Yes
2026 No Development	322	3.2	20	110	18%	2	9	B+	A	Yes
2026 With Development	393	3.2	20	110	18%	2	11	B+	A	Yes
South Arm - MID										
2017 Existing	535	3.2	37	110	34%	3	8	A-	A	Yes
2026 No Development	603	3.2	37	110	34%	3	9	B+	A	Yes
2026 With Development	622	3.2	37	110	34%	3	10	B+	A	Yes
West Arm - MID										
2017 Existing	1129	3.2	20	110	18%	6	32	D	B	No
2026 No Development	1399	3.2	20	110	18%	7	40	E	C	No
2026 With Development	1400	3.2	20	110	18%	7	40	E	C	No
East Arm - PM										
2017 Existing	296	3.2	20	110	18%	2	8	A-	A	Yes
2026 No Development	784	3.2	20	110	18%	4	22	C	A	No
2026 With Development	909	3.2	20	110	18%	5	26	C-	B	No
South Arm - PM										
2017 Existing	345	3.2	37	110	34%	2	5	A	A	Yes
2026 No Development	506	3.2	37	110	34%	3	8	A-	A	Yes
2026 With Development	537	3.2	37	110	34%	3	8	A-	A	Yes
West Arm - PM										
2017 Existing	881	3.2	20	110	18%	5	25	C-	B	No
2026 No Development	1881	3.2	20	110	18%	10	54	E	D	No
2026 With Development	1891	3.2	20	110	18%	10	54	E	D	No

Crossing Flow - Bligh/Hunter St

Scenario	Peak Hour Flow (ppl/h)	Crossing Arm Width (m)	Pedestrian Green Time (s)	Total Cycle Time (s)	Pedestrian Green %	Peak Hour Average Flow (ppl/min/m)	Relative Peak Hour Average Flow (ppl/min/m)	Relative Peak Hour Average TfL PCL	Relative Peak Hour Average Fuin	Meets TfL Suggested PCL for Crossings?
North Arm - AM										
2017 Existing	1425	3.2	80	110	73%	7	10	B+	A	Yes
2026 No Development	2943	3.2	80	110	73%	15	21	C	A	No
2026 With Development	2959	3.2	80	110	73%	15	21	C	A	No
East Arm - AM										
2017 Existing	772	3.2	22	110	20%	4	20	C+	A	No
2026 No Development	3026	3.2	22	110	20%	16	79	E	E	No
2026 With Development	3079	3.2	22	110	20%	16	80	E	E	No
South Arm - AM										
2017 Existing	1164	3.2	80	110	73%	6	8	A-	A	Yes
2026 No Development	4256	3.2	80	110	73%	22	30	D	B	No
2026 With Development	4284	3.2	80	110	73%	22	31	D	B	No
West Arm - AM										
2017 Existing	912	3.2	22	110	20%	5	24	C	B	No
2026 No Development	2376	3.2	22	110	20%	12	62	E	D	No
2026 With Development	2377	3.2	22	110	20%	12	62	E	D	No
North Arm - MID										
2017 Existing	1125	3.2	80	110	73%	6	8	A-	A	Yes
2026 No Development	1508	3.2	80	110	73%	8	11	B+	A	Yes
2026 With Development	1541	3.2	80	110	73%	8	11	B+	A	Yes
East Arm - MID										
2017 Existing	517	3.2	22	110	20%	3	13	B	A	Yes
2026 No Development	918	3.2	22	110	20%	5	24	C	B	No
2026 With Development	982	3.2	22	110	20%	5	26	C-	B	No
South Arm - MID										
2017 Existing	935	3.2	80	110	73%	5	7	A-	A	Yes
2026 No Development	1624	3.2	80	110	73%	8	12	B+	A	Yes
2026 With Development	1643	3.2	80	110	73%	9	12	B+	A	Yes
West Arm - MID										
2017 Existing	1212	3.2	22	110	20%	6	32	D	B	No
2026 No Development	1604	3.2	22	110	20%	8	42	E	C	No
2026 With Development	1610	3.2	22	110	20%	8	42	E	C	No
North Arm - PM										
2017 Existing	1009	3.2	80	110	73%	5	7	A-	A	Yes
2026 No Development	2360	3.2	80	110	73%	12	17	B-	A	Yes
2026 With Development	2382	3.2	80	110	73%	12	17	B-	A	Yes
East Arm - PM										
2017 Existing	717	3.2	22	110	20%	4	19	C+	A	No
2026 No Development	2769	3.2	22	110	20%	14	72	E	E	No
2026 With Development	2848	3.2	22	110	20%	15	74	E	E	No
South Arm - PM										
2017 Existing	1145	3.2	80	110	73%	6	8	A-	A	Yes
2026 No Development	3968	3.2	80	110	73%	21	28	D	B	No
2026 With Development	3975	3.2	80	110	73%	21	28	D	B	No
West Arm - PM										
2017 Existing	828	3.2	22	110	20%	4	22	C	A	No
2026 No Development	2160	3.2	22	110	20%	11	56	E	D	No
2026 With Development	2162	3.2	22	110	20%	11	56	E	D	No

Queuing Space - Bligh/Bent St

Scenario	Peak Hour Flow (ppl/h)	Queuing Space (sqm)	Pedestrian Green Time (s)	Total Cycle Time (s)	Pedestrian Green %	Cycles per Hour	Pedestrians Crossing per Cycle	Queue Density (ppl/sqm)	Fruin Queuing LoS	Relative Queue Density (ppl/sqm)	Relative Queuing Fruin LoS
East Arm Northbound - AM											
2017 Existing	246	15	20	110	18%	32.73	8	0.50	A	0.41	A
2026 No Development	832	15	20	110	18%	32.73	25	1.69	D	1.39	C
2026 With Development	916	15	20	110	18%	32.73	28	1.87	D	1.53	C
East Arm Southbound - AM											
2017 Existing	128	40	20	110	18%	32.73	4	0.10	A	0.08	A
2026 No Development	149	40	20	110	18%	32.73	5	0.11	A	0.09	A
2026 With Development	168	40	20	110	18%	32.73	5	0.13	A	0.11	A
South Arm Eastbound - AM											
2017 Existing	123	45	37	110	34%	32.73	4	0.08	A	0.06	A
2026 No Development	138	45	37	110	34%	32.73	4	0.09	A	0.06	A
2026 With Development	142	45	37	110	34%	32.73	4	0.10	A	0.06	A
South Arm Westbound - AM											
2017 Existing	813	29	37	110	34%	32.73	25	0.86	B	0.57	A
2026 No Development	1001	29	37	110	34%	32.73	31	1.05	B	0.70	A
2026 With Development	1016	29	37	110	34%	32.73	31	1.07	B	0.71	A
West Arm Northbound - AM											
2017 Existing	525	45	20	110	18%	32.73	16	0.36	A	0.29	A
2026 No Development	1508	45	20	110	18%	32.73	46	1.02	B	0.84	B
2026 With Development	1510	45	20	110	18%	32.73	46	1.03	B	0.84	B
West Arm Southbound - AM											
2017 Existing	375	40	20	110	18%	32.73	11	0.29	A	0.23	A
2026 No Development	431	40	20	110	18%	32.73	13	0.33	A	0.27	A
2026 With Development	432	40	20	110	18%	32.73	13	0.33	A	0.27	A
East Arm Northbound - MID											
2017 Existing	142	15	20	110	18%	32.73	4	0.29	A	0.24	A
2026 No Development	172	15	20	110	18%	32.73	5	0.35	A	0.29	A
2026 With Development	216	15	20	110	18%	32.73	7	0.44	A	0.36	A
East Arm Southbound - MID											
2017 Existing	114	40	20	110	18%	32.73	3	0.09	A	0.07	A
2026 No Development	151	40	20	110	18%	32.73	5	0.11	A	0.09	A
2026 With Development	177	40	20	110	18%	32.73	5	0.14	A	0.11	A
South Arm Eastbound - MID											
2017 Existing	209	45	37	110	34%	32.73	6	0.14	A	0.09	A
2026 No Development	239	45	37	110	34%	32.73	7	0.16	A	0.11	A
2026 With Development	248	45	37	110	34%	32.73	8	0.17	A	0.11	A
South Arm Westbound - MID											
2017 Existing	326	29	37	110	34%	32.73	10	0.34	A	0.23	A
2026 No Development	364	29	37	110	34%	32.73	11	0.38	A	0.25	A
2026 With Development	375	29	37	110	34%	32.73	11	0.39	A	0.26	A
West Arm Northbound - MID											
2017 Existing	589	45	20	110	18%	32.73	18	0.40	A	0.33	A
2026 No Development	707	45	20	110	18%	32.73	22	0.48	A	0.39	A
2026 With Development	708	45	20	110	18%	32.73	22	0.48	A	0.39	A
West Arm Southbound - MID											
2017 Existing	540	40	20	110	18%	32.73	17	0.41	A	0.34	A
2026 No Development	692	40	20	110	18%	32.73	21	0.53	A	0.43	A
2026 With Development	692	40	20	110	18%	32.73	21	0.53	A	0.43	A
East Arm Northbound - PM											
2017 Existing	123	15	20	110	18%	32.73	4	0.25	A	0.21	A
2026 No Development	142	15	20	110	18%	32.73	4	0.29	A	0.24	A
2026 With Development	181	15	20	110	18%	32.73	6	0.37	A	0.30	A
East Arm Southbound - PM											
2017 Existing	173	40	20	110	18%	32.73	5	0.13	A	0.11	A
2026 No Development	642	40	20	110	18%	32.73	20	0.49	A	0.40	A
2026 With Development	728	40	20	110	18%	32.73	22	0.56	A	0.45	A
South Arm Eastbound - PM											
2017 Existing	157	45	37	110	34%	32.73	5	0.11	A	0.07	A
2026 No Development	297	45	37	110	34%	32.73	9	0.20	A	0.13	A
2026 With Development	320	45	37	110	34%	32.73	10	0.22	A	0.14	A
South Arm Westbound - PM											
2017 Existing	188	29	37	110	34%	32.73	6	0.20	A	0.13	A
2026 No Development	209	29	37	110	34%	32.73	6	0.22	A	0.15	A
2026 With Development	216	29	37	110	34%	32.73	7	0.23	A	0.15	A
West Arm Northbound - PM											
2017 Existing	473	45	20	110	18%	32.73	14	0.32	A	0.26	A
2026 No Development	541	45	20	110	18%	32.73	17	0.37	A	0.30	A
2026 With Development	543	45	20	110	18%	32.73	17	0.37	A	0.30	A
West Arm Southbound - PM											
2017 Existing	408	40	20	110	18%	32.73	12	0.31	A	0.26	A
2026 No Development	1340	40	20	110	18%	32.73	41	1.02	B	0.84	B
2026 With Development	1348	40	20	110	18%	32.73	41	1.03	B	0.84	B

Queuing Space - Bligh/Hunter St

Scenario	Peak Hour Flow (ppl/h)	Queuing Space (sqm)	Pedestrian Green Time (s)	Total Cycle Time (s)	Pedestrian Green %	Cycles per Hour	Pedestrians Crossing per Cycle	Queue Density (ppl/sqm)	Queuing Fruin LoS	Relative Queue Density (ppl/sqm)	Relative Queuing Fruin LoS
North Arm Eastbound - AM											
2017 Existing	662	19	80	110	73%	32.73	20	1.06	B	0.29	A
2026 No Development	788	19	80	110	73%	32.73	24	1.27	C	0.35	A
2026 With Development	787	19	80	110	73%	32.73	24	1.27	C	0.35	A
North Arm Westbound - AM											
2017 Existing	763	19	80	110	73%	32.73	23	1.23	C	0.33	A
2026 No Development	2155	19	80	110	73%	32.73	66	3.47	D	0.95	B
2026 With Development	2172	19	80	110	73%	32.73	66	3.49	D	0.95	B
East Arm Northbound - AM											
2017 Existing	591	25	22	110	20%	32.73	18	0.72	A	0.58	A
2026 No Development	2756	25	22	110	20%	32.73	84	3.37	D	2.70	D
2026 With Development	2746	25	22	110	20%	32.73	84	3.36	D	2.69	D
East Arm Southbound - AM											
2017 Existing	181	23	22	110	20%	32.73	6	0.24	A	0.19	A
2026 No Development	269	23	22	110	20%	32.73	8	0.36	A	0.29	A
2026 With Development	333	23	22	110	20%	32.73	10	0.44	A	0.35	A
South Arm Eastbound - AM											
2017 Existing	563	24	80	110	73%	32.73	17	0.72	A	0.20	A
2026 No Development	762	24	80	110	73%	32.73	23	0.97	B	0.26	A
2026 With Development	761	24	80	110	73%	32.73	23	0.97	B	0.26	A
South Arm Westbound - AM											
2017 Existing	601	23	80	110	73%	32.73	18	0.80	A	0.22	A
2026 No Development	3494	23	80	110	73%	32.73	107	4.64	E	1.27	C
2026 With Development	3523	23	80	110	73%	32.73	108	4.68	E	1.28	C
West Arm Northbound - AM											
2017 Existing	631	20	22	110	20%	32.73	19	0.96	B	0.77	A
2026 No Development	2009	20	22	110	20%	32.73	61	3.07	D	2.46	D
2026 With Development	2009	20	22	110	20%	32.73	61	3.07	D	2.46	D
West Arm Southbound - AM											
2017 Existing	281	22	22	110	20%	32.73	9	0.39	A	0.31	A
2026 No Development	367	22	22	110	20%	32.73	11	0.51	A	0.41	A
2026 With Development	368	22	22	110	20%	32.73	11	0.51	A	0.41	A
North Arm Eastbound - MID											
2017 Existing	530	19	80	110	73%	32.73	16	0.85	B	0.23	A
2026 No Development	755	19	80	110	73%	32.73	23	1.21	C	0.33	A
2026 With Development	763	19	80	110	73%	32.73	23	1.23	C	0.33	A
North Arm Westbound - MID											
2017 Existing	595	19	80	110	73%	32.73	18	0.96	B	0.26	A
2026 No Development	753	19	80	110	73%	32.73	23	1.21	C	0.33	A
2026 With Development	778	19	80	110	73%	32.73	24	1.25	C	0.34	A
East Arm Northbound - MID											
2017 Existing	272	25	22	110	20%	32.73	8	0.33	A	0.27	A
2026 No Development	424	25	22	110	20%	32.73	13	0.52	A	0.41	A
2026 With Development	450	25	22	110	20%	32.73	14	0.55	A	0.44	A
East Arm Southbound - MID											
2017 Existing	245	23	22	110	20%	32.73	7	0.33	A	0.26	A
2026 No Development	494	23	22	110	20%	32.73	15	0.66	A	0.52	A
2026 With Development	532	23	22	110	20%	32.73	16	0.71	A	0.57	A
South Arm Eastbound - MID											
2017 Existing	423	24	80	110	73%	32.73	13	0.54	A	0.15	A
2026 No Development	846	24	80	110	73%	32.73	26	1.08	B	0.29	A
2026 With Development	855	24	80	110	73%	32.73	26	1.09	C	0.30	A
South Arm Westbound - MID											
2017 Existing	512	23	80	110	73%	32.73	16	0.68	A	0.19	A
2026 No Development	777	23	80	110	73%	32.73	24	1.03	B	0.28	A
2026 With Development	787	23	80	110	73%	32.73	24	1.05	B	0.29	A
West Arm Northbound - MID											
2017 Existing	701	20	22	110	20%	32.73	21	1.07	B	0.86	B
2026 No Development	870	20	22	110	20%	32.73	27	1.33	C	1.06	B
2026 With Development	871	20	22	110	20%	32.73	27	1.33	C	1.06	B
West Arm Southbound - MID											
2017 Existing	511	22	22	110	20%	32.73	16	0.71	A	0.57	A
2026 No Development	734	22	22	110	20%	32.73	22	1.02	B	0.82	A
2026 With Development	739	22	22	110	20%	32.73	23	1.03	B	0.82	A
North Arm Eastbound - PM											
2017 Existing	418	19	80	110	73%	32.73	13	0.67	A	0.18	A
2026 No Development	1655	19	80	110	73%	32.73	51	2.66	D	0.73	A
2026 With Development	1676	19	80	110	73%	32.73	51	2.70	D	0.74	A
North Arm Westbound - PM											
2017 Existing	591	19	80	110	73%	32.73	18	0.95	B	0.26	A
2026 No Development	705	19	80	110	73%	32.73	22	1.13	C	0.31	A
2026 With Development	706	19	80	110	73%	32.73	22	1.14	C	0.31	A
East Arm Northbound - PM											
2017 Existing	177	25	22	110	20%	32.73	5	0.22	A	0.17	A
2026 No Development	258	25	22	110	20%	32.73	8	0.32	A	0.25	A
2026 With Development	332	25	22	110	20%	32.73	10	0.41	A	0.32	A
East Arm Southbound - PM											
2017 Existing	540	23	22	110	20%	32.73	17	0.72	A	0.57	A
2026 No Development	2511	23	22	110	20%	32.73	77	3.34	D	2.67	D
2026 With Development	2516	23	22	110	20%	32.73	77	3.34	D	2.67	D
South Arm Eastbound - PM											
2017 Existing	560	24	80	110	73%	32.73	17	0.71	A	0.19	A
2026 No Development	3193	24	80	110	73%	32.73	98	4.07	E	1.11	C
2026 With Development	3200	24	80	110	73%	32.73	98	4.07	E	1.11	C
South Arm Westbound - PM											
2017 Existing	585	23	80	110	73%	32.73	18	0.78	A	0.21	A
2026 No Development	775	23	80	110	73%	32.73	24	1.03	B	0.28	A
2026 With Development	776	23	80	110	73%	32.73	24	1.03	B	0.28	A
West Arm Northbound - PM											
2017 Existing	409	20	22	110	20%	32.73	12	0.62	A	0.50	A
2026 No Development	504	20	22	110	20%	32.73	15	0.77	A	0.62	A
2026 With Development	506	20	22	110	20%	32.73	15	0.77	A	0.62	A
West Arm Southbound - PM											
2017 Existing	419	22	22	110	20%	32.73	13	0.58	A	0.47	A
2026 No Development	1656	22	22	110	20%	32.73	51	2.30	D	1.84	D
2026 With Development	1656	22	22	110	20%	32.73	51	2.30	D	1.84	D

Appendix C – TfL PCL Spreadsheet Guidance

Footpaths: Peak Hour Average PCL	TfL Spreadsheet Guidance
A+, A, A-, B+	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.
B, B-	Location width should be increased. If this is not possible, it is important that the footway is kept as clear as possible.
C+, C, C-	Location width should be increased. If this is not possible, it is important that the footway is kept as clear as possible. If this is a retail area, note that visitors will start to think about avoiding the area.
D	This footway is likely to be very uncomfortable. If it is an existing footway and it is not possible to increase the width it is important that the footway is kept as clear as possible. If it is a design, it is very important to increase the footway width.
E	This footway is likely to be extremely uncomfortable. If it is an existing footway and it is not possible to increase the width it is important that the footway is kept as clear as possible. If it is a design, it is very important to increase the footway width.

Footpaths: Average of Maximum Activity PCL	TfL Spreadsheet Guidance
A+, A, A-, B+	Even when under additional stress, the footway on this site should be comfortable.
B, B-	This level of comfort is appropriate for periods of additional stress for all Area Types
C+, C, C-	This level of comfort is appropriate for periods of additional stress in Office and Retail and Transport Interchange sites.
D	This footway is likely to be very uncomfortable. If possible, the footway width should be increased. If this is not possible, it is important that the footway is kept as clear as possible.
E	This footway is likely to be extremely uncomfortable. If possible, the footway width should be increased. If this is not possible, it is important that the footway is kept as clear as possible.

Crossings: Peak Hour Average PCL	TfL Spreadsheet Guidance
A+, A, A-, B+, B, B-	The crossing should be comfortable for its intended use, at most times. However you may need to re-assess the crossing in future if significant changes occur in land use or pedestrian activity.
C+, C, C-, D, E	There is not enough space for people to use the crossing arm comfortably. This could be improved by adjusting the signal times, increasing the width of the crossing or a combination of these two measures.

Appendix D – TfL Guidance Document

Pedestrian Comfort Guidance for London

Guidance Document

MAYOR OF LONDON

Transport for London

Pedestrian Comfort Level Guidance

First Edition 2010

This Pedestrian Comfort Level Guidance has been commissioned by Transport for London.

Thanks are due to:

Julie Dye, Tom Frith, and Oliver Lord

Rob Edwards

Brett Little

Dave Condon

John Lee

Danny Calver

Crispin Rees

Clare Woodcock and Lucy Godfrey

First Edition by Atkins 2010

Team led by Elspeth Finch

For further Information please contact:

Transport for London
Palestra
197 Blackfriars Road
Southwark
London
SE1 8NJ
Website: www.tfl.gov.uk/walking
Email: walking@tfl.gov.uk

Transport for London

Contents

Introduction

Who should use this guide?

This guide and accompanying spreadsheet is aimed at anyone involved in the planning of London's streets, whether TfL staff, local authority officers, elected members, consultants assessing the impact of development proposals, developers, or their agents. It is intended to ensure that the design of pedestrian footways and crossings are appropriate to the volume and type of users of that environment. The guidance is applicable whether evaluating a new design or assessing an existing footway.

What is the guide for?

The primary objective of the guidance is to assist those responsible for planning London's streets to create excellent pedestrian environments through a clear, consistent process during the planning and implementation of transport improvement projects.

For **existing sites;** undertaking a comfort assessment will identify priorities for action or attention, the cause of these issues and help to identify mitigation measures to make the site more comfortable.

For **schemes in development;** undertaking a comfort assessment will identify any potential problems at an early stage. Mitigation measures, such as the relocation of street furniture, can then be decided upon if required.

Why this guide is important

Footway provision is an essential factor in encouraging or hindering walking. Providing appropriate footways is important as:

- They encourage walking. The research underpinning this guidance has found that lack of comfort on footways discourages use of an area by pedestrians.
- In London, encouraging people to walk short trips will relieve pressure on public transport and promote more sustainable, environmentally friendly travel, with added health benefits. Moreover, regularly making trips on foot benefits the health of individuals as well as bringing wider economic and community benefits.
- Journeys conducted entirely on foot make up 24% of all trips in London. In addition, most other trips involve some walking (for example from the bus stop to home and vice versa). Therefore creating well designed pedestrian environments benefits everyone.

Recognising this, TfL has developed this guidance to improve the planning and design of the pedestrian environment and encourage walking. This guidance is tailored to the needs of London and provides a comprehensive approach by:

- Taking into account different user behaviour within a variety of area types, from high streets to transport interchanges.
- Including the real impact of street furniture and static pedestrians, for example, window shoppers.
- Going further than existing measures such as Fruin Level of Service which simply assess crowding. This guidance is based on comfort and takes into account user perceptions as well as observed behaviours.
- Providing a standard approach for the assessment and review of comfort on footways and crossings.
- Providing a template for recording data and generating results.

The Pedestrian Comfort Level for London should be considered when assessing both footways and formal pedestrian crossings. The provision of comfortable crossing facilities supports road crossing in a planned manner and may reduce the number of informal crossings that occur. Although tailored to London, as the guidance is based on area types it is applicable in other locations.

How to use this guide

This guidance document contains the method for carrying out a comfort assessment and guidance on reviewing the results. This has been designed with an accompanying spreadsheet for recording data and calculating the results.

The spreadsheet is available to download from http://boroughs.tfl.gov.uk/1058.aspx

If the design is at an early stage, **recommended minimum widths** can be found on page 25 in the appendix. This information provides an initial indication as to comfortable footway widths in different environments in advance of a full comfort assessment.

Undertaking a comfort assessment

Pedestrian Comfort Levels classify the level of comfort based on the level of crowding a pedestrian experiences on the street. Guidance is provided for different area types and times of day.

Pedestrian crowding is measured in pedestrians per metre of clear footway width per minute. This is calculated from data on pedestrian activity and the street environment.

This Pedestrian Comfort Level Guidance caters for both footways and pedestrian crossing points to ensure that the full pedestrian environment is assessed and reviewed. Figure 1 summarises this assessment and review process which is detailed on the following pages.

Although use of this tool for internal reviews during the design cycle is encouraged, it is assumed that some schemes will be subject to an external review from a reviewing authority. This is likely to be the planning or highway authority responsible for the site. The scope of the assessment and any assumptions should be agreed with the reviewing authority before the process begins.

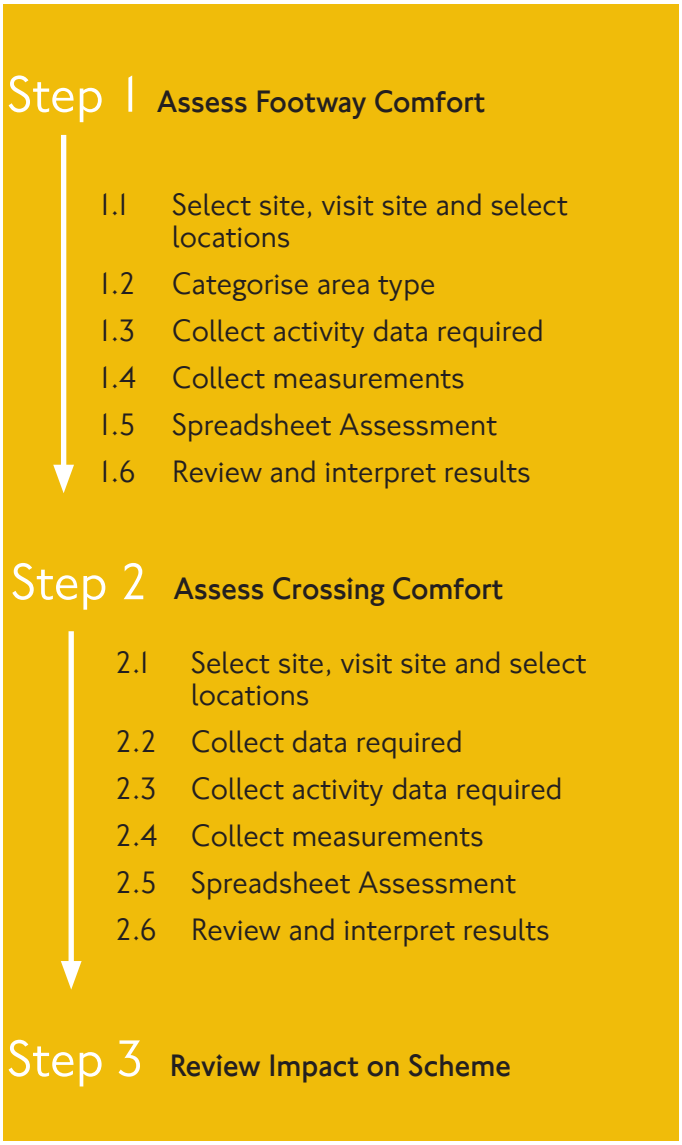


Figure 1 Pedestrian Comfort Level Assessment and Review Process

Step 1 Assess Footway Comfort

STEP 1.1 Select Site and Locations

The aim of a pedestrian comfort assessment is to understand the pedestrian experience as people walk along the street. Therefore a number of locations along a street (the site) are assessed to understand the level of comfort, and how this may change due to street furniture or changes in width for example. A Pedestrian Comfort Level (PCL) is calculated for each location, allowing a review of the whole site as well as individual problem areas. The assessment does not look at the quality of the footway or associated issues such as maintenance and rubbish that may affect the use of an area. Other assessments exist for these issues.

The site for the comfort assessment will be defined at the outset of the process in agreement with the reviewing authority. A site visit should then be undertaken to agree the boundaries of the site, the locations for assessments and to consider the following questions:

- What area type is the site (see step 1.2)?
- Are there any locations with high static activity (e.g. meeting friends, queuing, taking photographs) that may require a static activity survey? For more information see Appendix D: Measuring Pedestrian Activity on page 33.
- Do people cross away from the formal crossing facilities?
- Are there signs that the site is a route to and from school? This could include school age children, school crossing wardens and other indicators such as “only two schoolchildren at a time” signs on the local shops.
- Any other notes about pedestrian activity and behaviours that may be relevant.

If the scheme is in development and a site visit is impossible, or the scheme is going to significantly change the flow and activity profile in the area (e.g. a new shopping centre) assumptions should be agreed with the reviewing authority before the assessment begins.

The number of locations assessed will be specific to each site, but may include (where appropriate):

- A location with the typical footway width for the site and no street furniture.
- Locations where full footway width changes, and there is no street furniture.
- Locations which include the typical street furniture.
- Locations where there are bus stops, cafes, market stalls or other locations where there are high levels of people waiting.
- Locations where the street furniture are not aligned parallel to the building edge or kerb edge or there are more than two pieces within a length of three metres.

STEP 1.2 Categorise Area Type

Following the site visit, classify your site as one of the following area types. This will inform the data requirements for the assessment, and later, the impact of the results.

Not all sites fall into a distinct area type, for example a site could include a tourist attraction and commercial office buildings. In this situation, agree with the reviewing authority how you are going to conduct the data collection and assessment.

High Street

Areas dominated by a range of retail and food and drink premises represent a focus for the communities that use the services they offer.
Peak Pedestrian Time: Saturday 14:00 to 18:00, although weekday flows often have similar levels

Office and Retail

Areas dominated by substantial government and/or commercial office buildings. These streets experience high volumes of pedestrians.
Peak Pedestrian Time: Weekday 08:00 to 10:00 or 16:00 to 19:00

Residential

These areas are characterised by privately owned properties facing directly onto the street.
Peak Pedestrian Time: Weekday 14:00 to 19:00

Tourist Attraction

An area with high tourist activity. This could include attractions such as Madame Tussauds or renowned "sights" such as the South Bank, the Royal Parks etc.
Peak Pedestrian Time: Saturday 12:00 to 17:00

Transport Interchange

Transport Interchanges help to provide seamless journeys for people travelling in London. They range from local interchange between rail and bus to National Rail interchanges.
Peak Pedestrian Time: Weekday 08:00 to 10:00, 16:00 to 19:00

STEP 1.3 Collect Activity Data

To carry out a Pedestrian Comfort assessment, the following pedestrian activity data is required. A methodology for collecting this data can be found in Appendix C: Street Furniture on page 26.

- Pedestrian flow data for footways and crossings.
- A static activity survey to record the reduction in space available for walking from static activity unrelated to street furniture (meeting friends, queuing, taking photographs) is recommended at regional retail centres and tourist attractions as these areas tend to generate a lot of this activity.
- Also note any other relevant activity (e.g. delivery operating times if a loading bay is present).

STEP 1.4 Collect Measurements

To carry out a Pedestrian Comfort assessment, data on the footway width and the location and type of street furniture is required. This is used to calculate the clear footway width, which is the space available for walking after street furniture and its associated buffers are taken into account. This can be measured on site or from suitable records (e.g. a topographic survey). An explanation of the buffers for different street furniture can be found in Appendix C.

When collecting the measurements you may find it useful to mark up a plan with the buffers around each of the objects, as shown in the example below. This allows any space between object buffers that is less than 0.6m (standard body ellipse) to be identified as this should not be included in the clear footway width. The example below can also be found on the footway tab of the spreadsheet.

Diagram showing how to collect measurement data:

- A) This location is the typical width for the street. It has no street furniture, therefore you simply need to enter the total width (9.7m) into the spreadsheet. The spreadsheet will then deduct the standard kerb and building edge buffer (both 0.2m) to calculate the clear width (9.3m).
- B) This location has two pieces of street furniture. First enter the total width into the spreadsheet (8.3m). Then enter the size of the street furniture and the buffers around them. Finally, from the marked up plan, check that the smaller spaces e.g. between the signal box and cycle parking is more than 0.6m (standard body ellipse). In this case the space between the space between the signal box buffer and the kerb buffer is 0.45m. This is entered into the spreadsheet as "unusable space" and is not included in the clear footway width.
- C) As with location B, enter the total width and the size of the street furniture and associated buffers. Finally, double check that the space between the cycle parking buffers and the kerb and building line buffer is more than 0.6m (it is 0.85m).
- D) As with location A this location does not have any street furniture but is measured as it represents a significant change in width from the rest of the street. Simply enter the total width into the spreadsheet to work out the clear footway width.

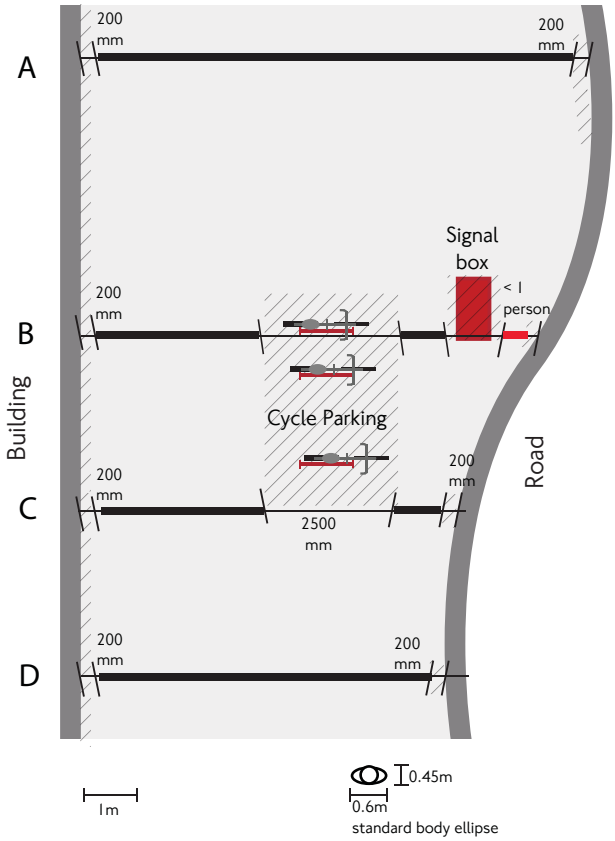


Figure 2 Example of marking up a site for assessment

STEP 1.5 Spreadsheet Assessment

Using the data and information collected in steps 1.1 to 1.5, use the "Worksheet (Footway)" tab of the spreadsheet to calculate the crowding and therefore the Pedestrian Comfort Level for each of the locations on your site. Figure 3 below shows how the spreadsheet looks.

1. Input Activity Data

For each location enter the activity data for the site

- Location name - this is defined by you.
- Area Type - this is a drop down box.
- Average Flow - average of all the samples taken throughout the survey hours.
- Peak Hour Flow- average of the samples recorded in the peak hour.
- Average of Maximum Activity - this is automatically calculated by the spreadsheet as a check. It is based on an average of the busiest 10 second samples from the research underpinning the project.

2. Input Measurement Data

Using your measurements taken on site or from records such as a topographic survey and the buffer zones from street furniture (outlined in Appendix C) complete the measurement data for each location - this is columns J to V and is measured in metres.

If, after the consideration of street furniture and its buffer zone, there is any space for movement that is less than 0.6m wide (a standard body ellipse) this should be entered into column M "Any unsuable width" in metres.

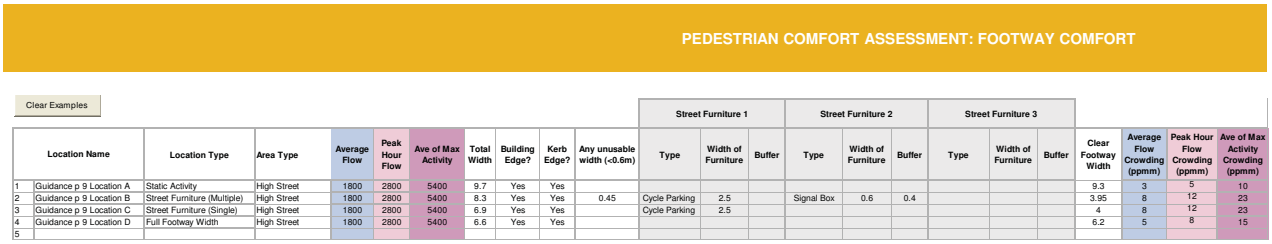
3. Calculations

The spreadsheet will then automatically calculate the following:

- Clear Footway Width - This is the space left for walking after the standard wall and kerb buffers and any street furniture is taken into account
- Crowding - Pedestrian crowding is measured in pedestrians per metre of clear footway width per minute (ppmm) and is calculated using the following formula:

  people per hour ÷ 60 ÷ clear footway width in m

  This is calculated for Average Flow, Peak Hour Flow and Average of Maximum activity
- Pedestrian Comfort Level Categorisation - The crowding level (ppmm) is then categorised according to the Pedestrian Comfort Level scale. See page 13 for more information on this scale.
- Clear Footway Width required for PCL B+ - The spreadsheet also calculates the clear footway width required to achieve a PCL of B+. This is to aid decision making, as PCL B+ is the recommended level of comfort for most area types.



PEDESTRIAN COMFORT ASSESSMENT: FOOTWAY COMFORT

Clear Examples

	Location Name	Location Type	Area Type	Average Flow	Peak Hour Flow	Ave of Max Activity	Total Width	Building Edge?	Kerb Edge?	Any unusable width (<0.6m)	Street Furniture 1			Street Furniture 2			Street Furniture 3			Clear Footway Width	Average Flow Crowding (ppmm)	Peak Hour Flow Crowding (ppmm)	Ave of Max Activity Crowding (ppmm)
											Type	Width of Furniture	Buffer	Type	Width of Furniture	Buffer	Type	Width of Furniture	Buffer				
1	Guidance p 9 Location A	Static Activity	High Street	1800	2800	5400	9.7	Yes	Yes											9.3	3	5	10
2	Guidance p 9 Location B	Street Furniture (Multiple)	High Street	1800	2800	5400	8.3	Yes	Yes	0.45	Cycle Parking	2.5		Signal Box	0.6	0.4				3.95	8	12	23
3	Guidance p 9 Location C	Street Furniture (Single)	High Street	1800	2800	5400	6.9	Yes	Yes		Cycle Parking	2.5								4	8	12	23
4	Guidance p 9 Location D	Full Footway Width	High Street	1800	2800	5400	6.6	Yes	Yes											6.2	5	8	15
5																							

Figure 3 The "Worksheet (Footway)" tab

STEP 1.6 Review and Understand Results

After completing the calculations, change to the "Print Sheet (Footway)" tab of the spreadsheet. This sheet summarises the results for each location and has four main sections.

Summary Information

This section summarises the key information about each location including the area type, activity levels, the space available for movement and the footway space used by street furniture and its associated buffers (impact of street furniture).

Summary Info	Location Name	Guidance p 9 Location A
	Location Type	Static Activity
	Area Type	High Street
	Average Flow (PPH)	1,800
	Peak Hour Flow (PPH)	2,800
	Total Footway Width	9.7m
	Clear Footway Width	9.3m
	Total Street Furniture Impact	0m

Figure 4 Summary information as shown on printing tab

Pedestrian Comfort Level

This section highlights the Pedestrian Comfort Level (PCL) the site operates at during the **Peak Hour Flow**. Footways should be designed to operate comfortably during the peak hour. This is colour coded to aid understanding. As well as identifying the PCL this section highlights the clear width required for PCL B+ and the total width required for PCL B+ (assuming the street furniture at the site remains the same).

A guide to the Pedestrian Comfort Levels can be found on page 13.

This section also highlights the PCL for the **Average of Maximum Activity**. This is included as a check to allow you to understand how the footway may feel in the busiest times. This will only impact your review of the footway if the results are significantly different than the peak hour flow. More information is included in the impact section.

Pedestrian Comfort (At peak hour flow levels)	Pedestrian Comfort Level (PCL)	A : 5 ppmm
	Total Width Required for PCL B+	4.29
	Clear Width Required For PCL B+	3.89
Pedestrian Comfort (Average of Maximum Activity)	Pedestrian Comfort Level (PCL)	B+ : 10 ppmm
	Total Width Required for PCL B+	7.91
	Clear Width Required For PCL B+	7.51

Figure 5 Pedestrian Comfort Level results

Impact

Using the PCL and area type, the spreadsheet provides an explanation of the impact of the Pedestrian Comfort Level at each location for both Peak Hour Flow and the Average of Maximum Activity. This is to inform your decision making in the next stage.

The information and recommendations provided in this section are based on the guidance outlined in the table on page 14.

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.
Impact	Pedestrian Comfort at Average of Maximum Activity	Even when under additional stress, the footway on this site should be comfortable.

Figure 6 Example of impact section on printing tab

Notes and Mitigation

This section allows you to provide extra information to inform the discussion with the reviewing authority. The notes field can be used to highlight issues such as a high number of conflicts at the site, or additional footway reduction caused by illegally parked bikes or rubbish etc.

The mitigation section is where suggestions for action and agreed action points should be recorded. More about this can be found overleaf.

Impact	Notes	
Impact	Mitigation	

Figure 7 Example of Mitigation section on printing tab

STEP 1.6 Review and Understand Results

Mitigation Measures

Once the assessment is complete, it may be necessary to consider mitigation measures to ensure the footway is as comfortable as possible. This should be done for individual locations (e.g. relocate or remove a post) but it is important to consider how consistent the comfort level is as people walk along the street. This section summarises what type of actions may be considered.

All Locations are Comfortable

If all the locations within your site meet the recommended comfort level for the area type the footway on this site should be comfortable for its intended use at most times. However you may need to reassess the site in the future:

- If temporary obstructions such as road blocks or hoardings are erected
- If significant changes occur in land use or pedestrian activity
- If new street furniture is installed such as wayfinding signs

A Single Location is Uncomfortable

If a single location within your site does not meet the recommended comfort level the first action is to create additional footway space by either removing or repositioning street furniture or increasing the footway width. This is especially important if the PCL is Level D or E as the footway will be extremely uncomfortable at this location.

If this is not possible it is important that the footway in the immediate area (6m either side) is clear of obstructions to ensure this pinch point is not perceived as a reason to avoid the area.

Multiple Locations are Uncomfortable

If more than one location within your site does not meet the recommended comfort level the perception of comfort at the site may be very low. A review of the street furniture on the site should be undertaken to create as much footway space for walking as possible. If there are locations where street furniture cannot be moved (e.g. signal posts) it is important to create free space for movement in the immediate area (6m length either side) to avoid the creation of a “slalom” for walking where pedestrians need to keep adjusting their route to bypass different street furniture objects.

All Locations are Uncomfortable

If all the locations within your site do not meet the recommended comfort level for the area type it is important that the space for walking is increased by moving or repositioning street furniture and/or increasing the footway width.

If the inadequate footway space is caused by static activity (people standing, sitting or queuing) the footway width may have to be increased. If this is not possible, it is important that the footway is kept clear of unnecessary street furniture. In addition, soft measures could be used to reduce the amount of static behaviour e.g. the operation of a queue could be discussed with the owner of an attraction or a meeting point in a less busy area could be created.

There are some situations where a lower level of comfort can be acceptable. For example, the vitality provided by on street cafe seating could compensate for a lower comfort level at that section of footway. However, even in this situation the PCL should not be lower than C+ at peak times.

Comfortable

PCL A — COMFORTABLE FOR ALL AREAS

A+ < 3ppmm
< 3% Restricted Movement

A 3 to 5 ppmm
13% Restricted Movement

A- 6 to 8 ppmm
22% Restricted Movement

The pedestrian environment is very comfortable at PCL A+ to A- with plenty of space for people to walk at the speed and the route that they choose.

PCL B — B+ RECOMMENDED MINIMUM FOR ALL AREAS

B+ 9 to 11ppmm
31% Restricted Movement

B 12 to 14ppmm
41% Restricted Movement

B- 15 to 17 ppmm
50% Restricted Movement

PCL B+ is the recommended level of comfort for all area types. This level provides enough space for normal walking speed and some choice in routes taken.
At PCL B and PCL B- normal walking speed is still possible but conflicts are becoming more frequent and, in retail areas, people start to consider avoiding the area.

PCL C — INCREASINGLY UNCOMFORTABLE

C+ 18 to 20ppmm
59% Restricted Movement

C 21 to 23 ppmm
69% Restricted Movement

C- 24 to 26 ppmm
78% Restricted Movement

The pedestrian environment is becoming increasingly uncomfortable, with the majority of people experiencing conflict or closeness with other pedestrians and bi-directional movement becoming difficult.

PCL D or E — VERY UNCOMFORTABLE

Uncomfortable

D 27 to 35ppmm
100% Restricted Movement

E >35 ppmm
100% Restricted Movement

At PCL D walking speeds are restricted and reduced and there are difficulties in bypassing slower pedestrians or moving in reverse flows.

At PCL E people have very little personal space and speed and movement is very restricted. Extreme difficulties are experienced if moving in reverse flows.

Figure 8 Pedestrian Comfort Levels on Footways

Figure 9 summarises which Pedestrian Comfort Level is suitable for different area types for use in the peak hour, and for the Average Maximum Activity level. This table informs the comments generated by the spreadsheet.

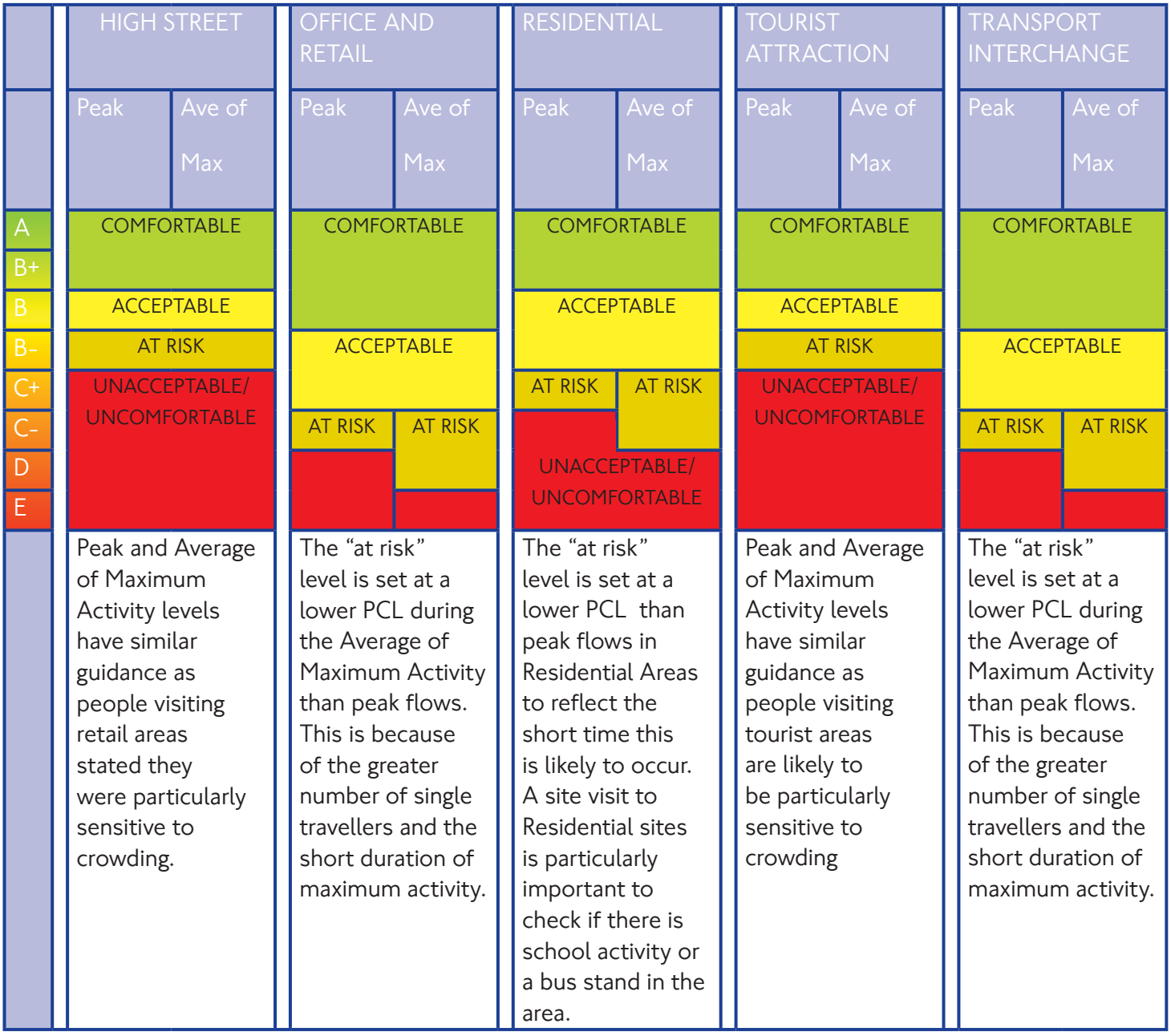


Figure 9 Guidance for different area types

Step 2 Assess Pedestrian Crossings

STEP 2.1 Select Site

The aim of a pedestrian comfort assessment on a crossing is to understand whether the infrastructure for crossing the road is comfortable for users. This is important to review as it will influence both the level of compliance on the crossing and how pedestrians perceive severance in the area. The crossing assessment evaluates three aspects of comfort when crossing the road:

- Is it comfortable to cross from one footway to another (or to the road island) in the space provided by the crossing arm?
- If the crossing has an island, is it comfortable to walk from one arm of the crossing to the other?
- How many rows of people will form when waiting to cross from the island to the footway?

All three aspects of the crossing should be shown to be comfortable, otherwise the design of the crossing may need to be reconsidered.

Note that a range of factors influence road crossing behaviour on signal controlled crossings and the assessment does not consider other important factors such as whether the crossing is aligned with pedestrian desire lines, or the impact of people waiting to cross on the clear footway width.

The research for this project was undertaken on pelican crossings. It is anticipated that this will be applicable to puffin crossings, although further research may be required due to the different signal timings and location of the pedestrian green man signal.

If you are undertaking an assessment of a crossing as part of a wider site assessment, you will already have visited the site as part of step 1.1. If you are undertaking the crossing assessment as a stand alone assessment you should visit the site to consider the following questions as these may affect the data you collect:

- What area type is the site (see step 1.2)?
- Are there signs that the site is a route to and from school? This could include school age children, school crossing wardens and other indicators such as “only two schoolchildren at a time” signs on the local shops.
- Do people cross away from the formal crossing facilities?
- Does the size of the queue waiting to cross significantly interfere with people walking along the footway?
- Any other notes about pedestrian activity and behaviours that may be relevant.

STEP 2.2 Collect Data Required

To undertake the crossing assessment the following data is required:

- The total demand for crossing the road. This includes people crossing during the green man, blackout and red man pedestrian phases. The methodology for collecting this data can be found in Appendix D.

The signal timings for the pedestrian phases of crossings (green man, blackout and red man) in seconds. If the crossing has a variable cycle length a number of cycles should be recorded and the median taken.

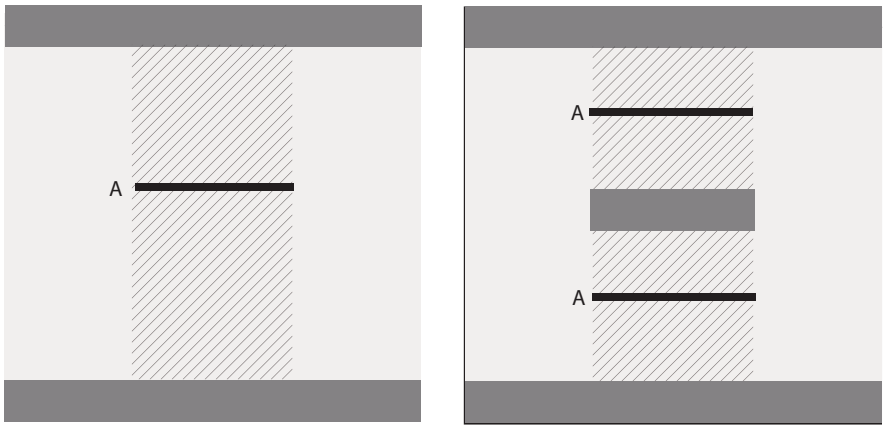
- Measurements of the crossing arms and island, if present, in metres.

The diagrams on this page show what measurements are required for different types of crossings.

Straight Across Crossing

A) The comfort of the crossing arm is assessed using the width of the arm (stud to stud) in metres.

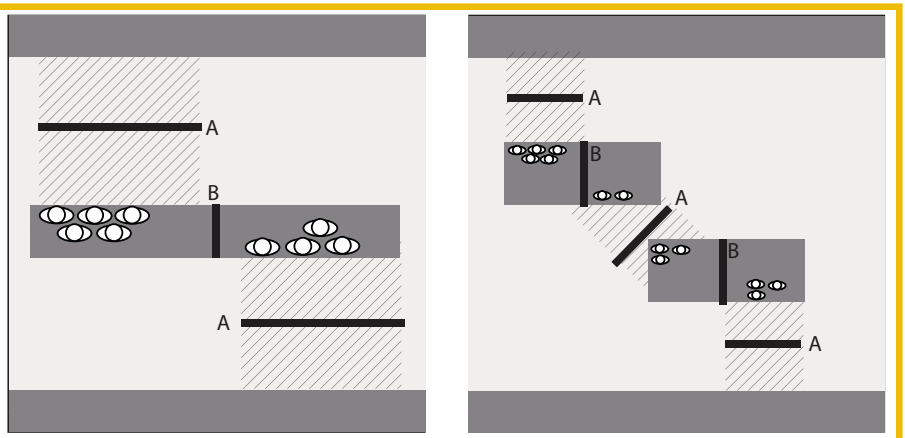
On straight across crossings, islands are designed to provide temporary shelter and are therefore not assessed.



Staggered and Multi-Armed Crossing

A) The comfort of the crossing arm is assessed using the width of the arm (stud to stud) and the demand for crossing the road. This measure is also used to assess the number of rows that form on the island as people wait to cross from the island to the footway.

B) The width of the crossing island (between guard rail if present) is used to assess the comfort of the island as people walk from one arm of the crossing to the other.



Note that on staggered and multi-arm crossings, each arm and its associated queue on the island will be assessed separately, although the results are reviewed together. That is, if any one part of the assessment is found to be uncomfortable the design of the whole crossing should be reconsidered.

STEP 2.3 Enter Data into Spreadsheet

Using the data collected in step 2.2 use the "Worksheet(Crossings)" tab of the spreadsheet to calculate the crowding and therefore the Pedestrian Comfort Level for each of the locations on your site.

1. Input Activity Data

For each location enter the activity data for the site:

- Location name /Arm.
- Average Flow - average of all the samples taken throughout the survey hours.
- Peak Flow- average of the samples recorded in the peak hour.

2. Input Measurement & Signal Time Data

Measurements for each arm should be taken on site or from a suitable record such as a topographic survey in metres, and entered into the spreadsheet (columns G to H).

Record the green man, red man and blackout time in seconds in column I to K. The total signal time will then be calculated from these numbers.

3. Calculations

The spreadsheet will then automatically calculate the following:

- % time available to cross - This is the proportion of time in a signal cycle that people can cross the road (during the green man and blackout periods).
- Relative People Per Hour (rpph) - This figure is calculated to use in the assessments, as the people per hour (pph) figure used on footways assumes that movement along the street is distributed evenly, i.e. 60pph means that 1 person will pass a point each minute. On crossings this is not the case as people should only cross during the pedestrian crossing phases. To reflect this the "relative pph" is calculated by dividing the pph by the % of time available to cross. Therefore a pph of 60 where people can cross the road 20% of the time is equivalent to 300pph.
- Crowding on the crossing arm - Pedestrian crowding is measured in people per metre minute of the width of the crossing arm (ppmm) and is calculated using the following formula:

  relative people per hour ÷ 60 ÷ crossing arm width in m
- Crowding on the Crossing Island - Pedestrian crowding is also measured in ppmm using the width of the crossing island (ppmm) and is calculated using the following formula:

  relative people per hour ÷ 60 ÷ crossing arm width in m
- Pedestrian Comfort Level Categorisation - The crowding level (ppmm) is then categorised according to the Pedestrian Comfort Level scale for both the crossing arm and the crossing island which is found on page 20.
- Queues on the crossing island -This section first works out how many people can queue parallel to the road (a row), based on the width of the crossing arm and the standard body ellipse.

  Then, based on the demand for crossing the road and the number of cycles per hour, it works out the average people waiting to cross per cycle. This is the average size of the queue.

  Finally the number of rows that are likely to form is calculated by dividing the average size of queue by the number of people in a row.
- Pedestrian Comfort Level Categorisation for Number of People Queuing - The number of rows that is likely to form in each cycle is then categorised according to the Pedestrian Comfort Level for crossing islands. As the queues that form would be very dense, it was found that more than three rows encouraged crossing outside of the island.

STEP 2.4 Review and Understand Results

After completing the calculations, change to the "Print Sheet (Crossing)" tab of the spreadsheet. This sheet summarises the results for each location and has four main sections.

Summary Information

This section summarises the key information about each arm of the crossing.

Summary Info	Location Name	Location 1 Eastern Arm		
	Area Type	Office Retail		
	Average Flow (PPH)	149		
	Peak Hour Flow (PPH)	166		
	Width of Crossing Arm	4m		
	Width of Island (for people to pass)	2.6m		
	Signal Timings	Green Man 4.5s	Interblack 5s	Red man 50s

Figure 10 Summary information shown on printing tab

Results for each assessment

The spreadsheet then highlights the Pedestrian Comfort Level (PCL) for each assessment, and provides an explanation of the impact of the Pedestrian Comfort Level at peak times. This is to inform your decision making in the next stage.

A guide to the Pedestrian Comfort Levels for each assessment can be found on Figure 12 on page 20.

Pedestrian Level of Comfort (PCL) (Crossing Arm)	PCL for Average Flows	A: 4 ppmm
	PCL for Peak Hour Flows	A: 4 ppmm
Impact	Pedestrian Level of Comfort (PCL) (Crossing Arm) at Peak Hour Flows	The crossing should be comfortable for its intended use, at most times. However you may need to re-assess the crossing in future if significant changes occur in land use or pedestrian activity.

Figure 11 PCL result and impact as shown on printing tab

Notes and Mitigation

This section allows you to provide extra information to inform the discussion with the reviewing authority. The notes field can be used to highlight issues such as a high number of cyclists or that traffic often waits across the stop line, blocking the crossing.

The mitigation section is where suggestions for action and agreed action points should be recorded.

If any aspect of the crossing is uncomfortable, the design of the crossing may need to be reconsidered or the signal timings adjusted.

STEP 2.4 Review and Understand Results

Mitigation Measures

Once the assessment is complete, it may be necessary to consider mitigation measures to ensure the crossing is as comfortable as possible. This section summarises what type of actions may be considered.

Pedestrian Comfort Level on the Crossing arm is C-, D or E

The Pedestrian Comfort Level could be improved by adjusting the signal timings, increasing the width of the crossing or a combination of these two measures.

The crossing should then be re-assessed to ensure the solution will be comfortable for users.

Pedestrian Comfort Level when using the island (space to pass) is C-, D or E

The Pedestrian Comfort Level could be improved by adjusting the signal timings, increasing the width of the island or a combination of these two measures. The design of the crossing could also be reconsidered as a straight across crossing may work better in this situation.

The crossing should then be re-assessed to ensure the solution will be comfortable for users.

More than two rows of people form on the island when waiting to cross

Three rows of people are likely to be acceptable at peak times. However if this is happening throughout the day, or the spreadsheet predicts more than three rows of people, it is important to try and reduce the number of rows forming to ensure the crossing is comfortable. This can be achieved by adjusting the signal timings, increasing the width of the crossing, or a combination of these two measures. The design of the crossing could also be reconsidered. A straight across crossing may work better in this situation.

The crossing should then be re-assessed to ensure the solution will be comfortable for users.

Pedestrian Comfort Level: Crossing Arms & Space to Pass on Island

Comfortable

Uncomfortable

PCL A — COMFORTABLE FOR ALL AREAS

A+ < 3ppmm
< 3% Restricted Movement

A 3 to 5 ppmm
13% Restricted Movement

A- 6 to 8 ppmm
22% Restricted Movement

The crossing is very comfortable at PCL A+ to A- with plenty of space for people to walk at the speed and that they choose.

PCL B — PCL B- RECOMMENDED

B+ 9 to 11ppmm
31% Restricted Movement

B 12 to 14ppmm
41% Restricted Movement

B- 15 to 18 ppmm
50% Restricted Movement

The crossing continues to be comfortable at PCL B+ to B- . **PCL B- is the recommended level of comfort for crossing arm and the space required for people to cross on an island (if present).**

PCL C, D, E — INCREASINGLY UNCOMFORTABLE

C 18 to 26ppmm
59% Restricted Movement

D 27 to 35ppmm
100% Restricted Movement

E >35 ppmm
100% Restricted Movement

If a crossing operates at PCL C, D or E the level of crowding may encourage users to cross away from the formal facilities.

Figure 12 PCL for Crossing Arm & Space to Pass on Island

Pedestrian Comfort Level: Queues on Crossing Islands

Comfortable

Uncomfortable

PCL A, B, C

PCL B RECOMMENDED FOR ALL AREA TYPES

A One Row

B Two Rows

C Three Rows

Once two rows of people form on the island people start to cross elsewhere. **PCL B (t o ro s) is the recommended num er of ro s ith up to ro s (PCL C) eing appropriate at us times.**

PCL D,E

D Four Rows

E More Than Four Rows

Once four rows or more form the island becomes very crowded. People begin to avoid the crossing island. In addition, anyone attempting to cross on the red man phase would not be able to shelter on the island.

Figure 13 PCL for Queues on Crossing Islands


TARBUCKS
COFFEE
HOLLAND
&
BARRETT
Nationwide
Zee&Co

Step 3 Review Impact on Scheme

This Pedestrian Comfort Level Guidance is designed to be a useful tool in both internal design processes and in dialogue with a reviewing authority. This is likely to be the planning or highway authority responsible for the site.

The Pedestrian Comfort Assessment is designed to inform a dialogue about a scheme by understanding how the scheme operates in practice, how this is perceived by users and what the impact of this is. For example, extreme crowding on a retail site is likely to put people off visiting the area in future. This will allow a more informed balance between the needs of different road users and a design that will work for all users.

Appendix A: About the research

This research was commissioned as TfL identified a need for consistent guidance for what footway widths should be used for comfortable movement in different situations, tailored to the needs of London.

The work and research undertaken by Fruin, and the Highway Capacity Manual, provided a basis for assessing footway comfort. However, as new ideas and research have arisen in the last ten years a range of new and innovative methods were used to understand and analyse pedestrian comfort.

Therefore a detailed study of over 75 sites across the Transport for London Road Network was undertaken to measure the following aspects of pedestrian behaviour:

- Detailed pedestrian flow information. This provided information on the level of pedestrian movement throughout the day, how the direction of movement changed throughout the day and what peaks were experienced.
- The speed of pedestrians was measured at peak and inter peak hours to assess the impact of the number of people and the direction in which they were travelling.
- The number of people who experienced restricted movement was recorded. Restricted movement is when people had to change their speed, route, experienced “shoulder brushing” or bumped into other users.
- The distance people leave between each other and between street furniture, the “passing distance”, was measured accurately using CCTV and a detailed topographic survey.
- A questionnaire survey was undertaken in a number of sites to assess peoples’ perception of comfort and how this may affect their actions.

The results of these studies were used in a comprehensive assessment of comfort in different area types, the tolerance to different comfort levels, and the passing distances people leave between each other and street furniture. This was then used to determine the guidance in this document.

The studies were undertaken using CCTV footage and through on-site surveys of pedestrian perceptions. Full details of the assessments can be found in the Pedestrian Comfort Guidance for London: Technical Report and Appendix.

Although the research was focused on TLRN roads, the results and methods are transferable across other parts of London as the guidance is organised and applied on an area type basis.

Appendix B: Recommended Widths

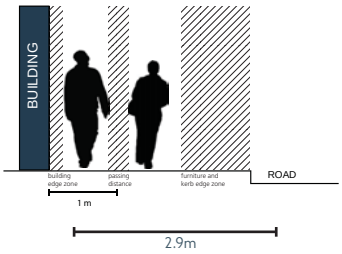
This diagram shows recommended footway widths for different levels of flow, based on the research carried out for this project. They show the total width of the footway rather than the clear footway width.

This information provides an initial indication as to comfortable footway widths in different environments in advance of a full Pedestrian Comfort Assessment.

Pedestrian comfort levels are defined on Figure 8 on page 13.

Low Flow

< 600 pph



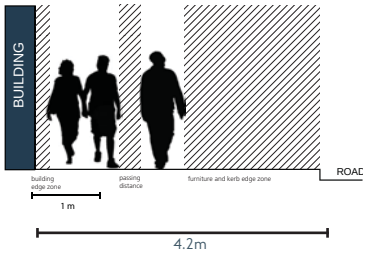
The recommended minimum footway width (total width) for a site with low flows is **2.9 m**. This is enough space for comfortable movement and a large piece of street furniture such as guard rail, cycle parking (parallel with the road), a bus flag for a low activity bus stop or a busy pedestrian crossing.

In high street or tourist areas the total width can be reduced to **2.6m** if there is no street furniture (except street lights) to allow space for people walking in couples or families and with prams etc.

In other areas, low flow streets can be **2m** wide if there is no street furniture. This total width is required for two users to pass comfortably and to meet DfT minimum standards.

Active Flow

600 to 1,200 pph



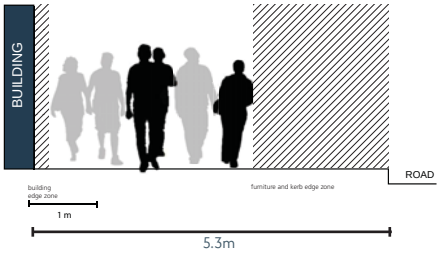
The recommended minimum footway width (total width) for a site with active flows is **4.2m**. This is enough space for comfortable movement and a large piece of street furniture such as a wayfinding sign, a bench or a bus shelter.

In high street or tourist areas the width can be reduced to **3.3m** if there is no street furniture (except street lights). This width allows two groups to pass.

In other areas, active flow streets can be **2.2m** wide if there is no street furniture. This width is required for the level of flow and to meet DfT minimum standards.

High Flow

> 1,200 pph



At this level of flow the recommended minimum footway width (total width) is **5.3 m**. This is enough space for comfortable movement up to 2,000 pph and a large piece of street furniture such as a wayfinding sign, a bench, a bus shelter or a busy pedestrian crossing.

In areas such as transport interchanges more space may be required if there are multiple bus stops on one footway. See Appendix B: Street Furniture on page 26 for more information.

If there is no street furniture, the width can be reduced to **3.3m**. This is enough space for comfortable movement up to 2,000 pph.

Appendix C: Street Furniture

A key part of the research into pedestrian comfort on footways was to investigate the real impact of street furniture on peoples' behaviour and the amount of space on the footway. For example: How much space do people leave between each other and street furniture? Where do people gather around street furniture? How many people and how do they behave? What type of street furniture generates static pedestrian activity?

Firstly, the research looked at the space people leave between themselves and the building and kerb edges. It was found that, if the footway was not busy, people tend to walk along the centre of the footway leaving a generous buffer between themselves and the building edge and kerb. However, if the footway is busy, people keep at least 200mm between the building edge or kerb and their position.

Therefore a standard buffer of 200mm has been identified for the building edge, and 200mm for the kerb edge. This means that on a footway with no street furniture the clear footway width is the total width minus 400mm.

Note that, if street furniture is placed against the wall or kerb edge, the street furniture will act as a new wall or kerb edge (i.e. buffer is not counted twice). In this situation the wall or kerb edge column in the spreadsheet should be marked "no" and the street furniture buffers used.

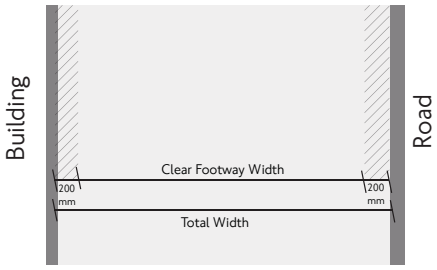


Figure 14 Unobstructed Footway

Figure 15 Examples of Location Where Guard Rail Replaces Kerb Buffer

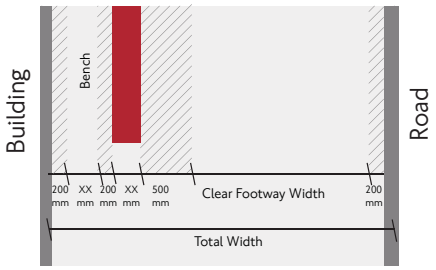


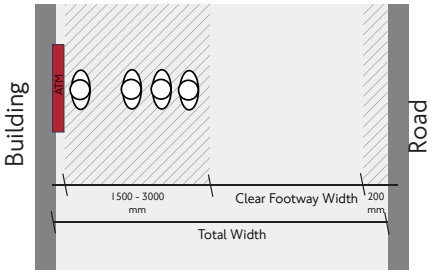
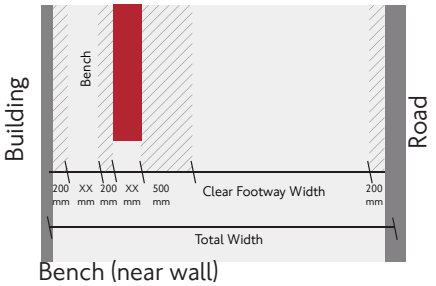
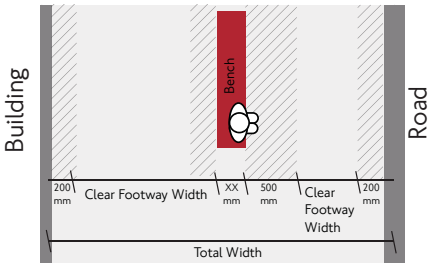
Figure 16 Examples of Location Where Bench Replaces Building Buffer

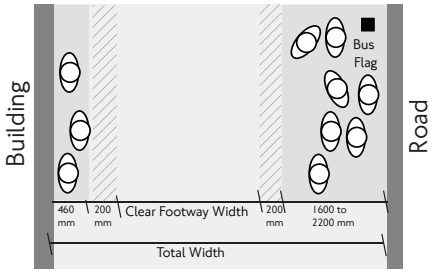
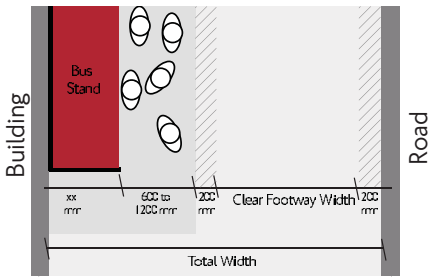
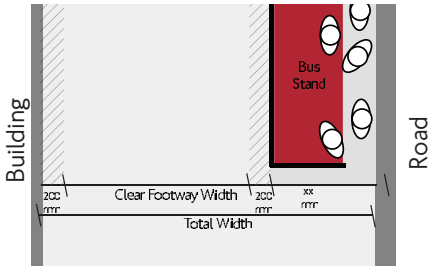
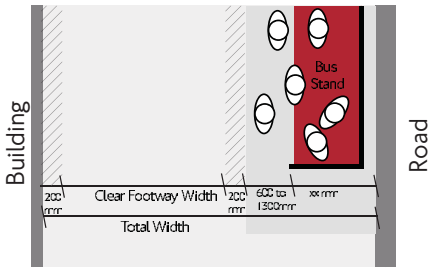
Secondly, this "passing distance" analysis was repeated for standard types of street furniture found on London's streets such as posts, bus stops, ATMs, market stalls and loading or parking bays.

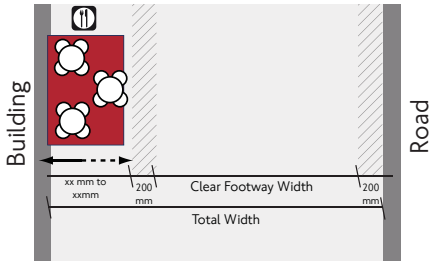
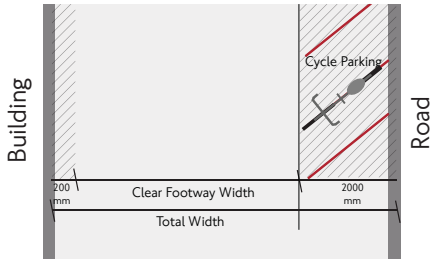
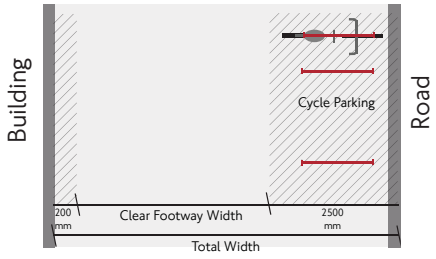
Following this analysis, and users' stated perceptions of crowding from questionnaire surveys on a selection of sites, it has been possible to determine the buffers that need to be taken into consideration when calculating Pedestrian Comfort on footways with street furniture.

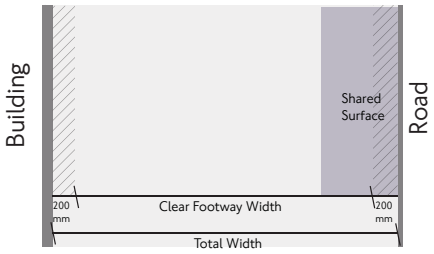
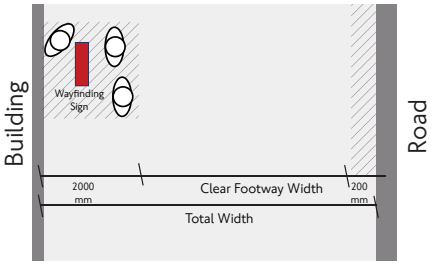
Details and diagrams of these buffers can be found on the following pages. Where a distance is marked as "xx" for example in the Bench diagram above, this is because the size of the object or its location on the footway is variable. **N.B The diagrams are not to scale.**

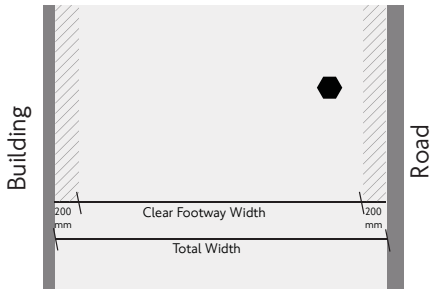
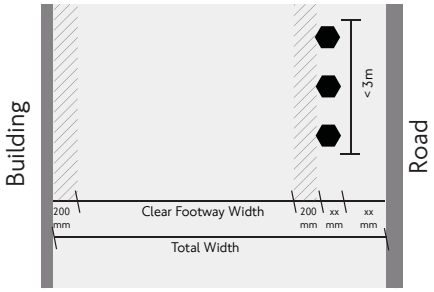
Finally, the research carried out did not evaluate the effect of restricted footway along a length of footway (e.g. a number of pieces of street furniture or multiple bus stops). Current Department for Transport guidance states that restricted footway length should be no longer than 6m. This concurs with user perceptions of street furniture. For example ATM queues and individual bus stops are not perceived to be a problem by users, whereas multiple bus stops are. Therefore this guidance should be used when undertaking Pedestrian Comfort assessments.

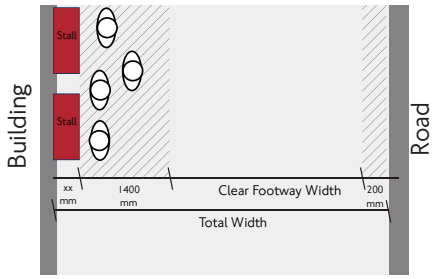
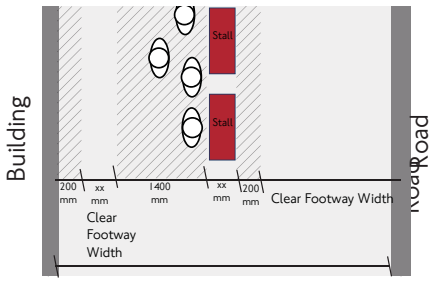
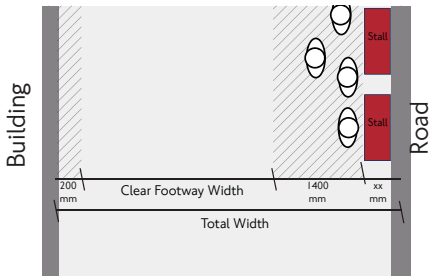
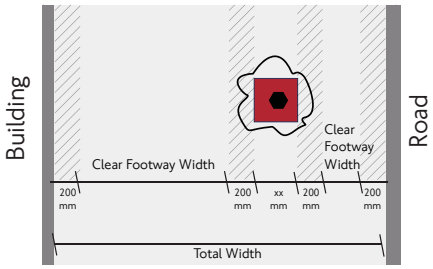
Obstruction	Description	Buffer	Diagram
ATMs			
	ATMs were not perceived to be a problem by users, probably as they expect these areas to be busy and the impact on movement is highly localised. However, queues around the ATM can reduce the clear footway width by between 1,500mm and 3000m of space depending on the area and number of machines available. The buffer should be decided following a site visit, and if necessary a static survey.	1,500 to 3000mm from ATM edge	 ATM
Benches			
	Benches reduce the clear footway width by the bench width, plus an additional 500mm in the direction of seating when in use (legs, bags etc). Note that for the bench to be attractive to people there needs to be room for two people to pass between the bench zone and the kerb or building line (1500mm clear footway width). If the bench is placed in the middle of the footway, with people able to sit facing one direction only, the reduction is 500mm plus 200mm on the other side. If you can sit facing either way the buffer would be 1,000mm (500mm either side).	500mm from Bench edge for direction of seating, 200mm on non-seating side If seating is in both directions, 1,000mm (500mm either side)	 Bench (near wall)  Bench (middle of footway)

Obstruction	Description	Diagram
Bus Stands		
Individual: General Comments	Individual Bus Stands are not perceived as causing crowding problems. However there are some points to note about the queuing patterns around each bus stop type as queuing is not restricted to the bus stand area.	
Individual: Bus Flag	Queues around this type of Bus Stand form around the flag parallel to the road, and at busy sites parallel to the building line as well. The impact depends on how busy the bus stop is but it was seen to be in the range of 1,600 to 2,200 mm at the road edge and one person deep (460mm) at the building edge.	 Bus Flag
Individual: Back to Building	Queues around this type of Bus Stand form between the stand and the kerb edge as well as on either side of the stand (see dark grey zone around stand). The impact depends on how busy the bus stop is but was seen to be in the range of 600 to 1,200 mm.	 Bus Stand: Back to Building
Individual: Back to Footway	Queues around this type of Bus Stand form predominantly on either side of the stand leaving the footway clear for free movement.	 Bus Stand: Back to Footway
Individual: Back to Road	This has a similar queuing pattern as to back to footway stands but the queue was seen to stretch between 600 and 1,300mm outside of the stand.	 Bus Stand- Back to Road
Multiple Bus Shelters	Although individual bus stands are not perceived as causing problems, groups of bus stands create crowding pressures on footways. Previous research by Atkins found that it is important that there are no other blockages, e.g. telephone boxes, that block sight lines, as this encourages people to queue further from the shelter in order to see the bus approaching.	

Obstruction	Description	Buffer	Diagram
Cafés			
	Café seating areas act like a wall, so the usable footway width is the width from the kerb to the edge of the Café zone plus the standard buffer. Note that the area around Café seating is flexible - tables may be intended for two but extra chairs may be introduced by both customers and vendors to seat a larger group. It is also important to consider additional obstructions such as advertisement boards as these can reduce footway width further.	200mm from edge of café seating zone	 Café
Cycle Parking	*This is for non-hire sites only. Cycle Hire Sites should be reviewed on a case by case basis.*		
Parallel Cycle Parking	If parallel to the road, cycle parking forms a barrier and is treated by pedestrians as a wall so the usable footway width is the width from the building to the edge of the cycle stands plus 200mm.	200mm from edge of Cycle stands	 Cycle- Parallel Parking
Diagonal Cycle Parking	If the cycle stand is positioned diagonally to the road, the reduction in clear footway width is approximately 2000mm.	Total reduction of clear footway width by around 2000mm	 Cycle-Diagonal Parking
Perpendicular Cycle Parking	If the cycle stand is positioned perpendicular to the road, the reduction in clear footway width is approximately 2,500mm.	Total reduction of clear footway width by around 2,500mm	 Cycle- Perpendicular Parking

Obstruction	Description	Buffer	Diagram
Guard Rail			
	For guard rail, a 200mm buffer should be added from its placement on the footway. At some locations people wait around the guard rail (near building entrances, tourist areas) and this static activity can reduce the clear footway width further.	200mm from guard rail	 Guard Rail
Loading Bay			
Loading Bay: Segregated	Where loading bay stops are delimited with a kerb, pedestrians only use the main footway section. Therefore the clear footway width is from the building line to the kerb with the normal buffer.	200mm from kerb edge	 Loading Bays - segregated
Loading Bay: Shared Surface	Where loading bay stops share the same surface as the footway pedestrians tend to use the full footway width. The assessment of the clear footway width should be carried out with and without a vehicle parked in the space. This is because the bay may be operational during peak pedestrian movement hours or, if it is not, there may be non-compliance with the operational times.	200mm from road edge	 Loading Bays- shared surface
Map Based Wayfinding Signs			
	For both mini-lith and mono-lith sign types the reduction in clear footway width is $2m^2$. This is the space used by pedestrians reading the sign on both sides. This can be a significant reduction of the clear footway width and was seen to cause an increase of bumps and deviations at busy sites.	$2000mm^2$ from the sign	 Wayfinding Sign

Obstruction	Description	Buffer	Diagram
Posts	*The guidance for posts is suitable for similar items of street furniture such as signal boxes and bins.*		
Individual Posts	Individual posts have a limited effect on clear footway width. Posts and bollards should be aligned with other street furniture to minimise impact. If the posts are located in the middle of the footway it creates a visual interruption and re-siting should be considered. The clear footway width either side should be checked to ensure that there is sufficient space for free movement.	N/A	 Individual Post
Multiple Posts	Where there are multiple posts within a length of 300mm they form an obstruction, similar to guard rail. If the posts are placed near the road or the wall edge, a 200mm buffer should be added from its placement on the footway. If the posts are located in the middle of the footway the buffer should be the width of the post plus 400mm (200mm either side).	200mm from placement of post Or 400mm plus width of post	 Multiple Posts

Obstruction	Description	Buffer	Diagram
Street Vendors			
Market Vendors	Where there is an on-street market or concentration of vendors the clear footway width is reduced by the stall footprint plus an additional 1,400mm to reflect people browsing and queuing around the stall. If the market stalls are located in the middle of the footway the reduction in width is the width of the stall, 1,400mm in the direction people are served and 200mm at the "closed" side of the stall. If the stall is open at both sides the reduction in width would be the width of the stall plus 2,800mm. If the market stalls are located parallel to the road the clear footway width is reduced by the stall footprint plus an additional 1,400mm to reflect people browsing and queuing around the stall.	1400mm from stall edge	 Street Vendors: Market Vendors Parallel to Building  Street Vendors: Market Vendors Middle of Footway  Street Vendors: Market Vendors Parallel to Road
Individual Vendor	The impact of individual street vendors is less than in a market but the clear footway width is still reduced by the stall footprint plus an additional 500mm to reflect people browsing and queuing at the stall. If the stall is located elsewhere on the footway the reduction will be the stall footprint, plus 500mm plus the standard building/kerb buffer of 200mm.	500mm from stall edge	 Street Vendors: Individual Vendor
Tree			
	For a single tree, the footway width should be reduced by the planting area plus a buffer of 400mm (200mm either side of the planting area)	200mm either side of the planting area	 Tree

Appendix D: Measuring Pedestrian Activity

Introduction

This section explains the method for collecting pedestrian data, for both footways and crossings, before detailing the specific data needs for each area type. This method is suitable for Pedestrian Comfort Level (PCL) Assessments.

Site Visit

Before carrying out data collection and the Pedestrian Comfort Level assessment you should first visit your site. When on site you should assess:

- Is the site the area type you thought it was?
- Do the peak hours seem appropriate for the full survey?
- Are there any locations with high static activity (meeting friends, queuing, taking photographs) that may require a static activity survey?
- Do people cross away from the formal crossing facilities?
- Are there signs that the site is a route to and from school? This could include school age children, school crossing wardens and other indicators such as “only two schoolchildren at a time” signs on the local shops.
- Any other notes about pedestrian activity.

You should follow the Health and Safety procedures of your organisation when going on site.

Footways

A number of factors should be taken into account when conducting a pedestrian activity survey for a footway:

- How many locations and where? Pedestrian flows can vary significantly over short sections, especially in areas with high levels of demand such as shopping centres, or near transport connections. Ideally samples will be taken in 2-3 locations on both sides of the carriageway. Moreover, it is important to avoid areas with conflicting movements, such as a bus stop or tube station exit.
- Recording the location: An exact reference for the sample location(s) should always be recorded on a map with a text description (e.g. stand in front of Halifax, facing WH Smith) and photograph for future reference.
- Performing the counts: The counts should be taken using the "stationary gate method" whereby all pedestrians who cross an imaginary line perpendicular to the footway are counted. Ideally the direction that pedestrians are walking in is also noted. This can be seen in the photograph below. It is advisable to use tally counters to record this information, particularly on busy sites. Weather conditions and unusual activity should be recorded throughout the survey hours. For example, a short spell of rain at 16:00, large tourist group passed at 13:30.

  The person conducting the count should try to stand so that they do not disrupt normal activity.
- Sample length and hours of survey: This will depend on the purpose of the study. Suggested sample periods and survey hours suitable for Pedestrian Comfort Level assessments, are found on page 37 to page 41, organised by area type.
- If there are outstanding circumstances that will affect counts, e.g. significant underground closures or delays, the study should be redone on another representative day.

Figure 17 Photograph showing stationary gate method

Static Activity

A key part of the research into pedestrian comfort on footways was to investigate the real impact of street furniture on peoples' behaviour and the amount of space on the footway. Therefore the buffers defined for each type of street furniture include the average "static activity" associated with the furniture, that is, people waiting, queuing, talking, taking photographs etc.

If there is an unusual amount of static activity (e.g. because a bus stand is served by a large number of services) or, because of the area, people are standing and waiting in areas they normally would not (e.g. near guard rail in a tourist attraction or regional retail site), then an additional static survey is recommended.

A number of factors should be taken into account when conducting a static activity survey for a footway:

- How many locations and where? The initial site visit should have indicated locations where static activity occurs at the site. Locations near street furniture and transport connections are the usual locations. Samples should be taken within a 6m zone either side of your location.
- Recording the location: An exact reference for the sample location(s) should always be recorded on a map with a text description (e.g. stand in front of Halifax, facing WH Smith) and photograph for future reference.
- Performing the survey: The counts should be taken using the "snap shot" methodology whereby the observer records with a "x" on a printed map all pedestrians who are standing still within the survey location. This is like taking a photo of each section and the observer need only note what was happening when they first stopped and looked. The images below show a bus stop in Brixton and how a data collection book for the same scene is likely to look.
- Sample length and hours of survey: This will depend on the purpose of the study but should match the flow activity being collected. That is, once every half an hour if five minute samples are being collected or twice every half hour if 10 minute samples are being collected.
- Calculating the impact of static activity: Once the data has been collected the impact of the static pedestrians can be considered by either inputting the standing locations recorded into GIS using scaled people markers or if it is a simple queue that behaves consistently throughout the day by using a standard body ellipse (0.6m wide, 0.45m depth) plus 0.5 buffer (0.2m beside the wall or kerb and 0.3m between the static person and people walking by).

Figure 18 Brixton High Street looking South

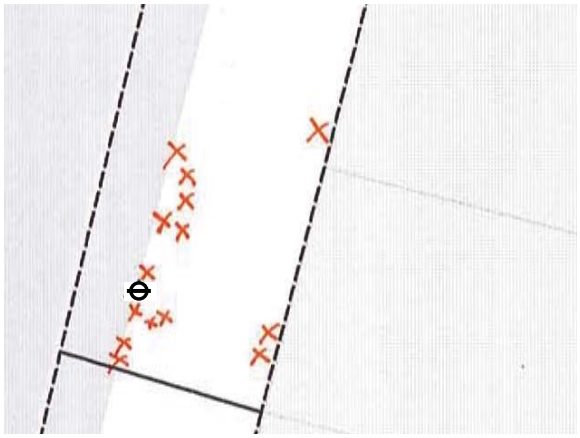


Figure 19 How a static survey of Figure 18 may look

Pedestrian Crossings

A number of factors should be taken into account when conducting a pedestrian activity survey for a crossing:

- Performing the counts: The counts should be taken using the "stationary gate method", described on page 34, whereby all pedestrians who cross an imaginary line parallel to the crossing arm are counted. It is advisable to use tally counters to record this information, particularly on busy sites. Weather conditions and unusual activity should be recorded throughout the survey hours. E.g. short spell of rain at 16:00, large tourist group passed at 13:30 etc.

  The best location to stand to record activity on the crossing will depend on the layout of the area, however beside the signal post is good for recording counts, as long as it is safe to do so.
- Samples should begin on the green man signal time and end when the next green man time begins. They should distinguish between people crossing on the green man and those crossing when the signal is red for pedestrians. It is not always possible to immediately record the next sample. If this is the case, the observer should wait until the next green man phase.
- Informal crossing: If there are a high number of people crossing adjacent to the crossing but not using the facility these should be included in the total demand for crossing the road.

  This can be counted either by defining a zone in which all informal crossings will be recorded or by using the stationary gate method.
- Queues on the Crossing Island (if present): If possible, it is useful to note how many people are queuing on the island to cross the road. The aim is to understand, for each direction, what the maximum number of people waiting are. This allows the results of the assessment to be checked against what is happening in practice. In particularly busy areas you may want to record the size and composition of the queues on the footway, although this is integrated into the minimum width recommendations on page 25.
- Sample length and hours of survey: This will depend on the purpose of the study. Suggested sample periods and survey hours suitable for Pedestrian Comfort Level assessments, are found on page 37 to page 41, described by area type.

To calculate Pedestrians Per Hour

3,600 ÷ (length of sample in seconds X no of samples)	X	total number of people recorded crossing the road in all samples

High Street

Survey Information

Areas dominated by a range of retail and food and drink premises represent a focus for the communities that use the services they offer. The research behind the project identified the peak pedestrian hours for this area type.

Peak Pedestrian Hours (Minimum Survey Hours)

14:00 to 18:00
Flows are generally bi-directional on High Street sites as people visit multiple destinations.

Recommended Survey Hours

07:00 to 19:00
It is possible to have breaks at 10:30 to 11:30 and 14:30 to 15:30

Recommended Sample Duration

5 minutes every half an hour on footways 5 samples every half an hour on crossings

Recommended Sample Days

Saturday and one weekday (Tuesday, Wednesday or Thursday). If there is late night shopping (usually Thursday) the survey hours should be extended to capture this

School Holidays

If there is a school in the immediate area, the site should be surveyed during the school term. Longer sample periods are required at the start and end of the school day (30 minute sample)

Weather

Flows are likely to be affected by poor weather. If weather is poor there may be a need to repeat the survey

Office and Retail

Survey Information

Areas dominated by substantial government and/or commercial office buildings. These streets experience high volumes of pedestrians. The research behind the project identified the peak pedestrian hours for this area type.

Peak Pedestrian Hours (Minimum Survey Hours)

08:00 to 10:00 and 16:00 to 19:00

In the AM and PM peak, flows in Office and Retail sites will often be concentrated in one direction as people walk directly to work. However at lunch time, flows are generally bi-directional.

Recommended Survey Hours

07:00 to 19:00

It is possible to have breaks at 10:30 to 11:30 and 14:30 to 15:30

Recommended Sample Duration

10 minutes every half an hour on footways 10 samples every half an hour on crossings

Recommended Sample Days

One weekday (Tuesday, Wednesday or Thursday)

School Holidays

Surveys should be carried out in term time if possible

Weather

Flows are unlikely to be affected by poor weather

Residential

Survey Information

These areas are characterised by privately owned properties facing directly onto the street. The research behind the project identified the peak pedestrian hours for this area type.

Peak Pedestrian Hours (Minimum Survey Hours)

14:00 to 18:00
There is no significant directional bias found in residential areas. The exception to this are areas where a school is located where there may be a bias found as pupils walk to and from school.

Recommended Survey Hours

07:00 to 19:00
It is possible to have breaks at 10:30 to 11:30 and 14:30 to 15:30

Recommended Sample Duration

5 minutes every half an hour on footways 5 samples every half an hour on crossings

Recommended Sample Days

One weekday (Tuesday, Wednesday or Thursday) and as a comparator, Saturday (09:00 to 16:00)

School Holidays

If there is a school in the immediate area, the site should be surveyed during the school term. Longer sample periods are required at the start and end of the school day (30 minute sample)

Weather

Flows are likely to be affected by poor weather. If weather is poor there may be a need to repeat the survey for the minimum survey hours

Tourist Attraction

Survey Information

An area with high tourist activity. This could include attractions such as Madame Tussauds or renowned “sights” such as the South Bank, the Royal Parks etc. Note that the peak pedestrian hours for this area type can depend on the opening hours of the attraction, if appropriate.

Peak Pedestrian Hours (Minimum Survey Hours)

14:00 to 18:00
There was no significant directional bias found in areas with Tourist Attractions, however this will depend on the surrounding land uses.

Recommended Survey Hours

07:00 to 19:00
It is possible to have breaks at 10:30 to 11:30 and 14:30 to 15:30

Recommended Sample Duration

5 minutes every half an hour on footways 5 samples every half an hour on crossings

Recommended Sample Days

Saturday and/or any day particular to that attraction e.g. Borough Market opens Thursday, Friday and Saturday and Spittelfields market opens on Sunday

School Holidays

Tourist sites are often busiest during the school holidays so should be surveyed at this time

Weather

Flows are likely to be affected by poor weather. If weather is poor there may be a need to resurvey the minimum survey hours

Transport Interchange

Survey Information

Transport Interchanges help to provide seamless journeys for people travelling in London. They range from local interchange between rail and bus to National Rail interchanges. The research behind the project identified the peak pedestrian hours for this area type.

Peak Pedestrian Hours (Minimum Survey Hours)

08:00 to 10:00 and 16:00 to 19:00

In the AM and PM peak, flows in Transport Interchange sites will often be concentrated in one direction. However this is not as pronounced as in Office and Retail sites.

Recommended Survey Hours

07:00 to 19:00

It is possible to have breaks at 10:30 to 11:30 and 14:30 to 15:30

Recommended Sample Duration

10 minutes every half an hour on footways 10 samples every half an hour on crossings However, this is dependent on frequency. It it is a low frequency travel service sample periods may need to be extended

Recommended Sample Days

One weekday (Tuesday, Wednesday or Thursday)

School Holidays

Surveys should be carried out in term time if possible

Weather

Flows are unlikely to be affected by poor weather.