Thames Pedestrian and Cycle Bridge, Canary Wharf to Rotherhithe

Chapter 4: User Parameters

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Authors

Sustrans makes smarter travel choices possible, desirable and inevitable. We're a leading UK charity enabling people to travel by foot, bike or public transport for more of the journeys we make every day. We work with families, communities, policy-makers and partner organisations so that people are able to choose healthier, cleaner and cheaper journeys, with better places and spaces to move through and live in.

Head Office
Sustrans
2 Cathedral Square
College Green
Bristol
BS1 5DD

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For further information please contact:

Cliff Matsuya, Business Support Manager

70 Cowcross Street, Farringdon, London, EC1M 6EJ

Telephone: 020 7017 2350

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Table of Contents

1. Introduction

This note presents the parameters for users of the bridge. Specifically, users are cyclists, pedestrians and people using mobility aids to cross and visit the bridge.

Sustrans' aspiration is for the bridge to provide a world-class experience for all its users, with these specific objectives:

- The design of the bridge should be both user-focused to maximise its functionality, and cost-effective. This means the designer should prioritise, as far as reasonably practicable, user levels of service and the user experience over non safety and security operational issues
- The design should make the bridge a simple, convenient route to get from Rotherhithe to Canary Wharf for all bridge users, while anticipating that the bridge may additionally fulfil a tourism function in itself
- The design should follow existing cycle, pedestrian and inclusive route design principles and best practise
- As the bridge's key purpose is for the mass transport of pedestrians and cyclists, it should cater for the predicted high flows, particularly of cyclists, expecting that demand will increase over time. The bridge should therefore be future proofed
- Conflict between the different users must be mitigated through legible design measures

1.1 User Needs

Users of the bridge are expected to be principally commuters, but the bridge is also expected to be used for tourism and leisure. Trips will be made by bicycle (including non-standard cycles), by foot and using mobility aids (including scooters).

User type	Needs
Cyclists – commuter/utility	• Desire line • Higher speed • Minimal interruption to journey desirable • Part of a longer distance journey • Reliable journey times
Cyclists - leisure	• May wish to stop at viewpoints • Slower • Social cycling in parallel
Adapted bikes (e.g. for users with disabilities)	• Slower • May need to stop • Greater turning circle • Wider
Cyclists - groups	• Slower • Likely to stop • Social cycling in parallel
Pedestrians – commuter	• Desire line • Higher speed • Minimal interruption to journey desirable • Reliable journey times
Pedestrians – leisure and groups	• Slower • Likely to stop • Likely to be two or more abreast
People using mobility aids – commuter	• Wider than a single pedestrian • Desire line • Higher speed • Minimal interruption to journey desirable • Reliable journey times
People using mobility aids – leisure and groups	• Wider than a single pedestrian • Slower • Likely to stop • Likely to be two or more abreast

Table 1: Needs of different user types

1.2 References

The following recognised guidance has been drawn on to define the user parameters:

- Sustrans, Handbook for Cycle Friendly Design (2014)
- Sustrans, Parapet Heights on Cycle Routes: Technical Information Note No. 30 (2012)
- Sustrans, A Guide to Controlling Access on Paths (2012)
- TfL, London Cycling Design Standards (2014)
- TfL, Pedestrian Comfort Guidance (2010)
- Equality Act (2010)
- Design Manual for Road Bridges, Volume 2, Section 2, Part 8 BD 29/04: 'Design Criteria for Footbridges' (2004)
- CROW, Design Manual for Bicycle Traffic (2007)
- Crime and Disorder Act (1998)
- Department for Transport, Inclusive Mobility (2005)
- TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015)

While the above guidance does exist, the level of cyclists expected on this bridge exceeds the scope of most current guidance. Additionally, the context of a bridge differs considerably from a highway, for which most of the guidance is applicable. Therefore key information from relevant pedestrian and cycling bridges is also presented.

Advice was also sought from Transport for London and Wheels for Wellbeing.

1.3 Factors Explored

The following factors are discussed, due to their impact on early design stages:

- How different user needs affect design requirements
- Segregation
- Access onto the bridge
- Deck widths
- Gradients of ramps
- Turning circles on ramps
- Parapets
- Lifts and stairs
- Speed and access controls
- Designing out crime and vandalism

2. Segregation

Sustrans' design guidance[1] indicates that the following factors should be taken into account to determine the need for segregation:

- Level of use
- Type of use (e.g. journey purpose)
- Variability of use
- Use by groups
- Use by vulnerable pedestrians
- Gradients
- Land take, drainage, maintenance

An assessment of deck segregation options is outlined in Table 2 below.

With high expected flows of cyclists, segregation will provide the greatest level of service to all users by minimising opportunities for conflict between modes, clarifying use of the bridge by all modes, and simplifying access/speed controls per mode.

Two bidirectional segregated decks – one for cyclists and the other for pedestrians - would provide a significantly greater benefit to users, and therefore will provide greatest functionality of the bridge.

A shared use deck, while reducing the required width and therefore upfront cost, would severely compromise the level of service to pedestrians, cyclists and users with disabilities, and reduce the expected level of use of the bridge, reducing its functionality and cost effectiveness.

1 Sustrans, Handbook for Cycle-Friendly Design (2014), p24

	Advantages	Disadvantages
One shared use deck	• Lower land take • Lower maintenance • Adaptable (can be retrofitted with segregation) • Lower cost	• Conflict at landing points and ramps between users more likely • Wider, single ramp creates greater shading / impact on park
Two single-direction shared or segregated use decks	• Greater resilience (redundancy should one deck be inaccessible)	• Higher land take: Both decks need to land cyclists at grade • Does not cater well for visitors • Conflict at landing points more likely • Propensity for non-compliance by users • Higher maintenance
Two bi-directional segregated decks (pedestrian deck and cyclist deck)	• Safest for users –avoids conflict, can accommodate groups, better for disabled pedestrians • Adaptable for tidal flow • Greater resilience (redundancy should one deck be inaccessible) • Pedestrian route can be shorter and more direct	• Moderate land take • Moderate maintenance costs

Table 2: Assessment of segregation options

2.1 Demarcation of the Tracks

On the cycle deck, directional tracks will be demarcated to encourage considerate directional cycling. The demarcation will still allow for overtaking.

3. Access Onto The Bridge - Lifts, Ramps and Stairs

Due to the height of the main span of the bridge, access onto it must be via a combination of lifts, ramps and stairs.

3.1 Access for Cyclists

Cyclists should not need to dismount to access the bridge, and therefore stairs with cycle channels and lifts would provide an inadequate level of service to cyclists.

Additionally, if lifts or stairs with channels are the sole means of accessing the bridge for cyclists, with 20 cyclists predicted to use the bridge per minute at peak times the capacity of the stairs or lifts would need to be high, and would have a high impact on the park. It is likely that this impact would still be less than a ramp, however.

Assuming a lift service duration of 3 minutes (1 minute load, 1 minute unload, 30 second journey each way), capacity for 60 cyclists and 81 pedestrians would be required at peak hour.[1] Assuming a maximum density of 1 cyclist per square metre and 3 pedestrians per square metre, a minimum of 80sqm lift space would be required, requiring a significant lift shaft. However, commuting cyclists, who would be the primary users during the morning peak hour, may be more prepared to pack more tightly to maximise the space available.

It is expected, however, that only a small proportion of cyclists will choose to use the lifts. Nevertheless, cycle access and use of the lifts should be considered in the design in order to avoid conflict with pedestrians and mobility aid users.

3.2 Access for Pedestrians

Access for pedestrians by stairs and lifts is considered the most appropriate solution for the sites. Ramps would create a significantly longer walking distance (approximately 300m), and a less direct route.

Using the proposed bridge geometry of 20m air draught over the water (see Chapter 3, Part 1), the height of the staircase will be approximately 11m above ground level in the park, or four storeys. In this case it is expected that the majority of pedestrians would use the lifts. The structure would also have a significant impact as a new feature in Durand's Wharf on the Rotherhithe side.

If the bridge air draught can be reduced from 20m to 15m, the stairs would be 6m above ground level in the park. With sufficient width and appropriate design, the stairs would be expected to attract a higher proportion of users than the lifts.

3.3 Lifts

Lifts are required to cater for disabled users and must be fully compliant with the Equality Act (2010), as must access to the lifts. Two lifts per bank are required for redundancy.

Significant resilience benefits arise from the combination of lifts, ramps and stairs.

1 Sustrans estimate based on existing lifts for cycle infrastructure

4. Deck Widths

4.1 Predicted Flow

Sustrans' demand analysis (see Chapter 2 and Appendix B) provides conservative estimates of flow of pedestrians and cyclists:

- 10,200 cyclists per day in 2020. This is equivalent to nearly 3,500 cyclists in the morning peak, or approximately 1,600 cyclists during the morning peak hour, or 27 per minute
- Between 11,028 to 12,624 cyclists during the morning peak in 2030. This is equivalent to 3,716 – 4,524 cyclists in the morning peak, or 1,754 – 2,007 in the morning peak hour, or 29 - 33 per minute
- 3000 pedestrians per day in 2020. This is equivalent to 1,011 in the morning peak, or 477 during the morning peak hour, or 8 per minute
- The flows are expected to be tidal, with the majority northeast bound in the morning peak

These cycle flows are described as "High or Very High" in the TfL London Cycling Design Standards (LCDS), as detailed in Table 3 and Table 4 below. The pedestrian flows are not high in comparison to other examples, as shown in Table 6.

However, predicted pedestrian flows are currently underestimated due to limited available data, so they should be regarded as a likely minimum.

	Peak hour	
	1-way lane/track	2-way track
Very low	< 100	<100
Low	100 – 200	100 – 300
Medium	200 – 800	300 – 1,000
High	800 – 1,200	1,000 – 1,500
Very High	1,200+	1,500+

Table 3: Peak hour categories for cyclists[1]

1 TfL, London Cycling Design Standards (2014), Figure 4.21a

	Peak hour		24-hour	
	1- way	2- way	1-way	2-way
Very low	< 600	< 600	< 800	< 800
Low	600 – 1,000	600 – 2,000	800 – 1,600	800 – 2,000
Medium	1,000 – 4,000	2,000 – 6,000	1,600 – 5,500	2,000 – 8,000
High	4,000 – 5,000	6,000 – 8,000	5,500 – 6,000	8,000 – 10,000
Very High	5,000+	8,000+	6,000+	10,000+

Table 4: Daily flow categories for cyclists[2]

There are few relevant examples of infrastructure with similar levels of cyclist flow, as can be seen in Table 5 and Table 6. Due to this, design guidance has been reviewed alongside available examples and compared to cycle infrastructure on the highway (Table 5). An additional consideration for this bridge is the need for future proofing, so that it is able to effectively accommodate changes in the type of cycle used (for example, more electric bikes) or the range of people cycling.

A detailed movement study will need to be undertaken at the next project stage. However, it must be noted that while pedestrian movement is well evidenced, cycle movement is less well quantified and therefore design guidance and experience may be more informative in this context.

	Daily cycle flow – 2014-2015[i]	Daily cycle flow - 2020 forecast[ii]	Dedicated width for cyclists (m)
Rotherhithe to Canary Wharf bridge	-	10,200[iii]	-
Blackfriars Bridge	7,067[iii]	12,809[iv]	4[iv]
London Bridge	5,558	5,926	0
Lambeth Bridge	3,695	3,940	0
Southwark Bridge	3,936	4,197	4

Table 5: Review of London bridges and dedicated widths

i. OIA Central Area Cycle Surveys Q3 2014-2015 report
ii. Based on annual cycle growth estimation of 4.1% per year between 2014 to 2020 (Thames Pedestrian and Cycle Bridge, Updated Economic Assessment, Colin Buchanan 2008)
iii. Chapter 2: Business Case
iv. Assumes a 70% increase in daily cycle flow due to the introduction of a new Cycle Superhighway, as recorded after the introduction of routes CS3 and CS7

2 TfL, London Cycling Design Standards (2014), Figure 4.21b

Example	Flow (per day)	Width
Nine Elms Pimlico proposed bridge, London	9,000 cyclists, 9,000 pedestrians	Dependent on winning design in current competition – all shortlisted designs are segregated Estimated 7m overall deck width
Cykelslangen, Copenhagen, Denmark	8,000 cyclists	4m - 2 x 2m bike lanes
Hawthorne Bridge, Portland, Oregon	8,000 cyclists	2 x 1.5m bike lanes with additional passing lane on left hand side before bridge
Kurilpa bridge, Brisbane, Australia	5,550 cyclists and pedestrians	6.5m wide – shared use space
Peace bridge, Calgary, Canada	1,370 cyclists	2.5m cycle area in centre, 3.7m pedestrian area (paths on either side)
Jane Coston cycle and pedestrian bridge, Cambridge to Milton, UK	800 cyclists and pedestrians	2m cycle area, 1.5m pedestrian
Millennium Bridge, London	18,500 pedestrians	4m pedestrian only
Tilikum bridge, Portland, Oregon, US	Not yet open at time of writing	2 x 2.34m bicycle paths; 2 x 1.93m pedestrian paths that enlarge to 4m at the viewing sections in the middle of the span

Table 6: Examples of cycling and pedestrian bridges

With conservative demand estimates, the bridge is expected to be one of the most heavily used bridges in London, with the additional unique appeal of being an opening bridge, and a landmark design. It therefore needs to be future proofed through an effective weighting placed on design flexibility:

- Advantages/economies of scale: additional investment in the upfront capital cost to cater for a larger demand would be cost effective in the future, avoiding retrofitting or alternative crossings
- Favouring the right infrastructure to cater for extra demand, over aesthetics, if cost efficiencies need to be made. A bridge well-used and loved by Londoners will be more worthwhile than one that is awkward and unpopular to use

4.2 Cycling Deck Width

The deck should be wide enough to accommodate the predicted high flows of cyclists. Expecting that demand will increase over time, it will need to be future proofed. The width should be based on cyclists riding two abreast in each direction.

Effective width for cyclists and pedestrians needs to be taken into account as the bridge will require parapets, reducing effective width by 0.5m on each side. Therefore the actual deck will be 1m wider than the effective width.

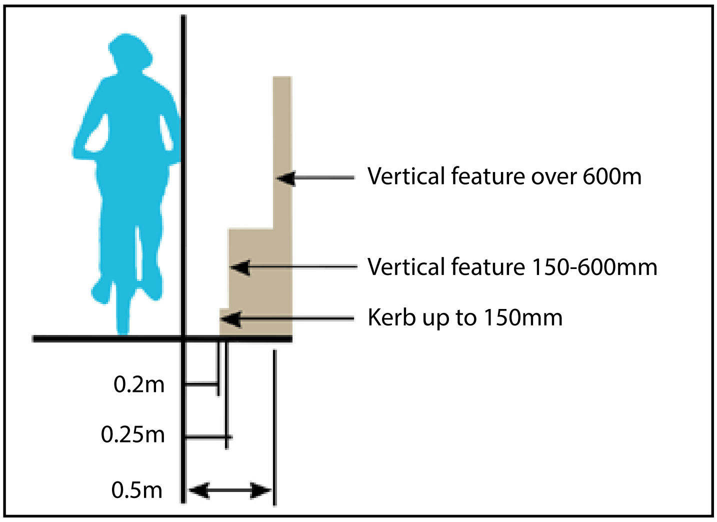

Figure 1: Effective width for cycles[3]

Dutch guidance is for a 3.5m effective width for a bi-directional track with cycle flows over 150 per hour, which requires a deck width of at least 4.5m.[4] The predicted flows for this bridge significantly exceed these flows and therefore require a greater effective width.

LCDS guidance is for at least 4m effective width for a two-way cycle track with a 'High/Very High' flow of cyclists, which is the predicted level for this bridge.[5] This would require an actual deck width of at least 5m.

Sustrans guidance for standard bicycles is for 2.5m effective width for two cyclists riding abreast – 1m dynamic width per cyclist with a 0.5m space between the two cyclists.

3 Sustrans, Handbook for Cycle Friendly Design (2014), p7
4 CROW, Design Manual for Bicycle Traffic, (2007)
5 TfL, London Cycling Design Standards (2014), Section 4.4.1

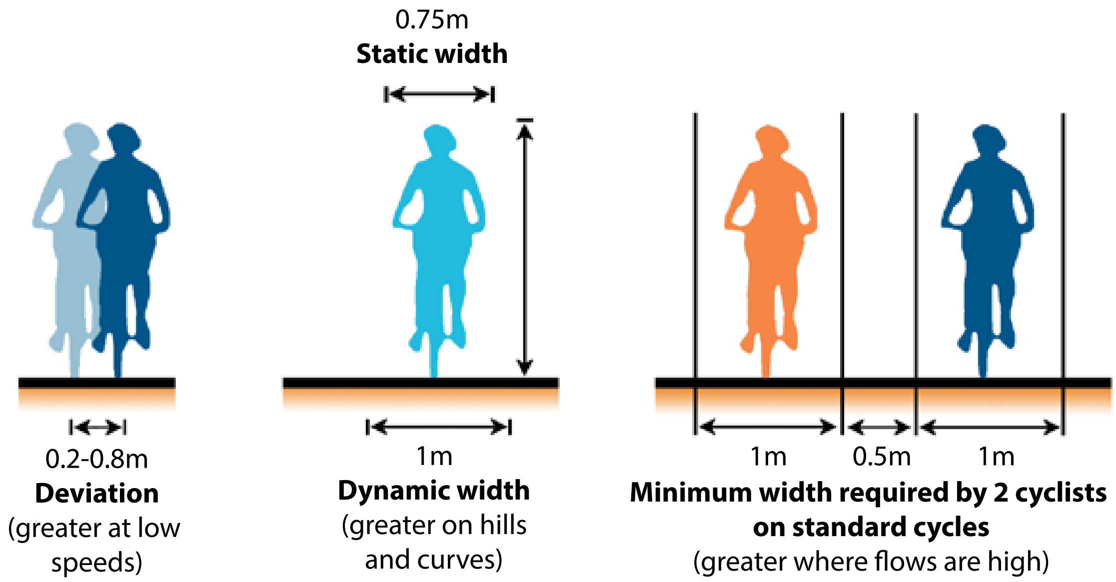

Figure 2: Required and dynamic widths for cycles[6]

Accounting for four cyclists, this would be a 5.5m effective width requirement, necessitating an actual deck width of 6.5m. Given that the design should also accommodate non-standard cycles, the required width is likely to be wider; advice from Wheels for Wellbeing is to accommodate a minimum width of 2.8m for two non-standard cycles side-by-side. Given that four non-standard cycles are unlikely to pass one another at once, a calculation of 2.5m + 2.8m + (2 x 0.5m) + 0.5m gives a minimum deck width of 6.8m.

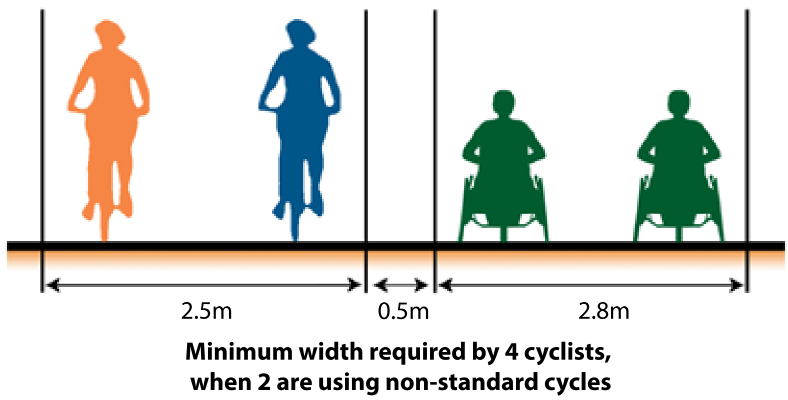

Figure 3: Widths for wider cycles, including non-standard cycles[6]

This is significantly wider than any of the examples given in Table 6, even considering a modestly greater projected use. However, cycle flows are expected to be highly directional and there will be no hard segregation between directional sides on the deck, so cyclists can use the opposite side to overtake if necessary. This means that the deck need not accommodate 4 cyclists side-by-side as this is an unlikely occurrence.

Therefore, the actual width of the deck will need to be at least 5m. This is an absolute minimum, taking into account already-existing examples, the demands of Sustrans' own design guidance, and the knowledge that the flow of cyclists will be highly directional.

The use of the bridge by groups of visitors on bicycles, or for anyone wishing to stop and view would reduce the effective width available to cyclists. A comfortable deck width, and one with greater resilience, would therefore be 6m or wider.

6 Sustrans, Handbook for Cycle Friendly Design (2014), p7

4.3 Pedestrian Deck Width

TfL Pedestrian Comfort Guidance classifies the predicted flows as “Active”, requiring a minimum of 2.2m in places of active flow with no street furniture, or 4.2m with street furniture, and 3.3m in tourist areas to allow two groups to pass.

Similarly, Sustrans guidance is for a minimum of 1.5m path width for two pedestrians side-by-side.

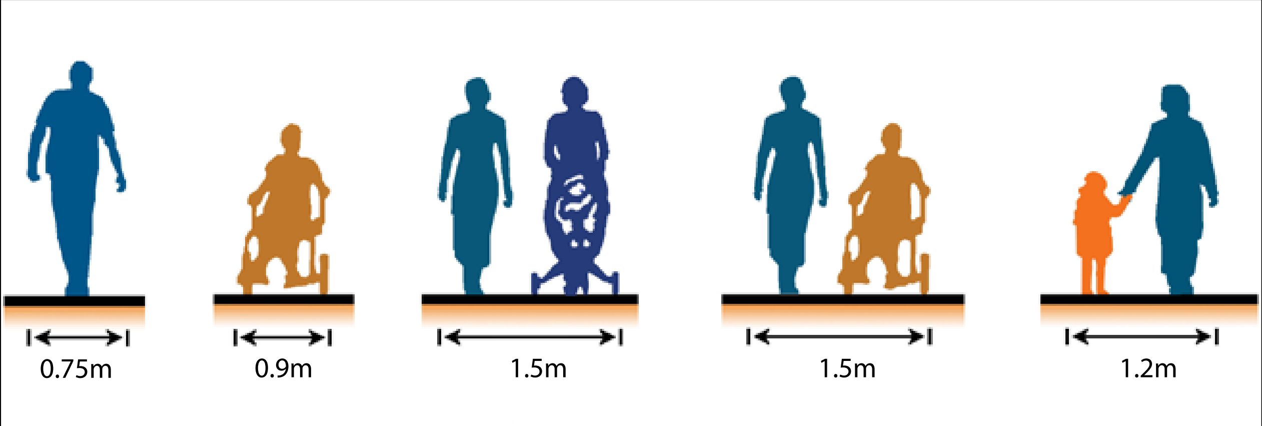

Figure 4: Typical widths required by pedestrians and wheelchair users[7]

A minimum deck width would therefore be 3m to allow for bi-directional movement of two pedestrians side-by-side. However, given the potential for pedestrians to congregate, and the expected use of the bridge by groups, a wider minimum deck width of 4m would allow better flow at busy times.

A deck width of 4m would be adequate for two pedestrians to walk comfortably side-by-side in each direction. The movement would be free flowing, and the space would allow for pedestrians to stop to look at the view without impeding the movement of other route users.

The Millennium Bridge London (see Table 6) has a pedestrian deck width of 4m and, although congested at peak visitor times, functions effectively as a key transport connection across the Thames. Pedestrian use of Millennium Bridge is considerably higher than that predicted for this bridge, and although this study has not quantified visitor use, it is expected visitor levels will be lower than in central London. This means that a 4m deck width will comfortably accommodate visitors.

The width of the ramp at points of congregation, such as the top of the stairs and viewpoints, may need to be widened. A people movement study is required to test and refine the current widths and space available.

7 Sustrans, Handbook for Cycle Friendly Design (2014), p8

4.4 Width Overview

4.4.1 Minimum Deck Widths

A 5m-wide bidirectional cycle track, and a 4m bidirectional pedestrian track are the minimum widths for user comfort.

Lower widths would lead to an inadequate level of service for users, creating opportunity for conflict and ultimately limiting the use of the bridge.

A difference of 1m between the pedestrian and cycling decks is also consistent with a balanced aesthetic.

4.4.2 Comfortable Deck Widths

A cycle deck width of 6m would give a comfortable level of service and cater for greater levels of uncertainty in the demand projections, and future use of the bridge.

Any excess width for the anticipated level of use in 2020 could be managed through simple landscaping, which would also improve the pedestrian experience in particular; this could be removed if usage became too high.

Variation in width on the ramp, at points of congregation (e.g. at the top of stairs) and on the main deck should be explored at the next design stage. It should be noted, however, that wider decks increase the need for access control, signage and management, and will add to the construction cost.

A variation of cost is expected to be around 5% for both pedestrian and cycle decks with an additional 1m in width.

5. Gradients of Ramps

Although all gradients are felt by cyclists and pedestrians, steeper gradients are more likely to create a hindrance to cyclists, pedestrians and people using mobility aids in ascending the ramps. They are also more likely to increase the speeds of cyclists descending the ramps.

The Design Manual for Roads and Bridges (DMRB), London Cycling Design Standards (LCDS) and Sustrans guidance all state that ramps for pedestrians and cyclists should not be steeper than 1 in 20, "unless agreed otherwise with the Overseeing Organisation".[1] This is also compliant with requirements of the Equalities Act (2010). The 1 in 20 is based on a good level of service to cyclists in particular, allowing for a climb without excessively lengthening the journey.

A gradient shallower than 1 in 20 provides a better user level of service. Since the cycle ramps are long (significantly longer than infrastructure typically referred to in guidance), at a minimum of 200m, shallower gradients would be favourable to make the climb easier for cyclists, in particular for those with disabilities. A lower gradient can be achieved either by lowering the main span height, or by lengthening the approach ramps.

The maximum gradient of the ramps for the bridge is therefore 1 in 20, but lower gradients would benefit users and should be favoured in the design.

5.1 Landings on Ramps

Current guidance is that if a ramp does not exceed a gradient of 1 in 20, landings are not necessary. However, given the length of the ramps, landings may be considered in order to provide an appropriate level of service for users. It is expected that a DMRB Advice Note with more inclusive advice on the need for landings on ramps will be published in the near future and could therefore be incorporated into future design stages.

1 Design Manual for Road Bridges, Volume 2, Section 2, Part 8 BD 29/04 (2004) Section 6.3-4

6. Turning Circles on Ramps

The ramps will be accessible for various different types of cycles and for people who use mobility aids.

Sustrans guidance for a range of cycles allows for the use of a tandem bicycle which requires a minimum inner radius of 2250mm and a minimum outer radius of 3150mm (shown as ‘a’ and ‘b’ respectively, in Figure 5 below).

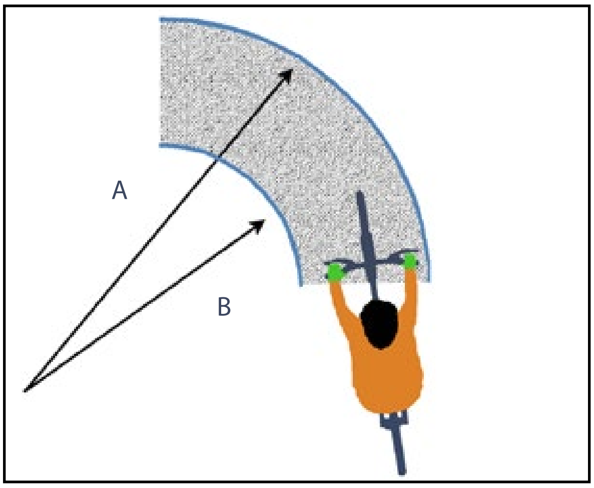

Figure 5: Minimum turning circles[1]

	Minimum turning circle (mm)	
	Outer radius (a)	Inner radius (b)
Conventional bicycle	1,650	850
Tandem	3,150	2,250
Bicycle and trailer	2,650	1,500
Cargo bike	2,300	100
Design Inclusive Cycle	3,400 (max)	100 (min)

Table 7: Minimum turning circles[2]

LCDS states that, “given the likely future use of cycle infrastructure by an even greater range

1 Sustrans, Handbook for Cycle Friendly Design (2014), p8
2 Sustrans, Handbook for Cycle Friendly Design (2014), p8 with additional information provided by Wheels for Wellbeing

of cycles […], it is recommended that design allows for these parameters to be significantly exceeded in practice."[3]

In order to accommodate electric pavement vehicles, the turning circle would need to be 4350mm.[4]

The turning circle outer radii will therefore need to be at least 4350mm for the pedestrian ramp, and 3150mm for the cycle ramp. These turning circles are exceeded by the 5.5m for bridge ramps stated by DMRB[5], however should be used as a minimum for any connecting routes or landings.

3 TfL, London Cycling Design Standards (2014), Section 3.2.3
4 Department for Transport, Inclusive Mobility (2005), Section 2.3
5 Design Manual for Road Bridges, Volume 2, Section 2, Part 8 BD 29/04 (2004), Section 6.13

7. Speed and Access Controls

7.1 Managing Speeds

Because of the high volume of use expected on the bridge, it is important to ensure free flowing movement, but also minimise the risk caused by cyclists building up high speeds, particularly when descending ramps. Speed calming measures at both landing sites may be required where use of space becomes mixed, such as a cycle path crossing Durand's Wharf on the Rotherhithe side.

Speed calming measures should primarily focus on encouraging courteous behaviour, including through "use of codes of conduct and signing, and through ensuring that sight-lines are as good as they can be".[1]

Visual techniques should be favoured over physical, particularly to indicate where cycling traffic may come into contact with other path users, and could include tighter path geometry, coloured surfacing, or apparent tables Figure 6 below).

Figure 6: Goldsmith's Row, Hackney

Vertical calming methods should be used only to supplement the aforementioned techniques, and could include positive textured surfaces or sinusoidal speed humps. Sinusoidal speed humps are different to round-top speed humps because they have a shallower initial rise (Figure 7 and Figure 9 below). This serves to minimise discomfort to cyclists while still reducing speeds.

1 TfL, London Cycling Design Standards (2014), Section 4.5.16

Figure 7: Sinusoidal speed hump

Sinusoidal speed humps may also be effective when deterring access to powered two wheel vehicles, as detailed in 7.2 below.

7.2 Preventing Motorbikes or Vehicular Access

Access controls can be used to safely restrict motorised vehicles, but should only be done without impacting accessibility for users. The use of physical barriers should never discriminate against people with disabilities, and can have a number of negative impacts if used improperly, including added inconvenience to users, visual intrusion, or encouraging anti-social behaviour.[2] In addition, they are ineffective at preventing access by motorbikes and other such motorised vehicles.

Moreover, physical access controls can often be ineffective at preventing any real or perceived inappropriate use. Physical controls sufficient to deter anti-social behaviour will often impose at least some inconvenience to legitimate users. Any access controls which impede the smooth flow of traffic across the bridge may lead to the build-up of crowds, and impact crowd management procedure.

Because the landing sites of the preferred alignments fall in areas which already have restricted access to motorised vehicles, any new controls should complement those in existence. Effective signage can be used to emphasise which users are not permitted to use a path. CCTV, supported by security staff as necessary, would provide the most effective deterrence to motorised access.

7.2.1 Design features

Any access controls should allow appropriate width clearance for bridge users; i.e. a minimum width of 1.5 metres for wheelchair users accompanied by another pedestrian, and most types of bicycles, including some hand-cycles, tricycles or trailers.[3]

2 Sustrans, A Guide to Controlling Access on Paths (2012), p10
3 Sustrans, A Guide to Controlling Access on Paths (2012), p17

Therefore, placement of a single row of bollards with a minimum of 1.5m spacing across the entrance to the path will be the most effective way of preventing unauthorised access to larger vehicles, with the minimum of impact on users.

Figure 8: Example of de-mountable bollard, on right

The bollards should be a minimum of 5m from edge of carriageway or back of footway, or further where cycle numbers are high. De-mountable bollards are likely to be needed to allow maintenance and emergency access.

Flexible bollards may be appropriate to provide greatest comfort to cyclists, particularly during times when a crowd may form while the bridge is lifting. After waiting for the bridge to open, crowds dispersing may be more likely to collide with bollards and so flexible bollards will mitigate harm caused should this occur.

Double humps with sinusoidal profiles can be used to deter access to powered two wheel vehicles (see Figure 9 below), and provide a speed calming measure at landing points.[4]

Figure 9: Speed humps on cycle track, York

4 TfL, London Cycling Design Standards (2014), Section 4.5.16

8. Parapet Heights

The DMRB states that all bridge spans, ramps and stairs must be provided with parapets.

Sustrans design guidance and LCDS give a recommended height of at least 1.4m for parapets next to cycle routes to ensure the safety of cyclists.[1]

Therefore the height of the parapets will be at least 1.4m. The height may need to increase in areas where crowding during a bridge lift is likely. This will need to be confirmed in a health and safety risk assessment at the planning stage, as may many other necessary safety requirements.

1 Sustrans, Parapet Heights on Cycle Routes: Technical Information Note No. 30 (2012), p2 and TfL, London Cycling Design Standards (2014), Section 7.5.2

9. Lifts

9.1 Capacity and Flow

The bridge will need two lifts at each lift zone to ensure consistent service. It is expected there will be one lift zone at each end of the pedestrian deck.

Using the current bridge geometry of 20m air draught over the water, the height of the staircase will be approximately 11m above ground level in the park, equivalent to a four storey building. In this case it is expected that the majority of pedestrians would use the lifts. If the bridge air draught can be reduced from 20m to 15m, the stairs would be 6m above ground level in the park, and with sufficient width and appropriate design, would attract a higher proportion of users than the lifts.

If all pedestrians projected to use the bridge were to use the lift, the maximum peak hour lift use would be 1,647 people.

If there are two 5m^2 33 person lifts, assuming a maximum of 3 minutes for a trip (1 minute load, 1 minute unload, 30 second journey each way), each lift handles 20 trips an hour. The total capacity of this lift system is therefore 1,320 pedestrians per hour.

A 5m^2 lift has a static capacity of 10 cyclists: the total capacity for cyclists is 600 per hour.

However, only a small proportion of cyclists would be expected to use the lift due to the lack of time advantage. It is also predicted that a proportion of pedestrians would use the steps. It is therefore anticipated that the two 33 person lifts are sufficient for the projected demand.

Should the air draught of the bridge be reduced to 15m, the necessary lift capacity will require a reassessment as fewer pedestrians will be expected to use the lifts. However, 2 lifts at each end of the bridge are still required to maintain a good level of service, and to ensure resilience.

The lifts would need to be secure, with CCTV, and regularly cleaned and maintained.

9.2 Accessibility Considerations

Minimum internal dimensions for lifts to allow accessibility for mobility aid users is 2m x 1.4m. The proposed 5m^2 space meets this requirement.

The lifts must be fully compliant with the Equality Act 2010, following requirements outlined in 'Inclusive Mobility' (2005).[1] Considerations will include:

- Door width
- Hand rails (colour contrast)
- Control buttons
- Announcements and display
- Door timings
- Lighting
- Stopping accuracy

1 Department for Transport, Inclusive Mobility (2005), Section 8.4.5

9.3 Access to Lifts From the Street

Access to lifts from Rotherhithe Street, the principle connecting route for pedestrians and people using mobility aids, must be accessible in order to be fully compliant with the Equalities Act 2010, and must feel secure at all times of the day or night. Minor landscaping works including lighting and security are required to achieve this, and should be agreed at the next stage following a Technical Landscape Study.

Although outside the scope of this project, to further support integration of the bridge into the local setting, and improve access to it, consideration should be given to the full re-landscaping of the park and upgrades to the Thames Path, a strategic leisure route for pedestrians to access the bridge, which is not currently fully accessible.

10. Stairs

The predicted pedestrian flow is 3,000 between 6am to 10pm (see Chapter 2 and Appendix B). The maximum peak hour predicted flow is 471, or 7.85 per minute.

The DMRB states that the clear width of stairs must be no less than 2m, and that for steps steeper than a 1 in 20 gradient, additional width is required to accommodate peak pedestrian flows. In such a case, 300mm of width is required per 14 persons per minute.[1] This means that for a flow rate of anything below 84 persons per minute on a 1 in 20 gradient, a width of 2m is sufficient. If the flow rate increased by another 14 people to 98 persons per minute on such a gradient, the width would need to be increased to 2.1m. A width of at least 2m also accommodates the requirements under the Equality Act (2010), outlined in Inclusive Mobility (2005), which states that concurrent two-way movement needs a stair width of at least 1.8m.[2]

In order to accommodate the peak flow comfortably, the steps must be at least 2m wide. Given the pedestrian ramp will have a minimum width of 4m, and the stairs could be widened at the landing points for aesthetic or access reasons, further consideration of the stairs should be given at the next stage of design.

Additionally, like the ramps, the stairs and lift shafts will become a feature of the park and should take into account the existing setting.

10.1 Accessibility considerations

The stairs will need to be compliant with the Equality Act (2010). Considerations from Inclusive Mobility (2005) will include:

- The number of risers in a single flight shall be no more than 12
- There will be resting places between flights of at least 1200mm
- Risers will be no higher than 150mm
- All steps in a flight will have the same dimensions
- Tread depth will be 300mm deep without overhang
- Stairs will be surfaced with slip resistant material, with colour contrast on the step noses which extends across the full width of the tread
- Stairs will have handrails
- Stairs will be well lit

1 Design Manual for Road Bridges, Volume 2, Section 2, Part 8 BD 29/04 (2004), Section 6.3
2 Department for Transport, Inclusive Mobility (2005), Section 8.4.1

10.2 Handrails

Inclusive Mobility (2005) states that handrails must be provided on both sides of stairs. The hand rails on the staircases will have a diameter of 40-50mm and a clearance from the frame of 50-60mm.[3] Handrails will be of a contrasting colour to the parapet to aid those with visual impairment. These requirements are also in accordance with DRMB.

Because the gradient of the bridge deck and ramps will not exceed 1 in 20, handrails are not necessary on the deck, nor on the ramps. However, they are recommended for comfort at points where users are likely to stop on a gradient; for example at viewing points, or at the barriers where users will be held during a bridge lift.

3 Department for Transport, Inclusive Mobility (2005), Section 8.4.1

11. Viewpoints

Given the high attraction value of the bridge due to the views it would offer, appropriate viewpoints should be included in the design. Users should be encouraged to stop and view at an appropriate place that is outside of the 18m privacy bounds referred to in the London Plan, and preferably further.[1] This will provide a high level of service to users, accommodating visitors and utility trips, but also minimise impact on residents of properties within close proximity of the bridge.

Congregation by visitors to the bridge is expected at the top of the lifts and at new viewing opportunities.

To determine the final alignment of the ramps in Durand's Wharf, a study will need to be conducted to determine appropriate viewpoints and their incorporation into the design. This is to be considered alongside a people movement study and in consultation with the planning authorities.

1 GLA, London Plan, Housing Supplementary Planning Guidance (2012), p70

12. Designing Out Crime and Vandalism

The public space created and directly changed by the bridge, including on the bridge itself and under the ramps, particularly in Durand's Wharf Park, will need to be designed to prevent crime in line with the Crime and Disorder Act (1998).

Additionally the DMRB states that "footbridges can be more prone to various forms of damage, misuse and vandalism by users than road bridges".[1] The design of the bridge needs to mitigate these risks as far as possible.

12.1 Context

In the preceding 24 months to June 2015, the total number of Notifiable Offences (not including anti-social behaviour) in the Surrey Docks Ward were 1,707, and in Canary Wharf 2,749.[2] Both wards have average levels of crime compared to London as a whole, and have below average crime rates compared to the boroughs in which they are situated.

During this period in Surrey Docks, the most common offences were Theft and Handling (38%), Violence Against the Person (19%), Burglary (16%), and Criminal Damage (10%). In Canary Wharf, the most common offences during this period were Theft and Handling (56%), Violence against the Person (24%), Criminal Damage (7%), and Burglary (5%).

In addition, in June 2015, 21% of crimes occurring in the LSOA (Lower Super Output Area[3]) identified as the preferred Southwark landing site on the south bank (LSOA Southwark 008A) were related to anti-social behaviour. 34% of crimes occurring in the LSOA identified as the preferred Tower Hamlets landing site on the north bank (LSOA Tower Hamlets 033A) were related to anti-social behaviour.[4]

12.2 Considerations

Materials and the design itself need to be robust so as to prevent unauthorised removal of parts. Materials also need to be chosen, where possible, so to limit vulnerability to fire damage or to graffiti that is difficult to remove.[5]

12.3 Conclusion

The bridge design should incorporate crime prevention measures such as simple, robust design features, effective lighting, help points, CCTV cameras and surveillance where appropriate. Any design features should be continuous with the landing zones: lighting may need to be installed in the park to improve personal safety. These measures should be in line with a security strategy agreed with key landowners, and will inform the detailed design stage.

1 Design Manual for Road Bridges, Volume 2, Section 2, Part 8 BD 29/04 (2004), Section 2.3
2 http://maps.met.police.uk/
3 Lower Super Output Areas are geographic areas designed to improve the reporting of statistics of small (sub-ward) levels
4 http://data.police.uk/data
5 Design Manual for Road Bridges, Volume 2, Section 2, Part 8 BD 29/04 (2004), Section 2.4

13. Further Work and Consultation Required

The bridge will become part of the cycle network in London. As such, the following will need to be defined at the next stage of work:

- A detailed movement study to refine the design of space for cyclists and pedestrians
- Design features required on the bridge to support flow to the connecting routes
- A place making study
- Signs and markings – to be in line with LCDS and Sustrans guidance
- Surfacing and materials
- Additional facilities, e.g. cycle parking
- A pedestrian and cycle safety plan for the construction phase