Thames Pedestrian and Cycle Bridge, Canary Wharf to Rotherhithe

Chapter 2: Outline Business Case

February 2016

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

Version History:

Revision	Issue date	Prepared by	Checked by	Authorised by	Purpose of Issue
v001	9 October 2015	German Dector-Vega	Nicholas Sanderson	German Dector-Vega	Draft for comments
v002	16 October 2015	Cliff Matsuya	German Dector-Vega	German Dector-Vega	Draft for comments
v003	18 November 2015	Annette Jezierska	Annette Jezierska	Annette Jezierska	Final issue for review
v004	30 November 2015	Annette Jezierska	Annette Jezierska	Annette Jezierska	Final issue
v005	3 February 2016	Annette Jezierska	German Dector-Vega	Annette Jezierska	Minor revisions

For further information please contact:

Cliff Matsuya, Business Support Manager

70 Cowcross Street, Farringdon, London, EC1M 6EJ

Telephone: 020 7017 2350

Thames Pedestrian and Cycle Bridge, Canary Wharf to Rotherhithe Chapter 2: Outline Business Case		
	Report Number:	SUSL281-TBFS-BC
	Revision Number:	v005
	Purpose of issue:	Final issue (minor revisions)
	Issue date:	04 February 2016
	Prepared by:	Annette Jezierska
	Checked by:	German Dector-Vega
	Date checked:	03 February 2016
	Approved by:	Annette Jezierska
	Date approved:	03 February 2016

Table of Contents

Executive Summary

In 2007 and 2008 Sustrans commissioned Colin Buchanan to produce an economic appraisal of the proposed Thames Pedestrian and Cycle Bridge linking the Isle of Dogs and the Rotherhithe peninsula.

This outline business case aims to review and update the strategic case, demand analysis figures, cost and associated benefits. It determines a likely range of Benefit Cost Ratios (BCR) for the scheme in order to inform decision making.

The proposal includes the construction and 24 hour operation of a Thames bridge for pedestrians and cyclists between the impound lock of Limehouse Reach in the Isle of Dogs and Durand's Wharf park in the Rotherhithe peninsula.

Strategic Context

The proposal for a new bridge comes at an opportune time in light of both national and regional policy and goals, which include increasing sustainable travel, improving health, and supporting economic development. This bridge would address a number of the needs of the local area and London as a whole. These include the increased growth in cycling, the projected employment growth in the area, the expected population growth, and the lack of appropriate or sufficient infrastructure to accommodate cyclists and pedestrians wishing to cross the river. With so few crossings over the Thames accessible to pedestrians and cyclists in the east of London, the river can prove to be a significant obstacle. Those crossings which do exist (Tower Bridge, the Rotherhithe Tunnel, the Hilton Ferry and the Greenwich foot tunnel) have either significant barriers, or have reached their capacity. The Jubilee line is already one of the most crowded tube lines in London, and with the expected increases in demand over the next several decades will remain very busy.

Scheme Objectives and Alternative Crossing Options

1. To improve connectivity for people on foot and bike by providing a direct, safe, and pleasant route across the Thames in an area with few crossing options, offering significant journey time reductions
2. To improve access and increase transport options for everyone by providing an accessible, free and easy-to-use transport link operating 24 hours a day
3. To increase physical activity by enabling a shift to active travel modes through the provision and improvement of pedestrian and cycling infrastructure
4. To enhance London's cityscape and public realm, creating better places for everyone
5. To showcase innovative design and engineering, creating a new landmark for London
6. To provide a high-capacity, low-carbon and zero pollution transport link for London's growing population, offering an alternative to overcrowded underground and poor quality road links for sustainable modes
7. To link residential with employment and leisure centres, supporting the sustainable regeneration and development of East and South East London

8. To achieve value for money
9. To be constructible

A qualitative assessment against the scheme objectives of alternative crossing options, including doing nothing, upgrading the ferry or building/adapting a tunnel, determined that although a bridge faces some technical and delivery challenges, it has the highest potential to cater for growth in existing trips, and generate new trips through mode shift. This in turn provides the highest economic benefits and strongest likely BCR.

Demand Analysis

A review of the previous demand analysis showed a potential increase in cycling journeys by 2020. In contrast, walking journeys remained as per previous appraisals. Key journey types contributing to demand include existing trips that will increase in line with growth in both cycle mode share and population, and new journeys due to mode shift from the Jubilee line and DLR, and due to unlocked suppressed demand. Analysis has been conducted using the standards set out in TfL's Business Case Development Manual and Business Case Assistant, and benchmarked against previous economic appraisals for the bridge. The main datasets used as the basis of this analysis were the Canary Wharf Staff Travel Survey (2013), TfL Isle of Dogs Cordon Survey (2015), and Colin Buchanan Thames Pedestrian and Cycle Bridge Updated Economic Appraisal (2008).

The updated demand analysis found that by 2020 approximately 2,041,500 cycling trips and 1,032,000 walking trip a year would use the proposed Thames Bridge. A full breakdown of the demand analysis is shown in Section 6 on page 23.

Costs

Outline costs were estimated by Arup using an example design at RIBA Stage 1/2 tailored to the detailed site parameters, and proven feasible and attractive. This can serve as a benchmark for scheme cost.

The cost model included UK sourced benchmarking rates and percentage additions for items such as preliminaries and logistics, professional fees and risk/contingency.

Cost estimates also took account of detailed construction techniques based on constraints in the area and additional costs for main contractor preliminaries, contractor profit margins etc.

Cost Estimates

- Base (construction) costs are estimated at £88.2 million
- 80th percentile statistical value and risk certainty analysis estimated costs at £121.4 million
- Full project costs were estimated at £204.9m – £272.0m
- Annual maintenance costs are estimated at £0.9m
- Annual operation costs are estimated at £0.5m
- Avoided costs are estimated at £150k a year from the decommissioning of the Hilton ferry

Benefits

Based on the revised demand analysis and following TfL's Business Case Development Manual, the following quantified benefits have been estimated.

Trip	Estimated annual trips by 2020	Estimated benefit (£ per annum)
Journey time saving for existing cyclists (not including Greenwich foot tunnel)	1,275,175	6,375,876
Journey time saving Jubilee line mode shift	68,763	85,953
Journey time saving from suppressed demand	311,459	1,557,296
Journey time saving from Hilton Ferry users	392,266	1,188,958
Ambience improvements to cyclists	2,041,500	1,254,000
Ambience improvements to pedestrians	1,031,000	1,220,000
Safety benefits to cyclists	Not demand dependent	60,000
Health benefits (cycling)	114,000 cyclists	651,000
Health benefits (walking)	109,500 pedestrians	385,000
Crowding benefits (from LUL)	223,500	42,465
TOTAL		**12,820,548**

Table 1: Estimated quantified benefits of the bridge

Key qualitative benefits are:

- Significant regeneration benefits for Rotherhithe, including an increase in local job opportunities for Surrey Quays, Deptford and Peckham residents
- Reduction in severance bringing benefits to thousands of residents in Rotherhithe, opening up a free walking route to Canary Wharf as a major employment, commercial and leisure destination
- Providing an alternative route offering increased transport resilience in the area
- Providing a much wanted choice for people sensitive to air pollution as the route avoids congested areas and includes alternatives through parks and quiet streets
- A new walking and cycling bridge that performs lifts to accommodate river traffic on this scale will be unique, and will attract visitors in its own right. Visitor spending potential has

not been quantified in this study but is expected to bring considerable additional economic benefits in line with other comparable river crossings

- A new walking and cycling bridge over the Thames will have the longest span of all bridges in London. It will also be unique in catering for walkers and cyclists only, highlighting the profile of cycling improvement interventions in London that support its growth and sustainability
- There is increasing evidence that new infrastructure that increases connectivity has a positive impact on supporting economic activity and regeneration often leading to making areas more attractive and desirable to live and work in

Benefit Cost Ratio

Benefit cost ratios (BCR) were calculated for a number of scenarios, including higher and lower costs. Based on these various cost scenarios and the sensitivity analysis, the benefit cost ratio for the proposed bridge is likely to be at least (although likely higher than) 1.8:1.

The full cost scenario for £204.9m – £272.0m reflects a strong positive outcome of 2.5:1 - 1.8:1.

Conclusions

The proposed bridge can be justified on cycling journey time benefits and walking and cycling ambience improvement benefits alone.

The full project cost of £204.9m – £272.0m reflects a strong positive outcome of a BCR of 2.5:1 - 1.8:1.

The lack of bridge crossings in the area causes severance, suppressing walking and cycling demand. This causes people to take much longer journeys and causes overcrowding on existing public transport options.

Raising private funding and sponsorship will strengthen the business case for the bridge, making it financially attractive.

The design and associated costs (including maintenance, operation and construction methodology) are critical to the business case for the bridge. It is paramount to select a design that offers a high quality experience for users and is aesthetically attractive but is still affordable.

To maintain value for money, it is recommended any design put forward does not exceed the base cost of £88m (2015 Q3 values not including contingency) and in fact should seek to reduce costs as much as possible through the design and early incorporation of operational and maintenance procedures.

1. Introduction

1.1 Background

As part of the feasibility work on the Thames Pedestrian and Cycle Bridge proposal, Sustrans has conducted an outline economic appraisal. This report sets the parameters for a detailed business case which would be commissioned at a later stage of the project lifecycle.

In 2007, Colin Buchanan was commissioned by Sustrans to produce an economic appraisal of the proposed Thames Pedestrian and Cycle Bridge linking the Isle of Dogs and the Rotherhithe peninsula. A further update was commissioned by Sustrans and produced by Colin Buchanan in 2008. This report builds upon the 2007 Preliminary Economic Appraisal and 2008 Updated Economic Appraisal both produced by Colin Buchanan for the previous Sustrans Thames Bridge proposal.

The previous appraisal was based on a capital cost of £107m (in 2007 price) including 10% contingency. It estimated that by 2020 the bridge would be carrying 1m pedestrians and 1.6m cycling journeys a year. The report estimated a BCR of 1.4:1.

This outline business case first defines scheme objectives and presents the case for change, as well as a comparison of crossing options. It then aims to review and update, where relevant, the demand analysis figures, costs, associated benefits and likely BCR, using more up to date information as follows:

- More accurate detailed cost estimate produced using an example design at RIBA Stage 1/2 tailored to the detailed site parameters, and proven feasible and attractive. This can serve as a benchmark for scheme cost
- A revised demand analysis that accounts for growth in cycling across London that exceeds previous estimates
- Revised population growth projections and substantial development in Canary Wharf, across the Isle of Dogs and the Rotherhithe peninsula, leading to an increased travel demand in the catchment area
- Substantial investment in cycling infrastructure across the capital as part of the Mayor's Vision for Cycling, which has led to increased connectivity to the bridge, and higher likelihood of an increase in cycle mode share

2. Scope and Objectives

2.1 Scope of Scheme

This scheme includes the construction and 24 hour operation of a bridge across the Thames for pedestrians and cyclists between the impound lock of Limehouse Reach in the Isle of Dogs and Durand's Wharf park in the Rotherhithe peninsula. The proposed location for the bridge is between Durand's Wharf park in Rotherhithe and adjacent to the former South Dock entrance to the West India Dock on the Isle of Dogs.

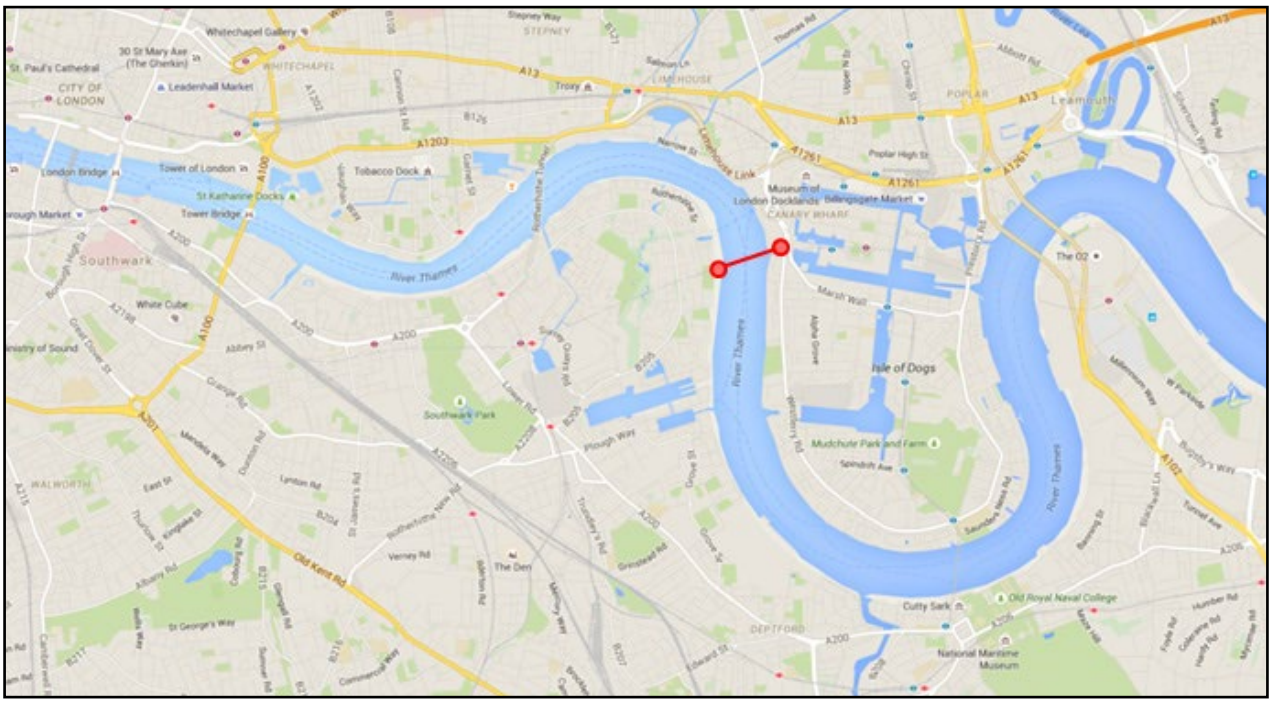

Figure 1: Proposed bridge location

Map data ©2015 Google

Included within the scope of the scheme is the construction, operation and maintenance of the bridge over the appraisal period of 60 years and provision for ramp approaches and other access to the bridge.[1]

A number of factors combine to make this scheme a timely and relevant proposal:

- London has been experiencing unprecedented levels of cycle growth in the last 14 years. The recent infrastructure projects being delivered as part of the Mayor's Cycling Vision are set to boost growth further
- New infrastructure is required to provide the river crossing capacity for cyclists in East London as currently only the Greenwich foot tunnel offers a viable alternative and its capacity is severely constrained due to width and quality
- A number of current and planned development initiatives on the Rotherhithe peninsula are increasing residential densities and jobs, and improving connectivity for walking and cycling

1 Following TfL's Business Case Development Methodology

- Canary Wharf employment growth projections are ambitious, and providing for walking and cycling is essential to be able to cater for the expected increase in travel demand in a sustainable and cost effective way
- The Olympics provided the impetus for the development of a set of cycle routes (Greenways) linking up communities in East London; since 2012 Stratford has developed and is continuing to grow into an area of dense population and strong economic activity

2.2 Scheme Objectives

There are a wide range of objectives for the Thames Bridge proposals. Those critical to the project's success are as follows:

Connectivity, Time Savings and Accessibility

- To improve connectivity for people on foot and bike by providing a direct, safe and pleasant route across the Thames in an area with few crossing options, offering significant journey time reductions
- To improve access and increase transport options for everyone by providing an accessible, free and easy-to-use transport link operating 24 hours a day

Economic Development

- To link residential, employment and leisure centres, supporting the sustainable regeneration and development of East and South East London
- To unlock economic regeneration by increasing connectivity and accessibility

Population Growth, Sustainability, and Resilience

- To provide a high-capacity, low-carbon and zero pollution transport link for London's growing population, offering an alternative to an overcrowded Underground and poor quality road links for sustainable modes

Better Place/Space/Design

- To enhance London's cityscape and public realm, creating better places for everyone
- To showcase innovative design and engineering creating a new landmark for Rotherhithe and Canary Wharf

Active Travel

- To increase physical activity by enabling a shift to active travel modes through the provision and improvement of pedestrian and cycling infrastructure

Affordable

- To achieve value for money
- To be constructible

3. Strategic Context Review

3.1 Policy Context Summary

Across all levels of government, there is clear commitment to increase cycling and walking. Within London there is a strong focus on promoting cycling and walking around areas with the capacity for significant development (Opportunity Areas) or with poor public transport accessibility. The bridge would directly serve two Opportunity Areas in Canada Water and the Isle of Dogs, covering a large proportion of east London's growth potential. The two adjoining boroughs – Southwark and Tower Hamlets - express strong support for the proposed bridge in their transport and local development policies. The bridge would make a significant contribution toward the Mayor's aim of growing cycling to 1.5 million trips per day by 2026[1] – there are currently approximately 610,000 trips per day.[2]

3.1.1 National

The national policy context is outwardly favourable toward a project of this kind. Not only due to its direct promotion of healthy, sustainable and zero-emission travel, but also because it would increase productivity and enhance access to jobs and homes currently severed by the Thames.

Ahead of the General Election in 2015, the Conservative Party Manifesto (2015) stated their intention to double the number of journeys made by bicycle and to invest in infrastructure "to attract businesses and good jobs", including more cycle routes. The bridge would provide a direct contribution towards these two complementary goals.[3]

The bridge will support the Department for Transport's (DfT) objectives of reducing greenhouse gases and other emissions from transport and making transport more accessible to all, by creating an accessible, free walking and cycling link across the Thames.[4,5]

To these ends, HM Treasury's National Infrastructure Plan (2014) highlights the proposed bridge as a means to connect communities across the river and allow them "to travel freely and easily, supporting jobs and growth". This explicit signal of support demonstrates a potential role for the Treasury in providing financial assistance or assurance toward the project.[6]

There is a strong case for significant central government support for the bridge due to this encouraging and supportive policy context.

3.1.2 Regional

The Mayor of London's spatial planning and transport policies are similarly positive toward a project of this kind, not only because it would support improvements to public health through increased physical activity, but also because it would enhance London's transport system to support growth in London's housing and employment capacity by linking Opportunity Areas east of Tower Bridge.

1 TfL, Roads Task Force - Technical Note 4: How has Cycling Grown in London (2013), p1
2 GLA, www.london.gov.uk/media/mayor-press-releases/2015/06/london-cycling-now-the-highest-on-record-as-rate-of-deaths-and
3 The Conservative Party Manifesto (2015), p15
4 www.gov.uk/government/policies/transport-emissions
5 www.gov.uk/government/policies/accessible-transport
6 HM Treasury, The National Infrastructure Plan (2014), Section 5.16

The London Plan (2015) identifies a connected approach to public transport provision and development in London – to reduce the impact of development on road congestion, transport crowding and other negative impacts of road travel. It gives specific priority to enhancing transport, and cycling and walking in particular, around Opportunity Areas. The proposed bridge site is directly adjacent to two Opportunity Areas (Isle of Dogs and Canada Water), serving to provide a direct cycling and walking link between the two, and to cater for the increased transport demand from significant growth in employment and housing.

The Mayor's Transport Strategy (2010) aims to achieve six high-level goals, which should:

- Support economic development and population growth
- Enhance the quality of life for all Londoners
- Improve the safety and security of Londoners
- Improve transport opportunities for all Londoners
- Reduce transport's contribution to climate change and improve its resilience
- Support the delivery of the London 2012 Olympic and Paralympic games and its legacy

The bridge is identified as contributing toward all six of these goals.[7] In particular, it contributes towards eight of the Mayor's transport policies, outlined below:

- To improve public transport accessibility and conditions for cycling and walking in areas of lower Public Transport Accessibility Level (PTAL), where there is an identified need for improving accessibility; and to improve access to economic and social opportunities and services for all Londoners
- To ensure efficient and effective access for people and goods within central London through providing improved central London connectivity and appropriate capacity. This will include improving access to major public transport interchanges for pedestrians, cyclists and by public transport
- To provide appropriate connectivity and capacity on radial transport corridors into current and potential metropolitan town centres and to Strategic Outer London Development Centres
- To reduce the need to travel, encourage the use of more sustainable, less congesting modes of transport (public transport, cycling, walking and the Blue Ribbon Network), set appropriate parking standards; and through investment in infrastructure, service improvements, promotion of smarter travel initiatives and further demand management measures as appropriate, aim to increase public transport, walking and cycling mode share
- To expand the capacity and quality of public transport services, improve passenger comfort and customer satisfaction, reduce crowding, and improve road user satisfaction
- To promote healthy travel options such as walking and cycling
- To seek to enhance connectivity, reduce community severance, promote community safety, enhance the urban realm and improve access to jobs and services in deprived areas

3.1.3 Local

A supportive policy context is found in the policies of the adjoining boroughs in which the proposed bridge would land.

Southwark's Transport Plan (2011) expressly supports the long-term aspiration to build a new

7 GLA, The Mayor's Transport Strategy (2010)

river crossing for pedestrians and cyclists between Rotherhithe and Canary Wharf.[8]

Tower Hamlets' Core Strategy (2010) expresses support for improving and enhancing cycling connections in the borough. It commits the borough to support Transport for London crossing projects across the river and its transport proposals map contains the proposed pedestrian and cycle river crossing between Canary Wharf and Rotherhithe.[9]

Further detail is presented in Appendix D: Planning Policy Review.

8 LB Southwark, Transport Plan (2011), p21
9 LB Tower Hamlets, Core Strategy (2010), p76

4. Case for Change

4.1 Challenges

4.1.1 Missing Link East of Tower Bridge

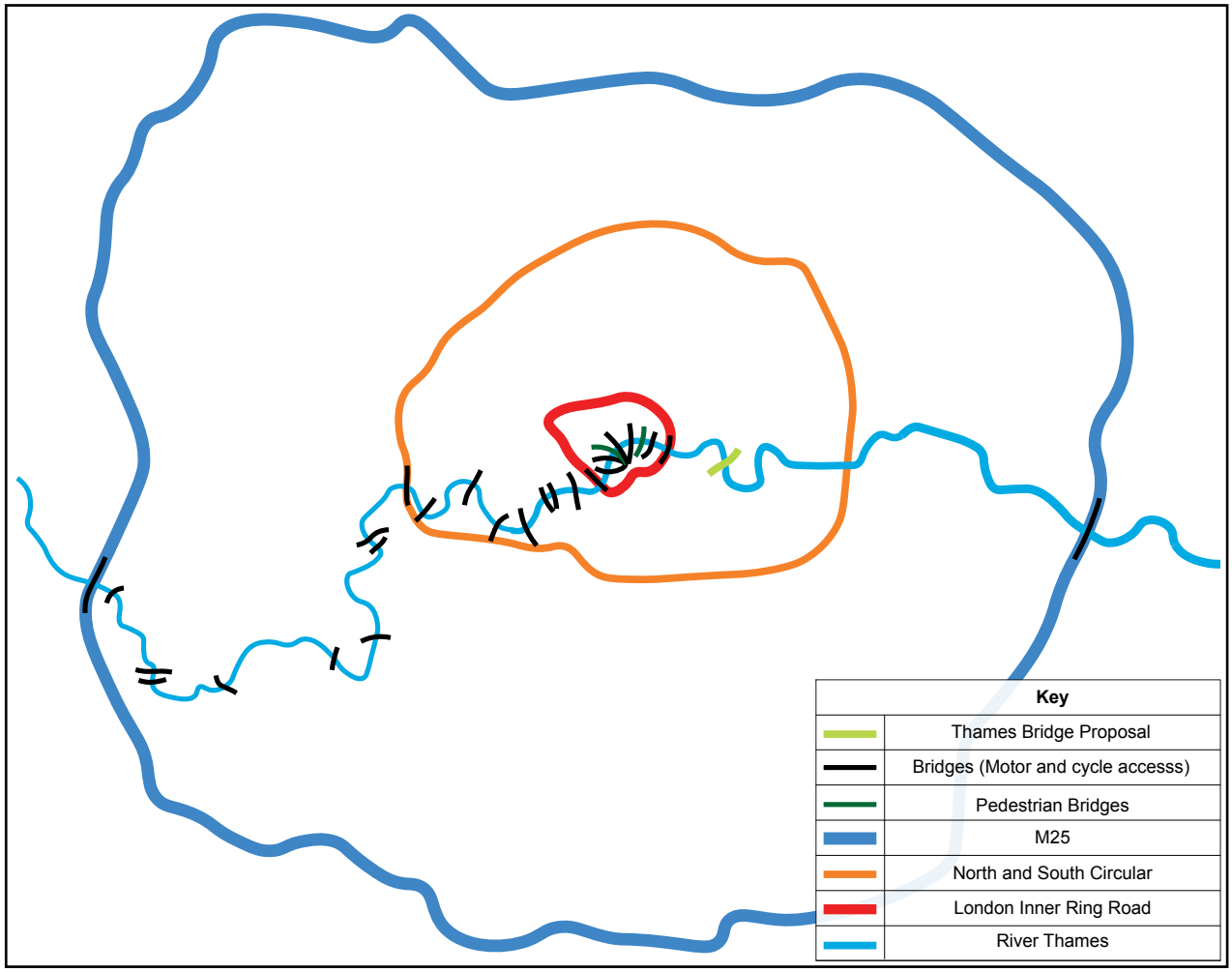

Figure 2: Location of bridges across Thames in London

As illustrated in Figure 2 above, Central London (bound by the inner ring road), is served by eight river crossings (excluding rail crossings). To the west there are a further eight crossings before the North/South Circular ring road, and sixteen in total before the M25. To the east, however, there are only four (excluding rail crossings and the Blackwall tunnel, which is inaccessible to pedestrians and cyclists). As a result, the river is a major obstacle to cross-river journeys by sustainable modes and existing cross-river trips can be arduous or indirect with large discrepancies between journey distances 'as the crow flies' and journey distances using the available crossings.

4.1.2 Poor Quality Pedestrian and Cycling Environment of Existing Options

In addition to existing crossing options being widely spaced, the quality of the environment for walking and cycling is poor.

- Tower Bridge is crowded, restrictive and features a number of pinch points for pedestrians that exacerbate the sense of crowding and unease. A two-way narrow carriageway is shared between all vehicles and carries a significant number of heavy goods vehicles that are dangerous and off-putting to people cycling. Railings along the footway add to the sense of restricted space for pedestrians and cyclists
- The Rotherhithe Tunnel is uninviting and can feel unsafe, both from traffic and for personal safety in a confined and narrow space. Carriageways and pavements are narrow. For cyclists, sharing space with significant volumes of traffic, unable to pass, can be intimidating and off-putting to even the fastest and bravest. Most cyclists appear to use the narrow footway
- The Hilton Ferry can be used, but at a relatively high cost (£3.90 Oyster pay as you go single) compared to other public transport fares (£1.70 London Underground Zone 2). Entry is via the hotel, which requires cyclists to dismount and walk a portion of their journey
- The Greenwich foot tunnel is a cramped and confined space. Without natural surveillance it can feel unsafe during off-peak hours. Despite this, however, due to the lack of viable alternatives, during peak hours it can still be particularly crowded and uncomfortable with cyclists having to dismount and use lifts. The lifts are particularly busy during peak hours

4.2 Opportunities

4.2.1 Overcrowding on Jubilee Line

The Jubilee line remains one of the only crossing options for those travelling between south-west London and Canary Wharf. During the morning peak it is one of the most crowded Tube lines in London, with over 4 people standing per square metre. Crowding may reduce the appeal of the option, leading to people taking more inefficient, longer journeys, which could reduce productivity. Despite the additional capacity provided by Crossrail, crowding on the Jubilee line is forecast to continue, as the Mayor's London Infrastructure Plan 2050 states, "*Forecast demand levels in 2050 will exceed realistic capacity on sections of several lines, including the Northern, Victoria, Piccadilly and Jubilee lines.*"[1]

4.2.2 Address Severance Caused by the Thames

East of Tower Bridge, the Thames separates local communities on either side of the river. The river separates services, jobs, homes and other opportunities. With development taking place on both sides, the sense that opportunities are being missed will only become greater. The bridge may deepen access to labour markets, and improve productivity through quicker journey times and savings made to the individual. Users that switch to walking or cycling will make savings compared to fares for ferries, public transport or the cost of motoring.

4.2.3 Increase Physical Activity

Increased physical activity is associated with reduced risk of cardiovascular, respiratory and musculoskeletal diseases, and is also associated with reduced absenteeism at work. Although an estimated 43% of London's adults do not achieve the recommended minimum level of

1 Mayor of London, London Infrastructure Plan 2050: Transport Supporting Paper (2014), p 66

physical activity each week, on average Londoners surpass the England average, in part through shorter trips by active travel.[2] These trips often involve the use of public transport, walking or cycling and form part of people's daily routines.[3] Providing a walking only link will increase journeys by foot and potentially entice people to make longer cross-river walking trips as a more pleasant alternative to a crowded rail service.

Similarly, a bridge that dramatically improves the convenience, comfort and safety of cycling will draw people currently making the trip by other means to shift to cycling, increasing their time spent physically active.

4.3 Conclusion

The bridge is identified as a solution to a lack of crossings in East London, providing journey time savings to those already cycling and encouraging others to switch to cycling and walking modes for short trips. It will provide capacity for new transport demand arising from the growth of surrounding areas. The poor quality of existing crossings deters cross-river trips in the surrounding area. In particular, the poor quality of crossings deters cycling and walking trips from being made in the first place, holding back potential for sustainable travel. As a result of a crossing that provides permeability to walking and cycling, a shift in travel behaviour toward sustainable, active modes can be expected. This will lead to increased physical activity and improved public health.

2 TfL, Improving the Health of Londoners: Transport Action Plan (2014), p23
3 TfL, Improving the Health of Londoners: Transport Action Plan (2014), p22

5. Appraisal of Crossing Options

5.1 Objectives

A qualitative analysis was used to determine whether a bridge is the most favourable crossing option for pedestrians and cyclists between Canary Wharf and Rotherhithe.

A range of options exist that could potentially address some or all of the objectives for reducing the access problems for pedestrians and cyclists between Rotherhithe and Canary Wharf, as well as the option of doing nothing and accepting the current situation.

Options that are considered realistic and practical and that could provide reasonable alternatives, include the following:

A. Do nothing: No change to existing arrangements

B. Improve passenger ferries: Invest in upgrading the ferry crossing and increasing its capacity, particularly for cyclists

C. Re-purpose Rotherhithe Tunnel: Close to motorised traffic, re-design for pedestrians and cyclists only

D. New walking and cycling tunnel: Build a new walking and cycling tunnel

E. New cable car: Build a new cable car offering a Thames crossing to pedestrians and cyclists on this alignment

F. New walking and cycling bridge: Build a new pedestrian and cycle bridge

The table below summarises how the options were considered against the scheme's objectives and additional deliverability criteria. Appendix A describes and discusses these options and their assessment against the criteria below in detail.

Core Objectives	Criteria
1. To improve connectivity for people on foot and bike by providing a direct, safe and pleasant route across the Thames in an area with few crossing options, offering significant journey time reductions	1.1 Journey time savings 1.2 Link into existing/planned cycle networks and pedestrian desire lines
2. To improve access and increase transport options for everyone by providing an accessible, free and easy-to-use transport link operating 24 hours a day	2.1 Accessibility 2.2 Free of charge to use 2.3 24h operability
3. To increase physical activity by enabling a shift to active travel modes through the provision and improvement of pedestrian and cycling infrastructure	3.1 Cycle- and pedestrian- friendly 3.2 Potential to support mode shift

Core Objectives	Criteria
4. To enhance London's cityscape and public realm, creating better places for everyone	4.1 Quality of environment and design
5. To showcase innovative design and engineering, creating a new landmark for London	5.1 Bold and functional architecture and engineering with tourism appeal
6. To provide a high-capacity, low-carbon and zero pollution transport link for London's growing population, offering an alternative to overcrowded underground and poor quality road links for sustainable modes	6.1 Capacity to cope with forecast demand 6.2 Low-carbon operation
7. To link residential with employment and leisure centres, supporting the sustainable regeneration and development of East and South East London	7.1 Land and property value increase 7.2 Increased commercial activity including services and commuter spending
8. To achieve value for money	8.1 Assessment of financial impact in Business Case
9. To be constructible	9.1 Stakeholder approval 9.2 Options fit site conditions and constraints

Table 2: Core objectives and criteria

5.2 Summary of All Options' Performance Against Objectives

Table 3 below shows a summary of the full options assessment detailed in Appendix A. Each option was assessed against the core project objectives, and its impact was rated on a five-point scale (from a +2 positive to a -2 negative impact). This provided each option with an overall score indicating its overall positive or negative impact.

The full breakdown of each option's assessment can be found in Appendix A.

Objective	Option					
	A: Do nothing	B: Upgrade ferry	C: Repurpose Rotherhithe Tunnel	D: New cable car	E: New walking and cycling tunnel	F :New walking and cycling bridge
To improve connectivity for people on foot and bike by providing a direct, safe, and pleasant route across the Thames in an area with few crossing options, offering significant journey time reductions.	Neutral -	Slight positive +1	Slight positive +1	Neutral -	Slight positive +1	Positive +2
To improve access and increase transport options for everyone by providing an accessible, free and easy to use 24 hour transport link.	Neutral -	Slight positive +1	Positive +2	Slight negative -1	Positive +2	Positive +2
To increase physical activity by enabling a shift to active travel modes through the provision and improvement of pedestrian and cycling infrastructure.	Neutral -	Slight positive +1	Slight positive +1	Neutral -	Positive +2	Positive +2
To enhance London's cityscape and public realm creating better places for everyone.	Neutral -	Neutral -	Neutral -	Slight positive +1	Neutral -	Positive +2
To showcase innovative design and engineering, creating a new landmark for London.	Neutral -	Neutral -	Neutral -	Neutral -	Slight positive +1	Positive +2

Objective	Option					
	A: Do nothing	B: Upgrade ferry	C: Repurpose Rotherhithe Tunnel	D: New cable car	E: New walking and cycling tunnel	F :New walking and cycling bridge
To provide a high-capacity, low-carbon and zero pollution transport link for London's growing population, offering an alternative to congested underground and road networks.	Neutral -	Slight negative -1	Negative -2	Slight positive +1	Positive +2	Positive +2
To link residential with employment and leisure centres, supporting the sustainable regeneration and development of East and South East London.	Neutral -	Slight positive +1	Slight negative -1	Slight positive +1	Positive +2	Positive +2
To achieve value for money.	Neutral -	Positive +2	Positive +2	Neutral -	Slight positive +1	Slight positive +1
The scheme is constructible.	Neutral -	Positive +2	Negative -2	Negative -2	Negative -2	Slight positive +1
Overall Score	**0**	**7**	**1**	**0**	**9**	**16**

Table 3: Summary of performance of Options A to F against objectives

5.3 Conclusions

The conclusions for each option are given below:

Option A: Do nothing – does not meet any project objectives, and will not cater for baseline growth in cycling.

Option B: Improved passenger ferries – an achievable low cost option, however its ability to meet the project's objectives is limited, falling short in particular of achieving significant mode shift potential. There is also high uncertainty regarding fares to cover ongoing operation costs. As a possible option this could be explored further as a short term solution in case Option F's development experiences financing or planning delays.

Option C: Re-purpose Rotherhithe tunnel – while meeting some objectives, its impact on vehicle traffic is of such magnitude that the option is deemed undeliverable. It is therefore not recommended for further assessment.

Option D: New walking and cycling tunnel– limited in its ability to meet project objectives, and likely to be costly. Ultimately not possible to construct due to unavailable land, and therefore not recommended for further assessment.

Option E: New cable car – while achieving the majority of objectives, a new cable car in this location is not constructible due to the unavailable linear land take, and this option is therefore not recommended for further assessment.

Option F: New walking and cycling bridge – facing some technical and delivery challenges, and high upfront costs. However, with an attractive design this would provide significant economic benefits and public and private financing opportunities as a result of its high public visibility. A new bridge scores strongly against all project objectives and is therefore recommended for further development.

6. Updated Demand Analysis

6.1 Background

Across Greater London, cycle journeys have grown by 79% between 2001 and 2011, outgrowing TfL targets and forecast estimates given in the original 2007 Preliminary Economic Appraisal and the 2008 Updated Economic Appraisal.[1] Cycle journeys now make up 8% of traffic crossing the Thames screenline.[2] Furthermore, travel demand to and from the Isle of Dogs is growing faster than the rest of London.[3] The previous demand analysis has been revised to take account of:

- Revised population projections and more ambitious employment growth aspirations for Canary Wharf, the Isle of Dogs and Rotherhithe
- An updated cycling mode share from the latest available Canary Wharf employee travel survey (2013)

6.2 Methodology

This appraisal has been prepared using the standards and format set out in TfL's Business Case Development Manual and Business Case Assistant. It uses data from the following three principal datasets:

- Canary Wharf Staff Travel Survey 2013 (10,479 responses)
- TfL Isle of Dogs Cordon Survey 2015
- Colin Buchanan (CB) Updated Economic Appraisal for the Thames Pedestrian and Cycle Bridge (2008)

Other information sources are used throughout the report to supplement assumptions and calculations.

The report was developed as follows:

1. Use of Colin Buchanan (CB) demand figures, which were calculated using a mode shift model based on generalised journey times, as a baseline
2. Use of 2013 Canary Wharf Staff Travel Survey and TfL Isle of Dogs Cordon Count 2015 data to update initial demand analysis assumptions
3. Use of existing local data (population growth, cycle growth, etc.) and a simple projection to calculate the potential number of walking and cycling trips by 2020
4. Benchmarking against the elasticity and mode shift analysis provided by Colin Buchanan in the 2008 Updated Economic Appraisal

1 TfL, Roads Task Force - Technical Note 4: How has Cycling Grown in London (2013), p1
2 TfL, Roads Task Force - Technical Note 4: How has Cycling Grown in London (2013), p4
3 TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p3

6.3 Key Assumptions

1. There is an annual growth in travel demand of 5.5% in Canary Wharf, the wider Isle of Dogs, and Rotherhithe. This is likely to be a conservative assessment.
2. By 2020, the rate of growth in travel demand and expected mode shift to walking and cycling will be similar across Canary Wharf, the wider Isle of Dogs, and Rotherhithe. Therefore Canary Wharf data is used as the baseline. This may overestimate some trips.
3. There is an annual growth in cycle mode share of 4.1% in Canary Wharf, the wider Isle of Dogs, and Rotherhithe. This is likely to be a conservative assessment.

Assumptions and data sources are explained in detail in Section 10.

6.4 Limitations of this Appraisal

The appraisal aims to inform the outline business case and, as such, there are limitations to statistical analysis and to trip forecasting.

The purpose of the report is not to produce a detailed demand or business case analysis but an outline report to: (a) highlight the potential quantitative and qualitative benefits of the bridge, (b) understand what further work needs to take place, and (c) identify risk at an early stage.

The demand analysis is based upon previous work, existing available information and simple statistical analysis. The methodology used in this analysis is likely to overestimate some trips, and underestimate others. Overall, given the uncertainty in suppressed demand and trips arising from the residential developments in the South of the Isle of Dogs, it is likely that this appraisal provides a low demand estimate.

It is recommended that a detailed demand analysis is conducted at the next stage, using a four stage elasticity model, which will inform detailed development of bridge design and cycle connections, operational procedures, and the final BCR.

Key assumptions are listed in Section 10.

6.5 Cycle Demand Analysis

Cycle trips using the bridge from south of the river are expected to arise from:

1. Displacement of all existing cycling trips into the Isle of Dogs from south of the river
2. Displacement of existing cycling trips via the Greenwich foot tunnel
3. New trips through mode shift from the Docklands Light Railway (DLR)
4. New trips through mode shift from the Jubilee line
5. New trips through unlocked suppressed demand

Additional sources of trips which have not been quantified in this study include:

- A detailed understanding of suppressed demand for trips beyond an eight kilometre radius
- New trips associated with projected population growth within the Isle of Dogs
- Recreation and tourism related trips

6.5.1 Existing Cycling Trips to the Isle of Dogs from South of the River

There were 389,500 total daily trips to the Isle of Dogs in 2013, of which 83% were to and from Canary Wharf.[4] 4% of trips to and from Canary Wharf in 2013 were made by bicycle and 3% on foot[6], proportions that have been extrapolated to apply to the Isle of Dogs.

This means that in 2013 there were approximately 15,500 daily trips by bike to and from the Isle of Dogs. Of this total, 27% came from south of the river and are directly transferable to the proposed bridge route (see also Figure 4 on page 49).[5]

Therefore a total of 4,207 trips per day or 840,000 trips per annum were made by bike to and from the Isle of Dogs in 2013 which would have benefited from the proposed bridge route.[6]

Assuming trips grow by 5.5% a year[4] until 2020 there will be 567,000 total daily trips to and from the Isle of Dogs by 2020.

Assuming cycle growth in the area continues at 4.1%[7] annually, the mode share for cycling in the Isle of Dogs will increase from 4% in 2013[5] to 5.3% by 2020.

That is a total of 30,000 daily trips by bike to and from the Isle of Dogs by 2020, of which 8,100 will benefit from the bridge route. The majority of these 8,100 trips will be to and from Canary Wharf.

This equates to 1,620,000 trips annually by bike to and from the Isle of Dogs via the proposed bridge route in 2020.[8]

4 TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p3
5 Canary Wharf Staff Travel Survey (2013)
6 Annualisation factor of 200 from Colin Buchanan, East London River Crossings: Pedestrian / Cycle Assessment (2010)
7 Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008), p13
8 Including cycling trips from the Greenwich foot tunnel

	2013	2014	2015	2016	2017	2018	2019	2020
Daily trips to and from the Isle of Dogs	389,500	410,923	433,523	457,367	482,522	509,061	537,059	566,598
Cycling mode share in the Isle of Dogs	4.0%	4.2%	4.3%	4.5%	4.7%	4.9%	5.1%	5.3%
Total daily cycling trips to and from the Isle of Dogs (from mode share)	15,580	17,111	18,792	20,638	22,666	24,893	27,339	30,025
Daily cycling trips from the south (27% of the total)	4,207	4,620	5,074	5,572	6,120	6,721	7,382	8,107
Annual cycling trips benefited by the new Thames crossing	841,320	923,984	1,014,770	1,114,476	1,223,979	1,344,241	1,476,319	1,621,375

Table 4: Estimated cycle trips in the Isle of Dogs in line with population growth and growth in cycling

6.5.2 Existing Cycling Trips from the Greenwich Foot Tunnel

On a typical day in 2013, there were 577 cycled trips through the Greenwich foot tunnel during the AM peak period.[9] This is approximately 346,200

9 TfL, Pedestrian and cyclist Thames screenline crossings count (2013)

trips annually which represent approximately 40% of the total number of cycling trips coming from the south into the Isle of Dogs.[10]

- It is assumed that the entirety of these cycling trips would switch to the route via the bridge due to the considerable time penalties and inconveniences of dismounting and walking through the foot tunnel (technically cycling through the tunnel is not currently allowed).
- It is assumed that most cycling trips originating east of the Greenwich foot tunnel should already be served via the Emirates Air Line Cable Car. In reality, some trips might continue via the Greenwich foot tunnel, however, it is assumed that they would be negligible due to the poor and restricted conditions for cyclists.
- It is also assumed that the number of cycling trips through the Greenwich foot tunnel peaked at around 2013 levels (with 577 cycling trips in the AM peak) and that the constrained environment is suppressing cycling demand considerably.

Trip type	Number of trips (rounded to nearest '000)	Percent of total existing trips transferred to the bridge by 2020
Total existing trips by bicycle transferred to the bridge by 2020	1,620,000	100%
Trips per annum by bicycle transferred from the Greenwich foot tunnel (capped at 2013 levels)	346,200	21%
Total existing trips by bicycle transferred to the bridge excluding those from the Greenwich foot tunnel	1,273,800	79%

Table 5: Existing trips by bicycle transferring to bridge by 2020

6.5.3 New Trips Through Mode Shift from the Jubilee Line

There were approximately 1,022 trips during the AM peak per day on the Jubilee line between Canada Water and Canary Wharf in 2013.[11] According to the population growth forecast, this is predicted to increase to approximately 2,200 trips in the AM peak period by 2020.[12]

With a new crossing option it is reasonable to assume that a percentage of these trips will switch to cycling (see also Section 4). Assuming the mode shift follows the same mode share pattern as Canary Wharf by 2020, 5.3% of these trips could transfer to cycling journeys via the bridge.

This equates to approximately 115 new cycling trips via the proposed bridge in the AM peak by 2020. **This is equal to approximately 69,000 cycling trips a year in 2020.**[13]

10 577 x 600 = 346,200 (trips during the AM peak x annualisation factor from AM peak to annual trips = annual trips)
11 Colin Buchanan, East London River Crossings (2010) and LUL data provided by TfL
12 Estimated at 5.5% a year - TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p3
13 Annualisation factor from AM peak to yearly of 600, estimated from Colin Buchanan, East London River Crossings (2010)

6.5.4 New Trips Through Mode Shift from the DLR

Table 6 below details the new trips across the bridge as a result of mode shift from the DLR and Jubilee line.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Jubilee line (Canada Water to Canary Wharf)															
Jubilee line trips (AM peak)	1,022	1,078	1,138	1,200	1,266	1,336	1,409	1,487	1,568	1,655	1,746	1,842	1,943	2,050	2,163
Mode split for cycling (4.1% growth from 2013)	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.16%	4.33%	4.51%	4.70%	4.89%	5.09%	5.30%
Mode shift to cycling trips (AM peak)	41	43	46	48	51	53	56	59	65	72	79	87	95	104	115
Mode shift to cycling annual trips	24,528	25,877	27,300	28,802	30,386	32,057	33,820	35,680	39,186	43,036	47,265	51,909	57,009	62,611	68,763
DLR (Greenwich to Canary Wharf)															
Greenwich DLR trips (AM peak)	601	634	669	706	745	785	829	874	922	973	1,027	1,083	1,143	1,205	1,272
Mode shift to cycling trips (AM peak)	24	25	27	28	30	31	33	35	38	42	46	51	56	61	67
Mode shift to cycling annual trips	14,424	15,217	16,054	16,937	17,869	18,852	19,888	20,982	23,044	25,308	27,795	30,526	33,525	36,819	40,437

Table 6: Mode shift projections from the Jubilee line and DLR based on growth in travel demand in line with population growth and growth in cycling. Mode share for cycling in Canary Wharf is assumed to be 4% until 2013, with a subsequent growth of 4.1% year on year until 2020[14]

14 Estimated at 4.1% a year - Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008), p13

There were approximately 600 trips during the AM peak per day on the DLR between Greenwich and Canary Wharf in 2006.[15] According to population growth forecast this is predicted to increase to approximately 1,300 trips in the AM peak period by 2020.[16]

With a new crossing option it is reasonable to assume that a percentage of these trips will switch to cycling. Assuming the mode shift follows same mode share pattern as Canary Wharf by 2020, 5.3% of these trips will transfer to cycling via the bridge.

This equates to approximately 70 new cycling trips via the proposed bridge in the AM peak in 2020. **This is equal to approximately 40,500 cycling trips a year in 2020.[17]**

6.5.5 New Trips from Suppressed Demand Around the Greenwich Foot Tunnel

A large proportion of existing cycling trips south of the river to and from Canary Wharf use the Greenwich foot tunnel. There were approximately 577 cycling trips during the AM peak per day using the Greenwich foot tunnel in 2013.[18] It is assumed that considerable additional growth in cycling from the south is being suppressed by the significant constraints for cyclists in the tunnel.

Applying population growth forecasts and cycling growth forecasts,[19, 20] cycling through the tunnel could increase to approximately 1,100 trips in the AM peak period by 2020.[21, 22]

This is approximately 520 additional cycling trips from the 2013 level.

This is equal to approximately 312,000 cycling trips a year in 2020.[23] These trips are considered new trips from existing suppressed demand.

Given the very constrained environment of the tunnel and potential for conflict with pedestrians it is reasonable to assume that these additional numbers of trips will be suppressed and will not materialise unless a new crossing option is provided. It is also logical to assume that the majority of these trips would use the bridge instead of dismounting to walk 370 meters through the tunnel.

6.5.6 Total Cycling Trips

From the analyses conducted for this outline business case and summarised in Table 7 below, it is expected that by 2020 there will be around 2.04 million journeys a year by bicycle to and from Canary Wharf via the proposed bridge. This represents a 2.5 fold increase on the number of cycling trips from the south to Canary Wharf in 2013. Furthermore, this figure represents 650,000 more cycling trips per year using the bridge than the previous demand study identified.

15 Colin Buchanan, East London River Crossings (2010)
16 Estimated at 5.5% a year - TfL's Isle of Dogs Cordon Survey, Travel in London Supplementary Report (January 2015)
17 Annualisation factor from AM peak to yearly of 600 estimated from Colin Buchanan, East London River Crossings (2010)
18 TfL, Pedestrian and cyclist Thames screenline crossings count (2013)
19 Population growth forecast estimated at 5.5% a year - TfL's Isle of Dogs Cordon Survey, Travel in London Supplementary Report (January 2015), p3
20 Cycling growth forecast estimated at 4.1% a year - Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008), p13
21 2015 data has been used retrospectively to calculate cycling growth increase from 2006
22 Potential for double count from annual population and cycling increases.
23 Annualisation factor from AM peak to yearly of 600 estimated from Colin Buchanan, East London River Crossing (2010)

Description	Annual cycling trips by 2020 (rounded to nearest '000)	Percentage of Total trips
Total existing trips by bicycle transferred to the bridge by 2020 (including Greenwich foot tunnel)	1,620,000	79.4%
Trips per annum by bicycle transferred from the Greenwich foot tunnel (capped at 2013 levels)	*346,200*	*17%*
Existing trips by bicycle transferred to the bridge excluding those from the Greenwich foot tunnel	*1,273,800*	*62.4%*
New cycling trips as a result of mode shift from the Jubilee line	69,000	3.3%
New cycling trips as a result of mode shift from the DLR	40,500	2%
Suppressed demand due to lack of suitable crossing	312,000	15.3%
Total cycling trips	**2,041,500**	

Table 7: Summary of annual cycling trips in 2020 via the proposed bridge

Table 7 details the summary of estimated annual cycling trips in 2020 by the proposed bridge, and equates to:

- 10,200 daily cycling trips
- 3,400 cycling trips during the morning peak
- 19 cyclists a minute during the morning peak

We interpret that the increase in demand from previous studies is a reflection of:

- Increase in cycling growth across London
- Increased population growth in Rotherhithe area
- Increased development (residential and employment) across of the whole of the Isle of Dogs
- Overcrowding on other modes resulting in mode shift to cycling

6.5.7 Sensitivity Analysis

Phil Jones Associates' 2013 Study shows that mode share could be as high as 7% in Southwark and could go up potentially to 15% in the near future.[24] A 7% mode shift will be used as part of the sensitivity analysis in the Benefit Cost Ratio calculations.

24 Phil Jones Associates, Cycle Demand Study, Southwark (2013)

6.6 Walking Demand Analysis

The Colin Buchanan (CB) 2008 study estimated generalised journey time for walking trips using:

- a least square analysis
- the elasticity of walking mode share to distance
- the ratio of walking to public transport

The CB study assumed that walking would only be attractive within a radius of 2.5km. It found that mode share for walking is relatively elastic against the utility of public transport within a 1.25km radius. Beyond this 1.25km radius walking mode share becomes very elastic.

This is a logical conclusion in that walking will become less or more attractive depending on public transport options (and the quality of service) and the distance to public transport station/ stop and destination.

This study conducted a review of existing CB walking trips forecast as follows:

- A simple linear projection of existing walking trips to and from Canary Wharf by 2020 discounting those coming from the east that would continue using the Greenwich foot tunnel
- Mode shift from Jubilee line (Canada Water to Canary Wharf)
- Mode shift from the Hilton Ferry
- Mode shift from the DLR assuming that only a proportion of trips would be suitable (those originating west of Greenwich DLR station, close enough to the 2.5km catchment area)

This simple analysis found that close to 1 million journeys would use the potential bridge alignment. It was concluded that the walking trips forecast remains as per the 2008 study.[25] This is a reasonable assumption due to the following:

- The catchment area for the bridge is limited to 2.5km
- The Jubilee line offers a crossing alternative within this catchment
- There are potential time penalties for trips coming from further afield

The CB report concludes that there will be approximately 1 million walking journeys a year across the bridge in 2020, as set out in Table 8 below.

25 Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008), p16

Description	Annual walking trips by 2020 (rounded to nearest '000)	Percentage of total trips
Existing walking trips (transfer from the Hilton ferry)	505,000	49%
Baseline growth in walking trips between 2006 and 2020 (82% increase as a result of employment and population growth)	412,000	40%
Mode shift	114,000	11%
Total walking trips	**1,032,000**	

Table 8: Existing trips by pedestrians transferring to bridge by 2020[26]

The total walking trips detailed in Table 8 equate to:

- approximately 3,000 walking trips a day over the bridge
- approximately 1,000 trips during the morning peak
- approximately 6 people a minute during the morning peak

These figures need to be revised in more detail as they are likely to underestimate walking trips due to:

- increasing population within the catchment area, particularly around Canada Water and Canary Wharf
- employment growth at Canary Wharf
- the effect of crowding on the Jubilee line (for short trips from Canada Water to Canary Wharf)
- the effect of temporary London Underground closures

However, it is reasonable to assume that cycling trips will be higher than walking trips across the bridge as:

- the catchment area for walking trips is limited and very local
- there are already some crossing alternatives in place (Jubilee line, DLR, Greenwich foot tunnel, Hilton Ferry)

26 Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008), p16

6.7 Summary of Usage Forecast

Description	Annual trips by 2020 (rounded to nearest '000)
Total existing trips by bicycle transferred to the bridge by 2020 (including from Greenwich foot tunnel)	1,620,000
New cycling trips as a result of mode shift from the Jubilee line	69,000
New cycling trips as a result of mode shift from the DLR	40,500
Suppressed cycling demand due to lack of suitable crossing	312,00
Existing walking trips (transfer from the Hilton ferry)	505,000
Baseline growth in walking trips between 2006 and 2020 (82% increase as a result of employment and population growth)	412,000
Mode shift in walking trips	114,000
Total walking and cycling trips	**3,073,500**

Table 9: Existing trips by cycles and pedestrians transferring to the bridge by 2020

6.8 Benchmarking

6.8.1 Comparable Corridors for Cycling

To benchmark potential use of the proposed bridge, figures were compared with other major cycle corridors. TfL's Central London Cycle Census (2013) is the key data source.

According to the Travel in London Report 7 (2014), between 2003 and 2013, average daily cycle journey stages increased from approximately 370,000 to 585,000. This represents a year on year growth of approximately 4.6%.[27] Applying this assumption to the TfL Central London Census (2013) data produces an approximate estimated forecast for cycles during the AM peak in 2020 on these corridors. Compared with central London's busiest roads for cycling, the bridge is ranked 6th (see Table 10 below). This includes five of central London's bridges over the Thames.

27 TfL, Travel in London Report 7 (2014), Section 3.15

Site	Cycles during the AM Peak (2013)	Estimated cycles during the AM peak (2020)	Estimated cycles per minute during the AM peak (2020)	Rank
Elephant and Castle Roundabout (Northbound)	2,710	3,730	21	1
Blackfriars Bridge (Northbound)	2,650	3,648	20	2
Waterloo Bridge (Northbound)	2,550	3,510	19	3
Kennington Park Road (Northbound)	2,550	3,510	19	3
London Bridge (Northbound)	2,500	3,441	19	5
Sustrans' Thames Bridge Proposal	-	3,400	19	6
North side of Parliament Square (Eastbound)	2,250	3,097	17	7
Theobalds Road (Westbound)	2,150	2,959	16	8
Old Street (Eastbound)	1,950	2,684	15	9
Tower Bridge (Northbound)	1,300	1,789	10	10

Table 10: Comparison of 2013 central London cycle flows through census sites with Sustrans' proposed bridge during the AM peak.[28]

Running a similar analysis on the Thames Bridge cycle counts, conducted in October 2013, produces similar results (see Table 11 below).

With 19 cyclists per minute during the AM peak, the proposed bridge ranks 4th busiest for cycles against the top ten busiest central London Thames Bridges.

An interpretation of this could be that the demand analysis for cycling is comparable to the demand seen for cycling across other Thames crossings in London, particularly on those serving the major employment centres found in the Central Activities Zone.

28 TfL, Central London Cycle Census: Technical Note (2013), Table A2

Thames Bridges	Cycles during the AM peak (2013)	Estimated cycles during the AM peak (2020)	Estimated cycles per minute during the AM peak (2020)	Rank
Blackfriars Bridge (Northbound)	2,650	3,648	20	1
Waterloo Bridge (Northbound)	2,550	3,510	19	2
London Bridge (Northbound)	2,500	3,441	19	3
Sustrans' Thames Bridge Proposal (Eastbound)	-	3,400	19	4
Chelsea Bridge (Northbound)	1,850	2,546	14	5
Vauxhall Bridge (Northbound)	1,500	2,065	11	6
Southwark Bridge (Northbound)	1,450	1,996	11	7
Tower Bridge (Northbound)	1,300	1,789	10	8
Lambeth Bridge (Westbound)	1,150	1,583	9	9
Westminster Bridge (Westbound)	1,050	1,445	8	10

Table 11: Comparison of 2013 central London cycle flows over bridge sites with Sustrans' proposed bridge during the AM peak [29]

29 TfL, Central London Cycle Census: Technical Note (2013), Table A2

6.8.2 Comparable Sites for Walking

Using pedestrian TfL survey counts for central London bridges, aggregated from 2010-2012, it is possible to compare demand forecasts for Sustrans' proposed bridge with other river crossings in central London.

Table 12 below highlights that the demand analysis in this report may underestimate walking trips. While many central London Bridges connect central London rail termini to major employment centres, those that do not (e.g. Southwark and Millennium) still have much higher walking counts than that predicted for the Rotherhithe Canary Wharf crossing.

TfL's Travel in London Report 6 (2013) features a focus on walking.[30] It provides a useful interpretation of the mode's interplay with public transport.

Bridge	Average daily total (both directions) 2010-2012	Average daily total (2020)	AM Peak flow (2020)	AM Peak pedestrians per minute (both directions)	Rank
London Bridge	42,500	66,723	22,241	124	1
Hungerford Bridge	27,700	43,488	14,496	81	2
Millennium Bridge	22,800	35,795	11,932	66	3
Waterloo Bridge	15,700	24,648	8,216	46	4
Blackfriars Bridge	12,200	19,153	6,384	35	5
Southwark Bridge	8,700	13,659	4,553	25	6
Sustrans' Thames Bridge proposal	-	3,000	1,000	6	7

Table 12: Pedestrian count comparison of Sustrans Bridge with Central London Thames Bridges[31]

Table 12 above assumes an 82% walking growth from 2006 to 2020, equating to 5.8% growth per year, and an AM peak flow assumed to be one third of the daily total.[32]

30 TfL, Travel in London Report 6 (2013), p51
31 Source: Pedestrian Counts on Central London Bridges, TfL Survey Data
32 82% walking growth taken from Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008)

7. Costs

7.1 Background

Outline costs were estimated by Arup using an example design developed by reForm Architects at stage 1-2.

Arup adopted a number of approaches to producing an assessment of capital expenditure. These include:

- Previous costing exercises with suitable inflation uplifts to the first quarter of 2015
- UK sourced estimating rates
- UK sourced benchmarking rates
- Percentage additions for items such as preliminaries and logistics, professional fees and risk/contingency.

The following assumptions have been made when preparing this estimate:

- Cycle lanes and pedestrian lanes are 5m wide each, bridge height is 20m above high tide mark and main bridge span is 184m
- Detailed construction techniques will be based on constraints in the area
- Works will be procured in a competitive pricing environment
- A bridge control room will not be required on site as controls will be located elsewhere (i.e. Tower bridge control room)[1]
- Amenities are not required as workers will only be at the bridge at scheduled times (not permanently)[2]
- Additional costs: 12% for main contractor preliminaries and 8% for offsite overheads and profit has been applied to the construction cost

7.2 Risks

A provision of 25% of the estimated value has been applied to this estimate as a risk/ contingency allowance and is considered to reflect the stage of project definition and level of risk that could occur.

The following items have been identified as potentially having higher than usual risks based on a technically complex design example:

- Risk around construction methodology, coordination and logistics
- Risk around design (risks are based on a detailed complex example design)
- Volatility in contractors' appetite for profit margins and preliminaries resources in the current buoyant market conditions, and potential scarcity of marine resources if construction

1 An on-site control room would cost approximately £0.7m. The site of the control room is discussed in Chapter 5: Navigational Parameters and Impacts

2 Site of staff welfare facilities and operational provision is discussed in Chapter 6: Operational Parameters

overlaps other major projects

- Requirements of services to the bridge in regards to lighting, security, public announcement systems and lifesaving equipment
- Locations of landside structural supports
- Encountering unexpected items (including architectural discoveries) during excavations and working in close proximity to live London Underground lines

7.3 Capital Costs

Current costs are estimated at £110 million, including design and management fees and 25% risk and contingency as follows:

Cost type	Cost (rounded to nearest '000)	Note
Sub-total works costs	£63,920,000	
Main contractor's preliminaries	£7,670,000	Estimated at 12%
Main contractor's overheads and profits	£5,114,000	Estimated at 8%
Sub-total construction costs	**£76,700,000**	
Project / design team fees	£11,505,000	Estimated at 15% (excluding planning application fees)
Sub-total construction cost including fees (Base cost)	**£88,210,000**	
Risks	£22,052,500	Estimated at 25% of base cost
Sub-total construction cost including fees	**£110,262,500**	

Table 13: Breakdown of capital costs and contingency, in 2015/16 Q3 prices

7.3.1 Excluded Items

The following items are excluded from the main cost projections. They are discussed later in Section 7.

- Removal/treatment of contaminated material
- VAT
- Legal fees
- Planning fees
- Other development/project costs (including land acquisition, financing costs, insurance, marketing/public relations, etc.)
- Contributions made to third parties and compulsory purchases
- Inflation beyond the third quarter 2015
- Major statutory services diversions
- Encountering significant obstructions in the ground when constructing support foundations
- Client direct costs (including early stage feasibility study)
- Works to existing buildings or surrounding infrastructure (e.g. upgrading cycle route and signage)
- Full re-landscaping of Durand's Wharf green space to make a new park (suggested allowance £2m)
- Creation of public realm area near Canary Wharf landing (suggested allowance £1m-2m)
- Monitoring and mitigations associated with working in close proximity with the Jubilee line (not anticipated to be required)
- Maintenance and operational costs
- On-site energy production
- Environmental mitigations
- Ramp extension over Westferry Road with extra stair and lift access (details of ramp options provided in Chapter 3: Site Parameters and Constraints)
- Provision of bridge operational facilities (assumed not required) - suggested allowance of £0.7m (see also Chapter 6: Operational Parameters)

7.3.2 Estimating Certainty

The level of accuracy of these cost plans are approximately -20% / +30%. The outline cost study has also determined that an 80th percentile value would be approximately £121.4m (38% above the base cost). The 80th percentile is a detailed statistical value and risk certainty analysis.

7.3.3 Optimism Bias

Two approaches are suggested for calculating a suitable Optimism Bias appropriate for this stage of the project.

The DfT[3] suggest an uplift of 66% is appropriate for a typical Stage 1 Fixed Link scheme. This has been applied to the risk adjusted figure.

However, given the cost plan was based on a design that is relatively advanced for this stage of the project, Arup recommend applying an alternative figure. The DfT suggests a 55% optimism bias uplift to the base cost for bridges and 32% for bicycle/pedestrian facilities to establish an 80th percentile value.[4] Following DfT optimism bias suggestions based on the example design, a 49% optimism bias uplift is appropriate.

7.4 Other Project Costs

Other costs (such as land, VAT and client costs) are estimated at 75% of the base cost, equivalent to £66.5m. This is based on a review of relevant infrastructure schemes (see Figure 3 below). This figure exceeds the typical uplift applied at scheme appraisal, and is therefore judged to be conservative.

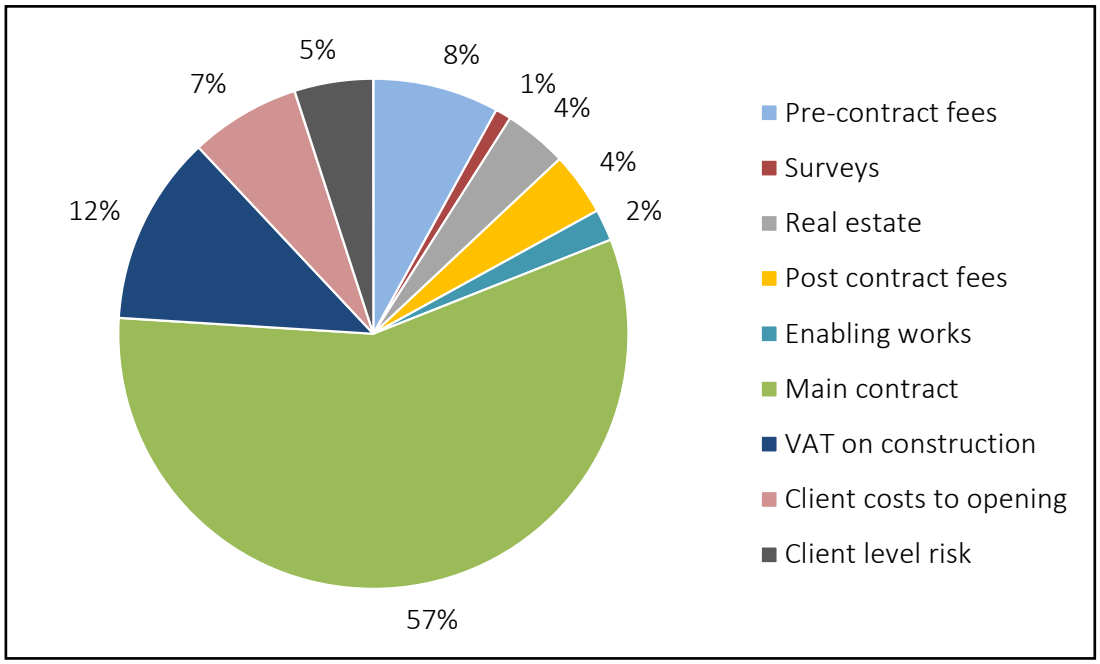

Figure 3: Indicative full project costs (57% base cost, 43% other project costs), Arup 2015

7.5 Maintenance/Operating Costs

The bridge's maintenance costs include regular inspections to monitor the condition of the structure and to replace major elements, such as waterproofing the bridge decks and its expansion joints. Annual maintenance costs are estimated to be in the order of 1% of construction costs, thus in the order of £900k per annum. These are outline operating costs and could vary depending on specific operation requirements attached to the selected design.

Based on the operational parameters (outlined in Chapter 6) and experience from other bridges across the UK (e.g. Gateshead bridge), operating costs have been estimated at £500k per annum.

3 WebTAG: TAG unit A1-2 scheme costs, November 2014
4 Department for Transport, Procedures for Dealing with Optimism Bias in Transport Planning Guidance Document, (June 2004)

ARUP tested these assumptions against a previous whole life cost cycle model. This brief analysis has indicated that these provisions are reasonable.

For the purpose of the benefit to cost ratio calculations, this study uses £0.9m per year for maintenance cost and £0.5m per year for operational costs.

Renewal of the hydraulic, electrical and other associated material will be required after the first 30 life years of the bridge. This is expected to be a one off cost of £3-5m at today's prices.

There is the potential to minimise maintenance and operating costs by integrating procedures into existing and planned river crossing resources.

7.6 Costs Avoided and Third Party Contributions

The bridge would make the current Hilton ferry between Rotherhithe and the Isle of Dogs redundant. Decommissioning the Hilton ferry would equate to savings in operating costs estimated at £150k per annum. The ferry is currently subsidised by the Hilton Group so any loss in revenue fares to the ferry operator are balanced out by savings to the Hilton Hotel. Furthermore, it is likely that the pier on the Rotherhithe side would no longer be necessary and thus further maintenance savings would be made.

The project proposal would try to maximize third party contributions from developers, private companies and sponsors. For the purpose of this study a contribution of £36m over ten years has been included as part of the benefit cost ratio calculation in Section 9. This figure has been taken from the Emirates Air Line (cable car) but there are other precedents through Santander Cycles (Cycle Hire) and Barclays Cycle Superhighways. A scenario without sponsorship is included as part of the sensitivity analysis in Section 9.2.

7.7 Summary of Costs and Contributions

Cost type	Cost (£m)
Base cost (construction)	88.2
Base cost plus 25% contingency	110.3
80th Percentile (P80)	121.4
Other project costs (land, fees, VAT, client costs etc)	66.5
Annual maintenance costs	0.9
Annual operation costs	0.5
Annual costs avoided	0.15
Annual third party contributions (sponsorship)	3.6

Table 14: Summary of costs and contributions for the proposed bridge, in 2015 Q3 prices

7.8 Full Scheme Costs

The following presents a range of costs adopting varying assumptions. The expected total scheme cost is **£204.9m – £272.0m** in 2019/20 prices, following risk and optimism bias uplifts.

Cost Scenarios	Description	Cost (millions)
1	88.21m main contract 25% Risk 66% Optimism Bias 9% Inflation Other investment costs at 43% main contract base cost	£272.0
2	88.21m main contract 25% Risk 49% Optimism Bias 9% Inflation Other investment costs at 43% main contract base cost	£251.6
3	P80 9% inflation Other investment costs at 43% main contract base cost	£204.9

Table 15: Cost scenarios against varying assumptions in 2019/20 prices

1. Upper bound: Uplifts applied to the Base construction cost are risk at 25%, Optimism Bias at 66%, plus other project costs. Inflation at 9% is applied.
2. Mid-range: Uplifts applied to the Base construction cost are risk at 25%, Optimism Bias at 49%, plus other project costs. Inflation at 9% is added. The 49% estimate of Optimism Bias departs from the standard suggested 66% in Webtag, however follows its guidance to determine a revised factor. The cost plan, determining the base cost of 88.21m, is based on an example design, which is advanced to a more detailed stage than would be typical of a scheme appraised at Stage 1.
3. Lower bound: The 80th Percentile cost (P80) can be presented as the likely scheme cost, and includes an uplift of approximately 38% uplift on the base cost. Inflation at 9% is added, and other project costs.

The costs are adjusted for inflation at 9%, presented in 2019/20 prices and are not discounted.

8. Explanation of Benefits

8.1 Monetised Benefits

8.1.1 Cycling Journey Time Savings

With a new fully accessible and 24 hour dedicated river crossing facility in this location, significant journey time savings can be achieved. In keeping with previous appraisals,[1] the bridge produces substantial journey time savings for a number of users:

- Current cyclists whose journey time is reduced because they can take a shorter route and, in most cases, avoid Tower Bridge or the Greenwich foot tunnel, which slows cyclists due to the stairs and lifts and requires cyclists to dismount
- Users of the current ferry service who no longer have to wait to cross the river
- Local resident shifting to cycling from public or private transport

A detailed assessment of more than 100 example cycling journeys showed that on average existing cyclists would save 20 minutes on their journey (excluding Greenwich foot tunnel users).

Cyclists currently using the Greenwich foot tunnel or the DLR would have on average no significant time saving as they would have to cycle further to use the bridge.

New cyclists as a result of mode shift from the Jubilee line would save on average 5 minutes on their journey.

Calculating time savings from new cyclists as a result of suppressed demand is more complex, and a more detailed origin destination analysis is recommended. However, sample trips within a 8km radius compared against various modes (car, bus, rail and combinations) also showed on average a time saving of 20 minutes per journey.

The area around South Bermondsey - which is earmarked for development - had the biggest time savings as public transport options are limited and several interchanges are required to travel to Canary Wharf.

Table 16 below shows an example of various journey times.

1 Colin Buchanan: Thames Pedestrian and Cycle Bridge Updated Economic Appraisal (2008)

Origin	Travel time using existing routes by bike	Travel time using the bridge route by bike	Time saved
Rotherhithe LUL	37 minutes	16 minutes	21 minutes
Tower Bridge / City Hall	26 minutes	26 minutes	0 minutes
Canada Water LUL	41 minutes	17 minutes	24 minutes
Lagado Mews	39 minutes	12 minutes	27 minutes
Trundleys Road	33 minutes	23 minutes	10 minutes
Burgess Park / Albany Rd	53 minutes	34 minutes	19 minutes
Deptford DLR	29 minutes	28 minutes	1 minutes
Greenwich Town Centre	22 minutes	33 minutes	-11 minutes
Surrey Quays LUL	43 minutes	15 minutes	28 minutes
South Bermondsey NR	42 minutes	22 minutes	20 minutes
Bermondsey LUL	34 minutes	21 minutes	13 minutes

Table 16: Comparative journey times for 11 example trips to Canary Wharf

Note that journeys from Greenwich Town Centre increase in length and therefore do not have a journey time saving. Due to the significantly higher level of quality offered to cyclists, it is expected displacement of these journeys to the bridge route will occur despite the increased duration.

Based on values of time, calculated demand and the average time saving, the following benefits have been estimated in Table 17:

Trip	Estimated trips per year	Value of time (£)	Average time saving	Estimated journey time benefit (£ per annum)
Journey time saving for existing cyclists (not Greenwich foot tunnel)	1,275,175	0.25	20	6,375,876
Journey time saving Jubilee line mode shift	68,763	0.25	5	85,953
Journey time saving from suppressed demand	311,459	0.25	20	1,557,296

Table 17: Journey time savings benefits for cycle trips using the proposed bridge

The study did not take into account journey time penalties due to the lifting of the bridge. The height of the bridge would minimise opening requirements from small boats and barges, however larger vessels could create considerable disruptions to users.

It is expected, however, that long bridge openings would only be required 40 times a year and this would be managed in advance through forewarning customers, reducing journey time impacts.

8.1.2 Walking Journey Time Savings

A detailed assessment of more than 100 example walking journeys showed that on average there are no journey time benefits to pedestrians. There are, however, journey time benefits to existing Hilton Ferry users.

8.1.3 Cycling Ambience Improvement Benefits

The proposed bridge will provide a dedicated cycle facility to a high standard:

- Cycle lanes marked on deck (wide enough to pass other cyclists)
- More than 15 minutes of the journey on a quiet and attractive route
- Even and smooth cycle surface
- Cycle surface free from debris
- No standing water on cycle surface
- Cycle signage at regular intervals
- Cycle route signage regularly on highways
- Fully accessible, 24 hour facility

The route will also be connected to existing attractive cycle routes on both side of the river: the Thames Path, Cycle Superhighway 3 on the north side and, on the south side, the Russia Dock cycle path and the proposed Cycle Superhighway 4.

Based on monetised benefits of cycling improvements from ambience benefit for cyclists have been calculated at £0.61 per trip.[2]

Ambience benefits will apply to all 2 million a year expected cycle journeys, **meaning ambience benefits for cyclists are estimated at £1,254,000 per year**

8.1.4 Walking Ambience Improvement Benefits

Pedestrian users will experience a major improvement in journey ambience due to the high quality walking environment and the attractive views from the bridge. The attraction of the bridge itself is hard to measure but several qualities of environment categories within Table E4.10 of the BCDM have been applied. These include

- Good bright and even lighting
- No litter, graffiti or sign posting
- Surveillance cameras monitored and recorded
- Maps of the local area, information boards and signs to public transport

2 Section E4.11, TfL Business Case Development Manual

- Wide walking area where two people can always walk side by side separated from cyclists
- Good walking surface throughout
- Walking route not obstructed by street furniture or vehicles
- Good maintenance

The quality of the walking environment on the North side in Canary Wharf is already high. Some improvements would be necessary on the south side at Rotherhithe, especially on streets and junctions in the vicinity of the bridge. However, a good walking route already exists through Russia Dock and the Riverside walk.

Based on monetised benefits of walking improvements, ambience benefits for pedestrians have been calculated at £1.22 per trip.[3]

Ambience benefits will apply to all 1 million a year expected walking journeys, **meaning ambience benefits to pedestrians are estimated at £1,220,000 per year**

8.1.5 Safety Benefits

The new bridge route will provide not only a dedicated facility for cyclists but suitable connections on both sides of the river.

On the south side the bridge will be served by the National Cycle Network which provides a traffic-free path through Russia Dock, connecting South Bermondsey, Canada Water and Rotherhithe and the riverside route to Greenwich. A Quietway from Greenwich to Canada Water and Rotherhithe ending at Tower Bridge will be delivered before 2020, as will Cycle Superhighway 4 linking Tower Bridge and Greenwich along Lower Road (A200).

On the north side, the bridge will connect National Cycle Network Route 13 (a mostly segregated route across the Isle of Dogs) and the Thames Path that links to Cycle Superhighway 3 to Tower Gateway and the East-West Superhighways (in construction). The route will also link directly to the Canary Wharf estate, which is a low-traffic and low-speed road network.

These new connections will mean that most cyclists coming from the South will avoid accident hotspots at Tower Bridge and Tower Gateway and the Greenwich Town Centre one-way system.

From AccStats 19 data, there have been 6 serious injuries involving cyclists in the last 9 years in these 3 areas. This is a rate of 0.67 serious injuries a year. Using BCDM factor of 0.1 and the rate of accident a year, the equivalent causality cost (each casualty valued at £1.8m) per year of avoiding these areas is around £120,000.

It is assumed that only about half of existing cyclists currently go through these accident hotspots. Therefore, annual safety benefits of avoiding these sections is estimated at £60k per year.

8.1.6 Health Benefits

A bridge would increase people's propensity to walk and cycle, bringing about a health benefit to those users by increasing fitness and wellbeing, reducing mortality. While a new bridge will shorten some journeys, many more journeys will become walkable and cyclable which are currently undertaken by other modes of transport.

Table 18 below shows the values applied to walking and cycling trips, generated using the WHO Health Economic Assessment Tool.

3 Section E4.10, TfL Business Case Development Manual

	Cycling	Walking
Total number of new trips per day	1,400	280
Proportion of return journeys	86 %	73 %
Number of individuals contributing to the observed trips (calculated from the proportion of return journeys)	798	177.8
Average number of trips per person	217.54 per year	1.57 per day
Average duration of a trip (minutes)	25	22
Average number of hours spent cycling/walking per person per year	90.64	34.65
This level of cycling/walking is likely to lead to a reduction in the risk of mortality of:	10 %	16 %
Total number of individuals regularly doing this amount of cycling/walking	798	178
Current value of the total benefits accumulated over 1 years	**£651,000**	**£385,000**

Table 18: Monetised values for the health benefits of new walking and cycling trips

Full HEAT results can be found in Appendix E.

8.1.7 Crowding and Congestion Relief on the DLR and London Underground

With the Jubilee line at capacity and DLR experiencing busy peak periods, forecast growth in jobs and housing will further intensify crowding. Projects that will reduce crowding will not only address current problems, but will also help to prevent it worsening over time.

Mode shift to walking and cycling has benefits in terms of congestion relief on other modes. Table 19 shows the values that have been applied. The LUL peak value has been taken from the Crossrail appraisal.[4]

Mode shift	Mode shift from LUL and DLR (trips per annum)	Value	Congestion relief benefits per annum
From LUL (peak trip only)	223,500	£0.19	£42,465

Table 19: Comparative journey times for 12 example trips to Canary Wharf

The bridge potentially has a large positive impact on Canada Water and Canary Wharf stations by freeing up peak time LUL and DLR capacity. This is of particular relevance to the eastbound Jubilee line and the northbound DLR in the AM peak.

4 Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008), p22

8.2 Wider benefits

8.2.1 Regeneration

The introduction of the bridge will improve access from the Rotherhithe peninsula to Canary Wharf, making it more attractive for employees to reside there. As a result, it is expected that there will be an increase in housing development on the peninsula in response to the increased connectivity to Canary Wharf. As the population density in Rotherhithe is currently relatively low, it is assumed that there is scope for intensification on the peninsula; as highlighted in the 2015 London Plan's designation of Canada Water as an Opportunity Area.

As the population in this area increases, the number of jobs in the area will also increase. This is because as the population rises, a number of services are required to support the population, such as health and leisure services. This increase in the number of jobs will support the renewal of nearby regeneration areas such as Deptford and Peckham. These are deprived areas with high unemployment, and providing greater employment within easy access will bring great benefits to these areas.

A rise in population density and service jobs has been calculated for the Surrey Docks ward. The population density in the eastern half of Surrey Docks closest to the bridge has been assumed to grow to the level of the Cubitt Town ward, which is a similar distance from Canary Wharf. This results in a predicted population of 15,500 in Surrey Docks in 2031, 2,800 higher than current predictions.

Due to the higher population in Surrey Docks, employment in the local area will increase. The level of employment has been assumed to grow by the same proportion as population, i.e. the ratio between population and employment in Surrey Docks has been kept constant. Therefore, by 2031, there will be almost 200 extra jobs in Surrey Docks, due to the rise in population from the opening of the bridge. Of these, it is expected that a proportion of jobs will likely go to local residents.

8.2.2 Severance

Severance is the effect of a barrier on people's journeys, which can lead to increased trip distances and times. The River Thames naturally leads to severance, particularly East of Tower Bridge. A new bridge would significantly reduce this severance effect.

Figure 4 below illustrates the severance effect, mapping out how the river Thames restricts 10 minute journeys both by bike and on foot.

A new walking and cycle bridge would reduce the severance between each bank of the river in this location. Pedestrians would be able to cross the Thames freely between Rotherhithe and Canary Wharf. The reduction in severance would benefit thousands of residents in Rotherhithe by opening up a free walking route to Canary Wharf as a major employment, commercial and leisure destination.

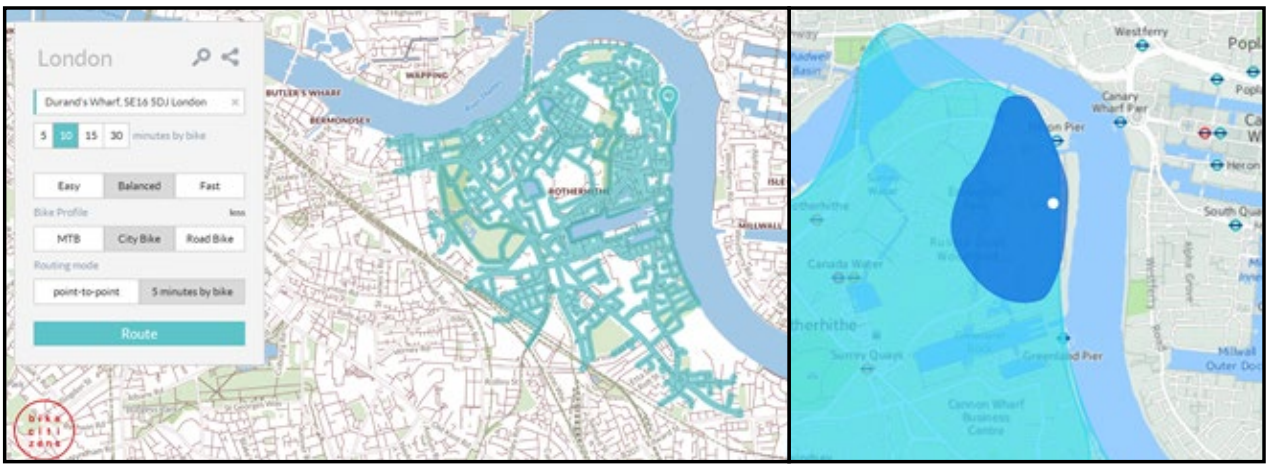

Figure 4: Left: blue lines illustrate the reach of any 10 minute cycle journey starting from Durand's Wharf, Rotherhithe[5]
Right: the dark blue area represents the reach of any 10 minute walking journey starting from Durand's Wharf, Rotherhithe[6]

8.2.3 Network Resilience

Any additional river crossing increases resilience. Technical problems, overcrowding and operational or staffing issues can affect the performance or running of London Underground and DLR networks. A bridge will offer an alternative route independent of these influences. While technical problems cannot be precluded, with back-up and efficient maintenance systems in place these would be carefully managed and mitigated.

8.2.4 Air Quality: Exposure to Emissions

As awareness of air pollution levels rises, more pedestrians and cyclists will choose to use routes where air pollution is lower to avoid discomfort and minimise impacts on personal health. Both Tower Bridge and Rotherhithe Tunnel show NO2 levels that are failing annual mean objectives.

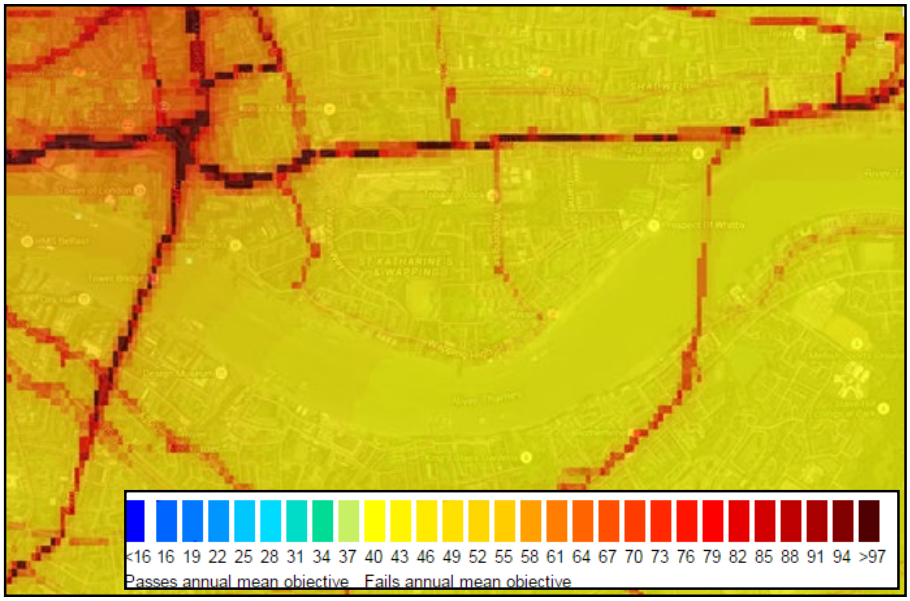

Figure 5: Heat map showing pass or fail of Nitrogen Dioxide level objectives around Tower Bridge [7]

5 Bike Citizens, http://map.bikecitizens.net/gb-london
6 Flavio Gortana, www.flaviogortana.com/isoscope/
7 London Air, www.londonair.org.uk/london/asp/AnnualMapsFullScreen.asp?species=NO2&LayerStrength=75

A bridge for non-polluting and emission-free transport modes provides a rare opportunity in London to experience close to zero air pollution and will be a welcome addition to London's commuting and recreational routes. Walking and cycling routes connecting to the bridge are also away from busy roads, further reducing exposure for users of the bridge. The bridge will therefore provide a much needed choice for health conscious Londoners and people sensitive to air pollution.

8.2.5 Visitors and Tourism

Many of London's visitor attractions and global icons are part of the transport system, offering transport benefits (Tower Bridge, Millennium Bridge, Greenwich foot tunnel, Santander Cycle Hire, New Bus for London and the Traditional Routemaster). We believe that a new walking and cycling bridge that performs lifts to accommodate river traffic will be more than just a transport link, and will attract visitors in its own right. The bridge lies on the Thames Path walking route, and visitors will include London or South-East residents having a "day out" or tourists visiting the bridge en-route to Canary Wharf and Greenwich. Visitor spending potential has not been quantified in detail but is expected to bring considerable additional economic benefits.

8.2.6 Showcasing Britain/London

A new walking and cycling bridge over the Thames with fascinating opening mechanisms will have a very high profile beyond London and Great Britain. Its location – connecting Rotherhithe and Canary Wharf – will span a wide section of the Thames, meaning it will have the longest span of all the bridges in central London. It will also be unique in catering for walkers and cyclists only, highlighting the profile of cycling improvement interventions in London that support its growth and sustainability. The bridge can be a showcase for great design, engineering and construction skills realised in London. It can offer significant promotional benefits not just to London and the Mayor but to Canary Wharf and its business community.

8.2.7 Land Value Uplift

There is considerable evidence that when new infrastructure unlocks connectivity it can have a positive impact on economic activity and regeneration. By reducing journey times and bringing places 'closer' it can make areas more attractive and desirable. This can speed up development and lead to an uplift in land values and property prices.

The Outline Business Case for the Garden Bridge assumes 5% uplift in property values and large additional business turnover benefits due to visitors and tourists attracted. Positive economic impacts of the Garden Bridge are estimated at £13.5 million a year.[8] Land value uplift is most likely to be felt south of the river due to the lower existing connectivity.

8 TfL, Garden Bridge Strategic Outline Business Case (2014), p84

8.3 Summary of Benefits

Trip	Estimated annual trips by 2020	Estimated benefit (£ per annum)
Journey time saving for existing cyclists (not including Greenwich foot tunnel)	1,275,175	6,375,876
Journey time saving Jubilee line mode shift	68,763	85,953
Journey time saving from suppressed demand	311,459	1,557,296
Journey time saving from Hilton Ferry users	392,266	1,188,958
Ambience improvements to cyclists	2,041,500	1,254,000
Ambience improvements to pedestrians	1,031,000	1,220,000
Safety benefits to cyclists	Not demand dependent	60,000
Health benefits (cycling)	114,000 cyclists	651,000
Health benefits (walking)	109,500 pedestrians	385,000
Crowding benefits (from LUL)	223,500	42,465
TOTAL		**12,820,548**

Table 20: Summary of quantifiable estimated benefits

9. Quantified Analysis

9.1 Benefit Cost Ratio

Transport for London's Business Case Assistant tool was used to calculate the Benefit Cost Ratio (BCR) of the proposed bridge.

From Section 6 and Section 8, demand forecast and associated benefits stand as follows:

Source of trips via the bridge	Trips
Existing cycling trips transferred to the bridge	1,620,000
New cycling trips as a result of mode shift from the Jubilee line	69,000
New cycling trips as a result of mode shift from the DLR	40,500
Suppressed demand due to lack of suitable crossing	312,000
Total cycling trips a year by 2020 using the proposed bridge	**2,041,500**
Existing walking trips (Hilton Ferry users)	917,000
New walking trips from mode shift	114,000
Total walking trips a year by 2020 using the proposed bridge	**1,031,000**
Total walking and cycling trips a year by 2020	**3,072,500**

Table 21: Summary of demand forecast

Based on the above demand figures, benefits have been estimated in Table 22 below.

Trip	Estimated annual trips by 2020	Estimated benefit (£ per annum)
Journey time saving for existing cyclists (not including Greenwich foot tunnel)	1,275,175	6,375,876
Journey time saving Jubilee line mode shift	68,763	85,953
Journey time saving from suppressed demand	311,459	1,557,296
Journey time saving from Hilton Ferry users	392,266	1,188,958
Ambience improvements to cyclists	2,041,500	1,254,000
Ambience improvements to pedestrians	1,031,000	1,220,000
Safety benefits to cyclists	Not demand dependent	60,000
Health benefits (cycling)	114,000 cyclists	651,000
Health benefits (walking)	109,500 pedestrians	385,000
Crowding benefits (from LUL)	223,500	42,465
TOTAL		**12,820,548**

Table 22: Summary of monetised benefits by type

As described in Section 7.3, the base cost is estimated at £88.2m. Different assumptions have been taken into account to calculate different benefit cost ratios in Table 23 below as follows:

- Maintenance and operating costs will be kept at the same level (0.9m and 0.5m respectively)
- It is also assumed that a sponsorship deal worth £36m over 10 years will be agreed before the construction of the bridge, so this assumption remains
- A 60 year appraisal in line with TfL's BCA
- Savings of £150k a year from the decommissioning of the Hilton ferry
- Construction to start in 2017/18 and the bridge to be completed by 2019/20
- Benefits (as above) to start in 2020

Cost Scenarios	Description	Cost (millions)	BCR
1	88.21m main contract 25% Risk 66% Optimism Bias 9% Inflation over 3 years Other investment costs at 43% main contract base cost	£272.0	1.8:1
2	88.21m main contract 25% Risk 49% Optimism Bias 9% Inflation over 3 years Other investment costs at 43% main contract base cost	£251.6	2.1:1
3	P80 9% inflation over 3 years Other investment costs at 43% main contract base cost	£204.9	2.5:1

Table 23: Summary of Benefit Cost Ratios calculated according to different cost scenarios

Based on Table 23 above it is reasonable to assume with a high degree of confidence that the BCR for the proposed project will be in the order 2.0:1 even when full project costs are included.

9.2 Sensitivity Analysis

A number of more pessimistic scenarios have been modelled as shown in Table 24 below.

Description	BCR		
	1	2	3
	272.0m	251.6m	204.9m
Total project costs	1.8:1	2.1:1	2.5:1
No sponsorship deal (less 36m private sector sponsorship)	1.7:1	1.9:1	2.2:1
No suppressed demand	1.6:1	1.8:1	2.2:1
4% mode shift – assumes no growth in mode shift	1.4:1	1.6:1	2.0:1
7% mode shift – adopts high estimate[ref: Phil Jones Associates, Cycle Demand Study, Southwark (2013)]	2.3:1	2.5:1	3.1:1
Reduced catchment area: trips are limited to Canary Wharf only, not the wider Isle of Dogs	1.6:1	1.8:1	2.2:1
Public sector contribution of one third of full project costs	4.5:1	5.0:1	5.9:1

Table 24: Summary of Benefit Cost Ratios calculated using the full project cost as a baseline

9.3 Summary of Benefit Cost Ratio Analysis

Based on the various cost scenarios and the sensitivity analysis, the benefit cost ratio for the proposed bridge is likely to be higher than 1.8:1.

The full cost scenario for £204.9m – £272.0m reflects a strong positive outcome of 2.5:1 - 1.8:1.

The main conclusions drawn from the benefit cost ratio analysis are:

- The proposed bridge can be justified on cycling journey time benefits and walking and cycling ambience improvement benefits alone
- The lack of bridge crossings in the area causes severance and is suppressing walking and cycling demand, causing people to take much longer journey and causing overcrowding on existing public transport options
- Raising private funding and sponsorship will strengthen the business case for the bridge,

making it more viable

- The design and associated costs (including maintenance, operation and construction methodology) are critical to the business case for the bridge. It is paramount to select a design that offers a high quality experience for users and is aesthetically attractive but is still affordable through its 60 year lifespan
- To maintain value for money, it is recommended any design put forward does not exceed the base cost of £88m (2015 Q3 values not including contingency) and should seek to reduce costs as much as possible through the design and early incorporation of operational and maintenance procedures

10. Key Data and Assumptions

All assumptions in this report have either been taken from previous studies or inferred from existing data. The key assumptions affecting the demand analysis and monetised benefits are detailed below.

10.1 Growth in Travel Demand

The analysis assumes a growth in travel demand of 5.5% from 2013 to 2020. This assumption was inferred from an observed increase in the number of people travelling to and from the Isle of Dogs between 2003 and 2013.

According to the TfL Isle of Dogs cordon count data, between 2003 and 2013 there was a 54 per cent increase in trips (by all modes) to and from the Isle of Dogs (trips to and from Canary Wharf increased by 84%).[1] This equates to approximately a 5.4% increase year on year. Similarly, from 2012 to 2013 the total number of trips to and from the Isle of Dogs increased by 5.5%.[1]

The mixed use development at Wood Wharf (Canary Wharf) and residential development in Canada Water and Rotherhithe makes it reasonable to assume that growth in trips will continue at this rate of 5.5% until 2020 in the Isle of Dogs area.

A brief analysis of London Travel Survey data in the areas surrounding the proposed bridge (Tower Hamlets and Southwark) shows that this assumption is in line with expected population increase between 2016 and 2021.

Anecdotally, the quantum of both residential and office development planned for both Canary Wharf and Rotherhithe is unprecedented, and discussion with key stakeholders points to the fact that population increase and travel demand is likely to exceed current predictions. Therefore, it is likely the 5.5% annual growth in travel demand is in fact conservative.

10.2 Growth in Cycle Mode Share

The CB updated appraisal from 2008 assumes an annual growth of 4.1% in cycle mode share from 2014 to 2020. This was based on comparing TfL targets and observed levels of growth over the previous 10 years across London.

Adopting this same level of annual growth, and the same assumption that this growth in cycling across London applies to the demand analysis catchment area, the mode share for cycling in the Isle of Dogs will increase from 4% in 2013 to 5.3% in 2020.

This growth rate was benchmarked against:

- Travel in London Report 7 (2015) which shows 4.6% annual growth[2]
- Phil Jones Associates Study (2014) which shows mode share in Rotherhithe could rise to 7% in 2020[3]

Therefore the 4.1% annual growth in cycle mode share is considered conservative.

1 TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p3
2 TfL, Travel in London Report 7 (2014), Section 3.15
3 Phil Jones Associates, Cycle Demand Study, Southwark (2013)

10.3 Demand Analysis Catchment Area

The analysis focuses on Canary Wharf, the Isle of Dogs and Rotherhithe. It assumes that the level of growth in travel demand and expected mode shift to walking and cycling will be similar across these areas and uses current Canary Wharf figures as the baseline. In reality there are currently small variations by ward, with some areas having lower mode shift and growth levels than Canary Wharf. However:

- The level of development in the Isle of Dogs has already extended beyond Canary Wharf and there are planned high density developments for the area for the next 5 to 10 years. It is reasonable to assume that the rest of the Isle of Dogs will have similar growth and travel patterns to Canary Wharf by 2020. The main variation will be more trips originating from the Isle of Dogs due to the growth in residential developments.
- Similarly, Rotherhithe is already earmarked for high density development and the cycling potential is extremely high, as shown by the Phil Jones Associates 2013 study that points towards a 7% mode share for cycling. This is reflected by the current investment in cycling in the area and current cycling infrastructure being delivered by Southwark, Transport for London and Sustrans over the next 3 years.

Existing trips have been analysed using the Canary Wharf Staff Travel Survey 2013, and TfL's Isle of Dogs cordon count survey 2015. The Isle of Dogs cordon count data has been used to identify the total number of journeys into the Isle of Dogs and Canary Wharf.

Of the two datasets, we assume that the journey patterns provided by the Canary Wharf Group survey better represent the existing and potential demand for walking and cycling across the Isle of Dogs. Based on a larger sample, it provides more statistically representative data that is not dependent on weather variations unlike the Isle of Dogs cordon count which was undertaken over a single day in Autumn.

We assume this contributes to the discrepancy between the TfL data (1% cycle and 5% walk mode share) and Canary Wharf Group data (4% cycle and 3% walk mode share).

To address some of the risks in these assumptions, the sensitivity analysis in the Benefit Cost Ratio includes a scenario with a lower mode share for cycling.

10.4 Suppressed Demand

Qualitative data shows that there could be significant levels of suppressed demand for both walking and cycling. It is recommended that if a better understanding of suppressed demand is required, a generalised costs model should be used.

This analysis uses a simple assumption based on existing journeys using the Greenwich foot tunnel to calculate potential suppressed demand (see Section 6).

While suppressed demand figures are not used to calculate journey time savings they are included in other benefits. To respond to the risks associated with this, a sensitivity analysis scenario was included that discounted ambience, health and congestion relief benefits from suppressed demand related trips.

10.5 Ambience Improvements

The following walking and cycling ambience improvements values were taken from TfL's Business Case Development manual section E4.10 and E4.11:

Walking ambience improvements	Value (pence per minute)	Journey time (minutes)	Final value (pence per minute)
Good bright and even lighting	1.03	30	30.9
No litter, graffiti or sign posting	0.48	30	14.4
Surveillance cameras monitored and recorded	0.88	15	13.2
Maps of the local area, information board and signs to public transport		-	17.38
Pavement is wide and two people can always walk side by side	0.5	15	7.5
Pavement has some cracks and is even	0.44	30	13.2
Little difference in height between the pavement and the road at some junctions	0.21	30	6.3
All bins, benches, posts across pavement	0.31	15	4.65
No trees and plans hanging over the pavement	0.12	15	1.8
Vehicles do not park on the pavement	0.57	15	8.55
Pavement for pedestrians only	0.3	15	4.5
Total value			**122**

Table 25: Summary of walking ambience improvements, showing a monetised value of £1.22 per minute[4]

4 Journey time benefits are applied to the whole trip, in line with the TfL BCDM

Cycling Ambience Improvements	Value (pence per minute)	Journey time (minutes)	Final value (pence per minute)
Cycle lanes marked on road, wide enough to pass other cyclists	5.92	-	5.92
15 minute journey has quiet and attractive route	0.6	30	18
Even and smooth cycle surface	6.84	-	
Cycle surface free from debris	0.82	30	24.6
No standing water on cycle surface	7.14	-	7.14
Cycle signage at regular intervals	1.03	-	1.03
Cycle route signage regularly on highways	4.76	-	4.76
Total value			**61.45**

Table 26: Summary of cycling ambience improvements, showing a monetised value of £0.61 per minute

10.6 Other Data and Assumptions

The table below outlines the main data, assumptions and sources used in this study:

Category	Data / Assumption	Source
Increase in number of people travelling to and from the Isle of Dogs from 2003 to 2013	54%	TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p3
Total daily trips to and from the Isle of Dogs	389,500	TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p4
Annual increase in the number of people travelling to and from Canary Wharf	5.5%	Assumption for growth projection, TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p3 LTDS data shows potentially higher growth rates both in Tower Hamlets and Southwark
Annual growth in cycling from 2013 to 2020	4.1%	Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008), p13
Daily travel to and from the Isle of Dogs (05:00 and 23:00 hours)	389,500	TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p4
Daily travel to and from Canary Wharf (5:00 and 23:00 hours)	83% of travel to and from Isle of Dogs	TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p3
Daily travel to and from Canary Wharf (5:00 and 23:00 hours)	323,285	Calculated
Percentage of walking and cycling trips to and from the Isle of Dogs	7%	TfL, Isle of Dogs Cordon Survey; Travel in London Supplementary Report (January 2015), p4
Cycling mode share	4%	Canary Wharf Staff Travel Survey (2013), Figure 6
Walking mode share	3%	Canary Wharf Staff Travel Survey (2013), Figure 6
High estimates of cycling mode share	7%	Phil Jones Associates, Cycle Demand Study, Southwark (2013)

Category	Data / Assumption	Source
Jubilee line trips between Canada Water and Canary Wharf during the AM peak period in 2006	1,022	Colin Buchanan, East London River Crossings (2010), p33
Cycling trips through the Greenwich foot tunnel in 2013	577	TfL, Pedestrian and cyclist Thames screenline crossings count (2013)
DLR trips between Greenwich and Canary Wharf in 2006 during the AM peak period in 2006	600	Colin Buchanan, East London River Crossings (2010), p33
Daily to annual annualisation factor for cycling trips	200	Colin Buchanan, East London River Crossings (2010), p33
Morning peak-to-annual annualisation factor for cycling trips	600	Colin Buchanan, East London River Crossings (2010) - calculated from daily annualisation
Morning peak-to-annual annualisation factor pedestrians	820	Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008), p16
Morning AM peak 07:00 - 10:00 AM	3hrs	
Value of time for cyclists	£0.25 per minute	TfL, Business Case Development Manual (2013)
Congestion/overcrowding relief benefits	£0.19 for mode shift from LUL trips	Colin Buchanan, Thames Pedestrian and Cycle Bridge, Updated Economic Appraisal (2008), p22
Health and reduced absenteeism benefits	£0.65 (per new cycling trip) £0.35 (per new walking trip)	Calculated from DfT's annual reduced mortality benefit and associated absenteeism benefit
Equivalent casualty rate	0.1	TfL, Business Case Development Manual (2013)
Equivalent casualty cost	1.8m	TfL, Business Case Development Manual (2013)

Table 27: Data, Assumptions and sources

Annualisation factors are applied to all calculations but do not include time loss due to bridge lift at this stage.