Volume 7

SILVERTOWN TUNNEL

7.1 Case for the Scheme

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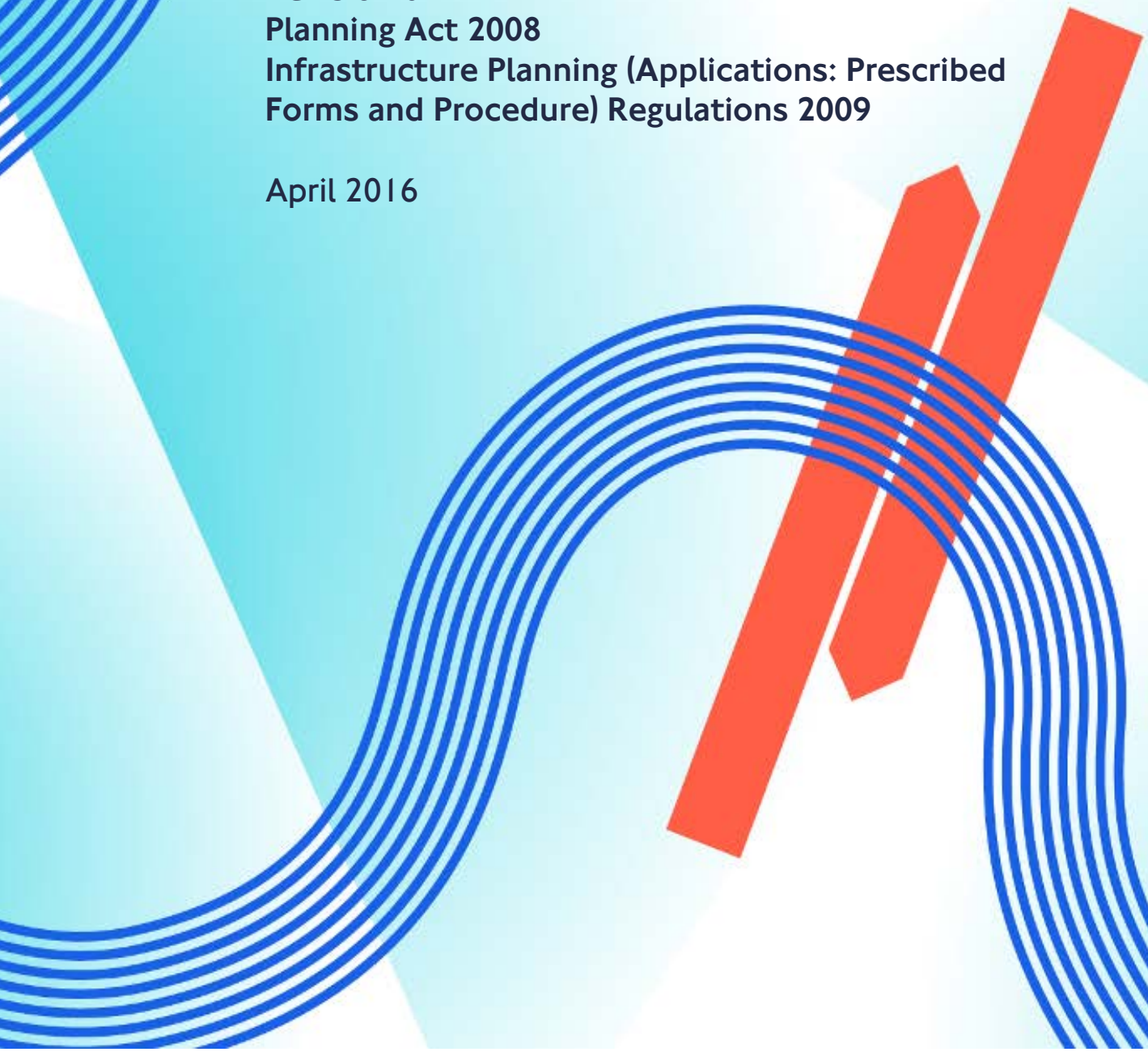

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Silvertown Tunnel

Case for the Scheme
7.1

Planning Act 2008

Infrastructure Planning

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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List of Abbreviations

AADT	Annual Average Daily Traffic
AQMA	Air Quality Management Area
BPH	Buses per Hour
CCTV	Closed Circuit Television
CEEQUAL	Civil Engineering Environmental Quality and Assessment Scheme
CEMP	Construction Environmental Management Plan
CIL	Community Infrastructure Levy
CoCP	Code of Construction Practice
DAS	Design and Access Statement
dB	Decibel
DCO	Development Consent Order
DLR	Docklands Light Railway
EAL	Emirates Air Line (cable car)
EAR	Economic Assessment Report

EDC	Early Draft Changes
EDS	Economic Development Strategy
ES	Environmental Statement
EiP	Examination in Public
ELL	East London Line
EqIA	Equality Impact Assessment
ES	Environmental Statement
EWT	Excess Wait Time
FALP	Further Alternations to the London Plan
FSC	Further Suggested Changes
FTA	Freight Transport Association
GLA	Greater London Authority
GLAA	Greater London Authority Act
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment

LB	London Borough
LEN	Low Emission Neighbourhood
LGV	Light Goods Vehicle
LoHAC	London Highways Alliance Contract
LTraCS	London Traffic Control System
LTDS	London Travel Demand Survey
MPH	Miles per Hour
MTS	Mayor's Transport Strategy
NB	Northbound
NNNPS	National Networks National Policy Statement
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NPV	Net Present Value
NSIP	Nationally Significant Infrastructure Project
OBC	Outline Business Case

OGV	Other Goods Vehicle
PCU	Passenger Car Unit
PEIR	Preliminary Environmental Information Report
PHV	Private Hire Vehicle (minicab)
PLA	Port of London Authority
PO	Project Objective
PT	Public Transport
PTAL	Public Transport Accessibility Level
RB	Royal Borough
RSI	Road Side Interview
SAF	Strategic Assessment Framework
SB	Southbound
SoS	Secretary of State
SPD	Supplementary Planning Document
STIG	Silvertown Tunnel Implementation Group

TfL	Transport for London
TGB	Thames Gateway Bridge
TIMS	Traffic Impacts Mitigation Strategy
TLRN	Transport for London Road Network
ULEZ	Ultra Low Emission Zone
WebTAG	DfT Web-based Transport Analysis Guidance

Glossary of Terms

Air Quality Management Area	Monitored results of any of the pollutants must be evaluated against national air quality objectives, which are defined by statutory legislation. An Air Quality Management Area (AQMA) is an area that local authorities are obliged to designate, if monitored air pollution exceeds the objectives.
AM peak	The morning peak hours when traffic is busiest. In the context of the Silvertown Tunnel scheme this applies to the hours between 6:00 and 10:00 in the northbound direction.
Assessed Case	Scenario adopted for assessment of likely effects of the proposed scheme, in the context of central forecasts of transport conditions and with user charges set so as to achieve the Scheme's traffic, environmental, socio-economic and financial objectives.
Blackwall Tunnel	An existing road tunnel underneath the River Thames in east London, linking the London Borough of Tower Hamlets with the Royal Borough of Greenwich, comprising two bores each with two lanes of traffic.
Bus and Goods Vehicle Lane	A dedicated highway lane that has restricted occupancy, available for use by buses, Heavy Goods Vehicles and taxis.
CEEQUAL	CEEQUAL is an evidence-based sustainability assessment and awards scheme for civil engineering, infrastructure, landscaping and public realm schemes, which recognises the achievement of high environmental and social performance.
COBA-LT	A computer program developed by the Department for Transport to undertake the analysis of the impact on accidents as part of economic appraisal for a road scheme.
Counter-peak	In the context of the Silvertown Tunnel, where traffic flow is tidal in nature, the counter peak refers to the hours of 6:00-10:00 southbound and 16:00-19:00 northbound i.e. the opposite directions of the AM peak and PM peak.

Cut and Cover	A form of construction usually involving in situ reinforced concrete, where a tunnel is built within an excavation which is undertaken from the ground surface.
Demand flow	A traffic modelling term which refers to the traffic that would be allocated to the link irrespective of capacity.
Development Consent Order	"This is a statutory order which provides consent for the project and means that a range of other consents, such as planning permission and listed building consent, will not be required. A DCO can also include provisions authorising the compulsory acquisition of land or of interests in or rights over land which is the subject of an application. http://infrastructure.planninginspectorate.gov.uk/help/glossary-of-terms/
Emirates Air Line	A cable car service for pedestrians and cyclists across the River Thames in east London, linking the Greenwich peninsula to the Royal Victoria Dock. The service is managed by TfL, and is part of the TfL transport network.
Enterprise Zone	An area in which state incentives such as tax concessions are offered to encourage business investment.
Excess Wait Time	The time waited in excess of the average scheduled wait time e.g. when waiting for a bus service.
Heavy Goods Vehicle (HGV)	European Union term for any vehicle with a gross combination mass of over 3500kg
Induced traffic	A change to the road network that has the potential to generate additional traffic on the improved section if new users respond by, for example, diverting from other routes, changing their origin or destination (trip locations), or switching from other transport modes. This additional traffic is often referred to as induced traffic.

Inter peak	The time period between the AM peak and the PM peak when traffic levels are lower. In the context of the Silvertown Tunnel scheme this refers to the hours between 10:00 and 16:00.
LoHAC	The London Highways Alliance Contract is a framework of collaborative highways services contracts. Authorities can form individual call-offs with no loss of sovereignty. The contract was developed jointly by London boroughs and TfL, it enables them to carry out a wide variety of tasks using four area-based contractors.
Mode share	The percentage of trips or people using a particular mode of transport. Also referred to as mode split.
Mode shift	A change in the percentage mode share composition e.g. increase in the percentage of trips made by public transport and decreasing the percentage of trips made by car.
Opportunity Areas	London's major source of brownfield land with significant capacity for new housing, commercial and other development linked to existing or potential improvements to public transport accessibility.
Passenger car unit	A method used in Transport Modelling to allow for the different vehicle types within a traffic flow group to be assessed in a consistent manner. Typical factors are 1 for a car or light goods vehicle, 2 for a bus of heavy goods vehicle, 0.4 for a motorcycle and 0.2 for a pedal cycle.
PM peak	The evening peak hours when traffic is busiest. In the context of the Silvertown Tunnel scheme this applies to the hours between 16:00 and 19:00 in the southbound direction.
Public Transport Accessibility Levels	A detailed and accurate measure of the accessibility of a point to the public transport network, taking into account walk access time and service availability. The method is a way of measuring the density of the public transport network at any location within Greater London.

Quietways	Quietways will be a network of radial and orbital cycle routes throughout London. Linking key destinations, they will follow backstreet routes, through parks, along waterways or tree-lined streets. This is currently a proposal and does not yet exist.
Ramp metering	A ramp meter, ramp signal or metering light is a device, usually a basic traffic light or a two-section signal (red and green only, no yellow) light together with a signal controller that regulates the flow of traffic entering freeways according to current traffic conditions.
Reference Case	An assumed 'future baseline' scenario, which represents the circumstances and conditions that TfL would anticipate in the future year 2021 without the implementation of the Scheme, taking account of trends (for example in population and employment growth) and relevant developments (such as other committed transport schemes). The Reference Case is used as a comparator for the Assessed Case, to show the significant effects of the Scheme against the appropriate reference scenario.
Reference Design	The design proposals for the Scheme that the DCO application refers to, as modified and developed in response to the Statutory Consultation process. The Reference Design has been developed to a concept stage appropriate to prove engineering and construction feasibility and to inform the construction and operational land requirements, environmental impact assessments and Scheme cost estimate.
Rotherhithe Tunnel	An existing road tunnel underneath the River Thames in east London, linking the London Borough of Tower Hamlets with the London Borough of Southwark, comprising a single bore with two lanes of traffic. Pedestrian and cycle access is permitted.

Safeguarding	Safeguarding is a formal process, undertaken by the Department for Transport (DfT), to protect land required for major new infrastructure projects from future development. The Safeguarding Directions, made by the Secretary of State for Transport, instruct local planning authorities to consult TfL on planning applications for land within the safeguarded area.
Thames Gateway	An area of land stretching 70 kilometres east from inner east London on both sides of the River Thames and the Thames Estuary.
The Scheme	The construction of a new bored tunnel with cut and cover sections at either end under the River Thames (the Silvertown Tunnel) between the Greenwich peninsula and Silvertown, as well as necessary alterations to the connecting road network and the introduction of user charging at both Silvertown and Blackwall tunnels.
Tidal flow	Tidal flow refers to a road where a lane or lanes can sometimes carry traffic in one direction and at other times in the opposite direction, to help with traffic flow. This was in operation at the Blackwall Tunnel between 1978 and 2007.
Transport for London (TfL)	A London government body responsible for most aspects of the transport system in Greater London. Its role is to implement transport strategy and to manage transport services across London. These services include: buses, the Underground network, Docklands Light Railway, Overground and Trams. TfL also runs Santander Cycles, London River Services, Victoria Coach Station and the Emirates Air Line. As well as controlling a 580km network of main roads and the city's 6,000 traffic lights, TfL regulates London's private hire vehicles and the Congestion Charge scheme.
Transport for London Road Network	The network of 580km of London's main roads for which TfL is the highways and traffic authority.

The Tunnel, Silvertown Tunnel	Proposed new twin-bore road tunnels under the River Thames from the A1020 in Silvertown to the A102 on Greenwich Peninsula, East London.
User Charging	The charge to be paid by users of the Silvertown Tunnel and Blackwall Tunnel that is to be imposed in order to manage traffic demand and help pay for the Scheme.
WebTAG	The Department for Transport's web-based transport analysis guidance.
Woolwich Ferry	The Woolwich Ferry links Woolwich (Royal Borough of Greenwich) and North Woolwich (London Borough of Newham). It also links two ends of the inner London orbital road routes; the North Circular and South Circular. It runs every 5-10 minutes throughout the day, from Monday to Friday and every 15 minutes on Saturdays and Sundays. It carries pedestrians, cyclists, cars, vans and lorries. The ferry is operated by Briggs Marine and Environmental on behalf of TfL.

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SUMMARY

S.1 Purpose of this Case for the Scheme

S.1.1 This document sets out the need for the Scheme, explains how strategic options were assessed, and describes how the details of the Scheme, including the user charging proposal, were developed. It then describes the benefits for private and public transport users, and outlines how impacts would be managed.

S.2 A growing London needs a range of river crossings

S.2.1 There has been a period of sustained investment in public transport capacity across the whole of east London over the past 20 years, which, by the opening of Crossrail in 2018, will have resulted in an almost a tenfold increase in the capacity of the cross river rail network east of Tower Bridge. This has contributed to London's excellent track record in achieving substantial mode shift from private to public transport. Since 2000 the public transport mode share for London has increased by eleven percentage points and in 2013 public transport mode share overtook private mode share for the first time.

S.2.2 London’s population continues to grow and there is set to be further substantial growth in population and employment in London over the next 15 years – with an estimated ten million people expected to reside in the Capital by 2030. With this growth comes increased pressure on existing infrastructure, services and connections to move our people and goods. Within London, it is the east sub-region which will see the biggest increase in population, housing and employment.

S.2.3 The Mayor and Transport for London (TfL) are planning for the impacts of this growth. Fundamental to accommodating this growth in a sustainable manner will be measures to overcome poor connectivity in east London. In particular it is necessary to address the severance caused by the River Thames.

S.2.4 This will require further investment across the board in river crossings which improve connections for pedestrians, cyclists, public transport and road users. TfL has developed plans for a series of new crossings as outlined in ‘Connecting the Capital’, published in December 2015, which proposes a series of crossings to improve highway, public transport and walking and cycling connections. Many of these proposals are now being progressed

and the Silvertown Tunnel, which forms an integral part of this programme of improved connections, could be operational in 2022/23.

S.2.5 Additional non-highway schemes are also being progressed in east London, such as the electrification and additional capacity on the Gospel Oak to Barking section of the London Overground, and the consideration of further DLR stations, for example at Thames Wharf.

S.3 The need for a new road crossing close to the Blackwall Tunnel

S.3.1 While much has already been done to improve public transport connections across the river in east London, there are few road-based crossings in the east: the Rotherhithe Tunnel and the Blackwall Tunnel along with the Woolwich Ferry (the Dartford Crossing, 25km to the east, is outside London). All of the vehicle river crossings in east London are capacity-constrained, outdated in design and ageing.

S.3.2 Because of its position, and the lack of alternatives, the Blackwall Tunnel has become *the* strategic crossing in east London. Not only does it carry the most traffic of all the road crossings in east London, it carries the most traffic of any road crossing in all of London. But the Blackwall Tunnel has three significant problems: congestion, closures and incidents, and a lack of resilience. These problems are long-standing and have significant adverse effects on the environment and the economy. They also act as a constraint on the provision of public transport services across the river by bus and coach. Given the importance of the Blackwall Tunnel as a road crossing in east London, the effects of these problems are highly significant.

S.3.3 Despite huge increases in the availability and use of public transport, traffic at the Blackwall Tunnel has grown steadily over the last twenty years. The significant investment already made in public transport, and the committed future investment means that sustainable mode share has increased in east London, and is forecast to continue to increase regardless of this Scheme. However, the scale of growth forecast in east London means that the trend of increasing traffic will continue. Although only one in five cross-river trips is made by private transport, some trips can only be made in a vehicle (for example, 85 per cent of all freight in London is carried by road).

S.3.4 Since the election of a new Mayor in 2008, TfL has thoroughly assessed a range of options for river crossings in east London. This work has led to the development of policy in the London Plan and local development plans, as well as the Mayor's Transport Strategy (MTS) which support a road tunnel at Silvertown as part of the River Crossings Programme. A user charge as a

means of managing demand and paying for new river crossings is also supported in the MTS.

S.3.5 TfL has developed the Scheme as the best option to address the three problems of the Blackwall Tunnel. Once the Silvertown Tunnel becomes operational, a user charge would be applied at both Blackwall and Silvertown Tunnels. The user charge would help to manage demand for both crossings and help to pay for the new Tunnel.

S.4 Benefits of the Scheme

S.4.1 The Scheme would directly address the severe and ongoing lack of resilience in the cross-river network in east London by adding a new tunnel adjacent to the Blackwall Tunnel. Being built to modern standards, the Tunnel would be able to accommodate the tall vehicles which are currently the cause of the many closures of the Blackwall Tunnel. The existence of a diversion route so close to the Blackwall Tunnel would also mean that congestion and delay on the surrounding road network would be reduced in the event of any remaining closures.

S.4.2 The Blackwall Tunnel currently provides only limited opportunities for bus services, due to its constrained height northbound and difficulty in operating reliable scheduled services due to traffic congestion. The opening of Silvertown Tunnel would provide the infrastructure to facilitate a network of new cross-river bus services (including double-deck buses) to be implemented. For the purpose of assessing the Scheme impacts, TfL has identified several potential route extensions and two potential new routes. Similarly it would provide further opportunities for enhanced cross-river commuter coach services through extra capacity and more reliable journey times.

S.4.3 All users of the Blackwall and Silvertown tunnels - including bus and coach passengers - would experience shorter journey times to cross the River Thames as a result of the Scheme, with journey time savings on the immediate approaches to the tunnels of up to 20 minutes in peak periods. Journey time reliability would also be greatly improved and drivers are more likely to travel at the time of their choosing, rather than adapt their journey time to avoid the worst of the congestion. Overall levels of traffic are not predicted to increase, because of the demand management effect of the charge and the existence of new public transport alternatives. The user charge would maximise time-savings and lock them in for the future.

S.4.4 With a similar amount of traffic moving more efficiently, the Scheme will not result in a significant effect on air quality.

S.4.5 The development of the Scheme has been informed throughout by the desire to support future development and optimise the use of sustainable transport. TfL would use the opportunity provided by the Scheme to improve the road layout in the area to help cyclists and pedestrians and make a more attractive environment around the northern and southern portals.

S.4.6 The public transport mode share in the east and south-east sub-region is expected to increase from around 56 per cent of all trips to around 59 per cent[1] of trips in 2021, regardless of whether the Scheme is in place. The share of daily Blackwall Tunnel / Silvertown Tunnel trips made by public transport would increase from just over 10% currently to nearly 30% with the Scheme in 2021.

S.4.7 The scheme has an Initial Net Present Value (NPV) of £783m, rising to £1,041m once reliability benefits are included.

S.4.8 The powers granted by the DCO would allow TfL to set the initial user charges closer to Scheme opening and to vary the user charges in future, having regard to the achievement of the Project Objectives. Limited discounts and exemptions would be available to help mitigate any adverse impacts.

S.4.9 As well as the main benefits summarised above, the Scheme has been designed to optimise the additional (or legacy) impacts, both in construction and operation. These include for example a commitment to local employment and training, changes to road layout on the approach roads and the use of low-emission buses.

[1] 24-hour demand RXHAM simulation, as described in the Transport Assessment (Document Reference 6.5)

S.5 Next steps

S.5.1 TfL has undertaken several non-statutory consultations which indicate support for new river crossings in east London, and, when asked about a crossing at Silvertown, a majority of respondents have been supportive each time. In preparation for the statutory consultation TfL revisited all the options for potential new river crossings – including those put forward by stakeholders and other consultation respondents – to check that this is still the right option. This assessment is included in this Case for the Scheme.

S.5.2 The Scheme was designated as a Nationally Significant Infrastructure Project (NSIP) by the Secretary of State in 2012. As such, TfL is applying for a Development Consent Order (DCO) in order to construct the Tunnel.

S.5.3 A statutory consultation on the Silvertown Tunnel scheme ran from 5 October to 29 November 2015. Fifty-eight per cent of respondents stated that they supported the Scheme, with 31 per cent opposing it and 11per cent either not answering the question or stating that they did not know.

S.5.4 TfL has carefully considered comments made by the public and stakeholders as part of its continuing appraisal of the justification for the Scheme and in order, where appropriate, to improve and refine the Scheme proposals. These changes are listed in the Consultation Report (Document Reference 5.1) and Chapter 5 of this document.

S.5.5 Over the next 20 years TfL envisages that multiple new crossings of the river will be needed across London with a clear focus on east London. The commitment to these crossings is set out in both the MTS (2010) in Proposal 39 and, more recently, in Connecting the Capital (2015). In winter 2015 TfL consulted on potential multi-modal crossings at Gallions Reach and Belvedere, which could be in place soon after the Silvertown Tunnel, and has also set out its plans for thirteen additional river crossings in London, most of which will be in east London[2]. Together, these crossings will improve the reliability and resilience of the road network – which is vital to businesses in London. They will transform connectivity, bringing in investment and open up London's opportunities. They will also provide for the expansion of public transport connections and encourage more active travel. In this way the shift

[2] TfL, 2015, Connecting the Capital, Our plan for new river crossings for London http://content.tfl.gov.uk/connectingthecapital-newrivercrossingsforlondon-dec-2015.pdf

towards public transport can still be maintained in the context of significant growth.

1. INTRODUCTION

1.1 Overview of the Silvertown Tunnel scheme

1.1.1 Transport for London (TfL) is a statutory body created by the Greater London Authority Act 1999 (GLAA). The GLAA imposes on the Mayor of London a general duty to develop and apply policies to promote and encourage safe, integrated, efficient and economic transport facilities and services to, from and within London. TfL is responsible for delivering these services on the Mayor's behalf.

1.1.2 TfL is also the statutory highway and traffic authority for the TfL Road Network (TLRN), and is responsible for the maintenance, management and operation of traffic signals throughout London. TfL has a network management duty under the Traffic Management Act 2004 which requires it to make sure road networks are managed effectively to minimise congestion and disruption to vehicles and pedestrians.

1.1.3 The Silvertown Tunnel scheme (the Scheme) involves the construction of a twin bore road tunnel providing a new connection between the A102 Blackwall Tunnel Approach on the Greenwich Peninsula (Royal Borough of Greenwich) and the Tidal Basin roundabout junction on the A1020 Lower Lea Crossing/Silvertown Way (London Borough of Newham).

1.1.4 The Scheme also includes the introduction of free-flow user charging on both the Blackwall Tunnel (northern portal located in London Borough of Tower Hamlets) and at the new Silvertown Tunnel. This measure is intended to play a fundamental role in managing traffic demand and supporting the financing of the construction and operation of the Silvertown Tunnel.

1.1.5 The Silvertown Tunnel would be approximately 1.4km long and would be designed to accommodate large vehicles including double-deck buses. It would include a dedicated bus, coach and goods vehicle lane, which would enable TfL to provide additional cross-river bus routes.

1.1.6 The Scheme is proposed in response to the need to address three significant transport problems which exist at the Blackwall Tunnel crossing: continuing congestion, frequent closures and incidents, and a lack of resilience to traffic disruption and delay caused by incidents at the Tunnel (owing to the lack of proximate alternative road crossings). As well as being costly in themselves in terms of time lost and unpredictability, these transport problems have significant adverse social, economic and environmental effects both locally and regionally. In the context of continued significant

growth, the transport problems of the Blackwall Tunnel are forecast to become more serious, and in turn their secondary adverse impacts (on the economy, environment and public transport) will increase. Failing to address these problems could hamper the sustainable and optimal growth of London and the UK. By providing an additional link which is also able to accommodate larger vehicles, the Silvertown Tunnel would enable the Blackwall Tunnel to function better as a strategic link.

1.1.7 Although the additional tunnel would increase capacity, the user charge would help manage traffic demand, meaning that induced demand could be avoided. As a result, the Scheme would not lead to an overall increase in highway demand, including cross-river highway demand in the east sub-region. It would lead to a significant reduction in severe congestion and delay on the approach roads to the tunnels, with the user charge acting effectively to avoid generating induced traffic. Journey time in the peak period and directions would be reduced by up to 20 minutes[3], with enhanced journey time reliability and a more typical peak period emerging. As a result of the additional tunnel, the crossing would be more resilient in the event of a closure at either tunnel.

1.1.8 The most important impact on public transport would be the opportunity the Scheme would create for TfL to run new cross-river bus services to improve public transport links between south-east and east London, notably the growing employment areas in the Royal Docks and Canary Wharf. The Silvertown Tunnel is designed to accommodate double-deck buses, thus providing operational flexibility in the bus routes that could be extended across the Thames, as well as greater capacity for buses and commuter coaches alike.

1.2 The application for a Development Consent Order (DCO)

1.2.1 In June 2012 the Secretary of State for Transport gave a direction under section 35 of the Planning Act 2008 that the proposed Silvertown Tunnel scheme should be treated as a Nationally Significant Infrastructure Project (NSIP). The NSIP designation means that the project may only be authorised by means of a Development Consent Order (DCO) made by the Secretary of State under the Planning Act 2008.

[3] Based on a selection of journeys in east and southeast London. See Chapter 7 of the Transport Assessment (Document Reference 6.5) for details.

1.2.2 The reasons given for the direction were:

i. London's importance as an engine for economic growth nationally;

ii. the projected growth of London;

iii. the impact of congestion at the Blackwall Tunnel on the strategic road network; and

iv. the size and nature of the Silvertown Tunnel and comparison to other NSIPs.

1.2.3 DCO applications must be determined in accordance with the relevant National Policy Statement (NPS). For highway schemes, the relevant NPS is the NPS on National Networks (December 2014). The Secretary of State will use this NPS as the primary basis for the decision on the DCO application made by TfL. The Planning Policy Compliance Statement (Document Reference 7.2) provides a detailed assessment of the Scheme against planning policy.[4]

1.2.4 For schemes which have been designated as nationally significant under section 35, the NNNPS states that:

'the relevant development plan is also likely to be an important and relevant matter especially in respect of establishing the need for the development'.

1.2.5 In this case the relevant development plan is the London Plan together with the local development plans of the three host boroughs for the Scheme: Royal Borough of Greenwich and London Boroughs of Newham and Tower Hamlets. The Mayor's Transport Strategy (MTS)[5] is also a document constituting a significant material consideration in this context. The Planning Policy Compliance Statement (Document Reference 7.2) shows how the Scheme complies with the development plan and the MTS.

[4] In the Preliminary Case for the Scheme (TfL, 2015), an assessment of how the Scheme complies with planning policy was given in Chapter 7. The assessment is now in the Planning Policy Compliance Statement (Document Reference 7.2).
[5] GLA, 2010, Mayor's Transport Strategy.

1.3 Structure of this document

1.3.1 This document sets out the need for the Scheme, explains how strategic options were assessed, and describes how the details of the Scheme, including the user charging proposal, were developed. It then describes the benefits for private and public transport users, and concludes with a summary of the Scheme in context. A comprehensive assessment of the Silvertown Tunnel application proposals against the requirements of planning policy is set out in the Planning Policy Compliance Statement (Document Reference 7.2)[6].

1.3.2 Chapter 2 describes how the Blackwall Tunnel came to be the only strategic highway crossing in east London, and explores the three transport problems directly arising from this. It explains the secondary effects of these and how in the context of growth, the need to resolve these problems becomes more pressing.

1.3.3 Chapter 3 sets out the strategic assessment of options undertaken by TfL in identifying the road tunnel option at this location, and provides context in relation to TfL's wider River Crossings Programme of which the Silvertown Tunnel scheme is part. It also describes how this assessment led to the development of policies for both new river crossings and for the use of road user charging in the London Plan and Mayor's Transport Strategy. In preparing the proposed application for statutory consultation TfL has reviewed the options again to ensure that the selection process remains valid and robust. The review is reported at Appendix A.

1.3.4 Chapter 4 outlines why and how user charging forms an integral part of the Scheme. It describes why a user charge is important and how TfL proposes to set this charge in future.

1.3.5 Chapter 5 focuses on the detailed development of the Scheme which is now proposed, summarising the options considered for the road tunnel. Both this chapter and Chapter 3 make reference to how consultation has informed the development of the Scheme.

[6] The Preliminary Case for the Scheme contained an appraisal of the Scheme against national and local policies in Chapter 7. This can now be found in the Planning Policy Compliance Statement (Document Reference 7.2).

1.3.6 Chapter 6 sets out how the Scheme has been optimised in terms of its direct and additional benefits, which together encompass transport, environmental and other benefits. It also illustrates how the Project Objectives would be fulfilled.

1.3.7 Chapter 7 concludes the Case for the Scheme by placing it in the context of TfL's overarching strategy for accommodating London's forecast growth.

1.4 Next steps

1.4.1 Substantial growth is forecast for London over the next 15 years – with an estimated ten million people expected to reside in the Capital by 2030. With this growth comes increased pressure on existing infrastructure, services and connections to move our people and goods. Within London, it is the east sub-region which will see the biggest increase in population, housing and employment in the coming years.

1.4.2 Transport for London is planning for the impacts of this growth. Fundamental to accommodating this growth in a sustainable manner will be measures to overcome poor connectivity in east London. In particular it is necessary to address the severance caused by the River Thames.

1.4.3 This will require investment across the board in river crossings which improves connections for pedestrians, cyclists, public transport and road users. TfL has developed plans for a series of new crossings as outlined in 'Connecting the Capital', published in December 2015, which proposes a series of crossings to improve highway, public transport and walking and cycling connections. Many of these proposals are now being progressed and the Silvertown Tunnel, which forms an integral part of this programme of improved connections, could be operational in 2022/23.

1.4.4 These crossings will improve the reliability and resilience of the road network – which is vital to businesses in London. They will transform connectivity, bringing in investment and opening up London's opportunities. They will also provide for the expansion of public transport connections and encourage more active travel.

1.4.5 This Case for the Scheme is part of a suite of documents which TfL is submitting alongside its DCO application to the Planning Inspectorate in

spring 2016[7]. This application will seek development consent to build, operate and maintain the Scheme and all associated measures. A decision from the Secretary of State could be expected in September 2017, with TfL awarding a contract around a year later. Under this timetable, the new Silvertown Tunnel could be open in 2022/23. Upon implementation, a user charging regime would be put in place at both the Blackwall and Silvertown tunnels.

[7] A preliminary version of this Case was made available for the statutory consultation on the Silvertown Tunnel scheme which ran from 5 October to 29 November 2015.

2. THE NEED FOR THE SCHEME

2.1 Overview

2.1.1 This chapter considers how the development of London has led to a situation where the Blackwall Tunnel stands as the single strategic river crossing in London for vehicular traffic east of Tower Bridge, and how (together with problems inherent in its design) this situation leads to significant transport problems. It also identifies important secondary effects of these transport problems, showing that they have existed for some time and that they are already having a negative effect on London.

2.1.2 In the context of significant growth, under a 'do nothing' scenario, without the Scheme, these effects are forecast to deteriorate with an increasing impact on the London and UK economy. This means that there is a pressing need to take action now.

2.2 River crossings reflect the development of London

2.2.1 The limited number of east Thames river crossings for highway traffic is in part a legacy of the Capital's development[8]. This saw residential and commercial growth take place in the central and western parts of the city, while the east became the home for industrial and shipping activities which had less need for extensive cross-river infrastructure.

2.2.2 However, the last five decades have seen those industries decline, and the inner eastern sector of London has become a hub of the knowledge economy, a leisure destination, and home to a rapidly growing population. Together with growth in central London, this change has led to increasing demand for travel to and through the former docklands from London and the wider South East.

2.2.3 Central to this story is the River Thames. East of the Tower of London, the river is broad and deep – ideal for docks and shipping. As a consequence, wharves and industry began to line the banks. The presence of large, sea-going ships prevented the construction of low-level bridges, and the concentration of industry along the river banks led to limited demand for

[8] See for example: Centre for London, 2014, Linking London East Thames Crossing Report

cross-river movements. These characteristics, and the physical and engineering constraints imposed by the River Thames, are reflected in the river crossings constructed to date.

2.2.4 In the east, the river crossings are few in number and limited in capacity. Crossings that have been constructed here (the Rotherhithe and Blackwall Tunnels and the Woolwich Ferry) were all designed to avoid interference with shipping. What is now the northbound bore of the Blackwall Tunnel was opened in 1897, and like the Rotherhithe Tunnel, was originally for horse-drawn traffic[9]. A second bore was opened in 1967, in recognition of the inadequacy of the single tunnel, which had until that point served traffic in both directions. While shipping now constitutes a smaller part of London's economy than it has in the past, it remains important and vessels retain the right of navigation downstream and plans for crossings in east London must still consider the need to avoid impeding their movement.

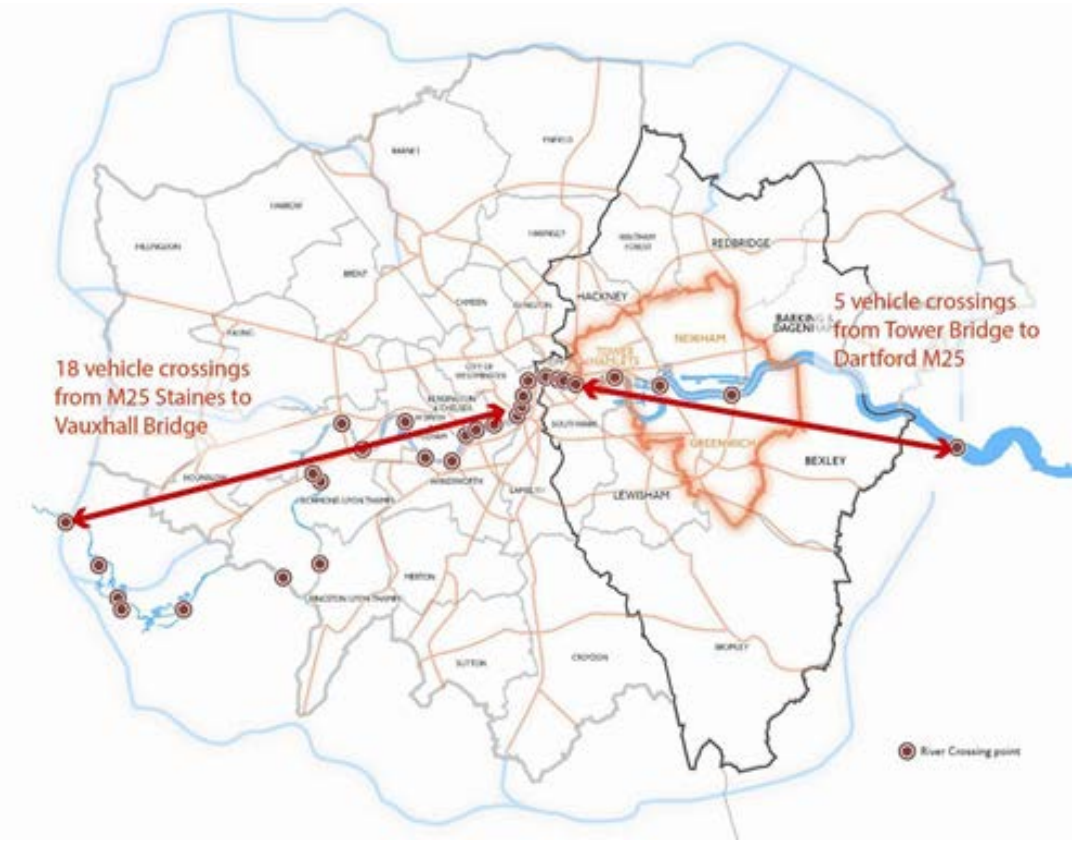
2.2.5 Meanwhile west London attracted predominantly residential and commercial uses and the Thames posed fewer constraints to engineers. Tall ships cannot travel west of London Bridge, and the distance from bank to bank at Putney is one fifth as wide as at Woolwich. For these reasons, it is comparatively easy to construct low-level bridges in west London which can be used by vehicles, pedestrians and cyclists alike. These are generally cheaper than tunnels to construct, and as a consequence of demand and feasibility, low-level bridges have proliferated.

2.2.6 The result is that in west London, highway crossings of the Thames are spaced on average 2km apart, and in central London the average distance is around 1km. In the east, the average is 8km (three crossings in a 25km section, with a much longer distance between the easternmost London crossing at Woolwich and the Dartford Crossing in Kent/Essex). Yet population numbers and population density between west and east are now not dissimilar and with much of London's population growth happening in east London, the demand for crossings will increase.

[9] The tunnel could also be used by pedestrians, but this was not its primary purpose.

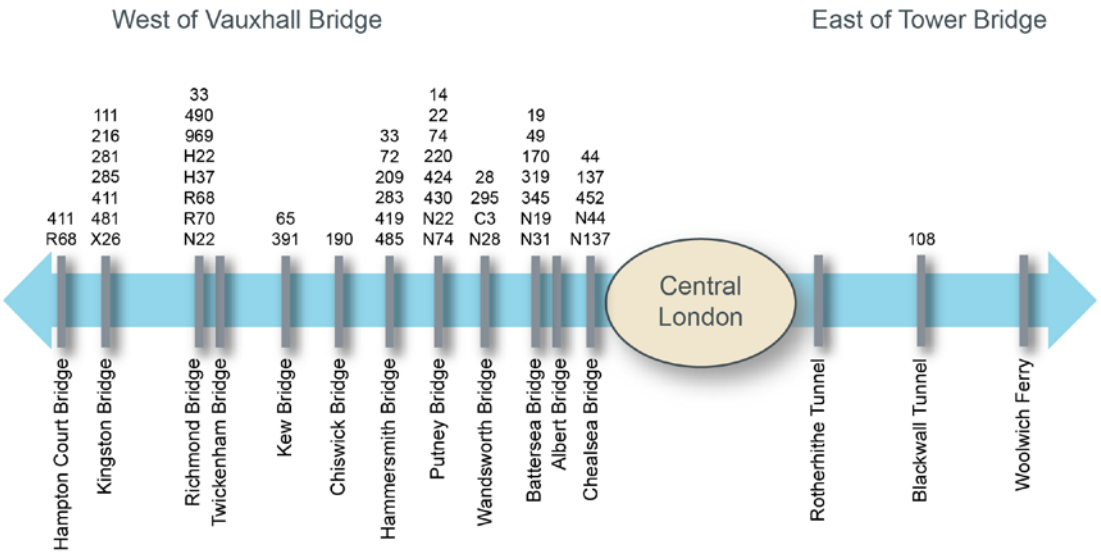
2.2.7 The disparity between the availability of crossings in the east and west of the Capital is illustrated clearly in Figure 2-1 where it can be seen that there are 18 crossings in the 29km from Vauxhall Bridge to the M25 (Staines) in west London, but only five crossings in the 23km from Tower Bridge to the M25 (Dartford) in the east.

Figure 2-1: Vehicle crossings in east and west London



2.2.8 It is not only users of private vehicles who are disadvantaged by this paucity of road crossings in east London: the provision of bus and coach services is also hindered, as is the efficient movement of goods. In west London there is at least one bus route over all but two of the bridges (the exceptions being Albert and Twickenham bridges), as shown in Figure 2-2.

Figure 2-2: Cross-river bus services in east and west London



2.2.9 In east London, the limited number of road crossings acts as a major constraint on the number of cross-river bus services that can be operated. Only the Blackwall Tunnel provides a suitable opportunity for a bus route (the 108) and it can only accommodate single-deck buses owing to its size.

2.2.10 As will be described in section 2.9.10 below, the 108 service is adversely affected by the congestion, closures and lack of resilience of the Blackwall Tunnel. These problems undermine the feasibility of running further services through the Blackwall Tunnel. Of the three remaining crossings to the east of Tower Bridge, the Dartford Crossing[10] is outside the Greater London Authority (GLA) area, and neither the Rotherhithe Tunnel nor the Woolwich Ferry can accommodate buses.

2.2.11 Highway travel is an important component of transport provision in London for private road users, delivery and transportation of goods and for public transport in the form of buses and coaches. However, it is only part of the transport story: dedicated public transport links are also important. In contrast to the road network, there has been a period of sustained

[10] The Dartford crossing comprises a tunnel and a bridge.

investment in public transport capacity across the whole of east London over the past 20 years.

2.2.12 Led by the regeneration of Docklands, six new rail crossings of the Thames in east London have been implemented, with a further crossing to come in the form of Crossrail. This means that by 2020, there will be almost as many rail crossings to the east of Tower Bridge as to the west of Vauxhall Bridge (Figure 2-3). This investment will have led to almost a tenfold increase in the capacity of the cross river rail network east of Tower Bridge, as shown in Figure 2-4.

Figure 2-3: Cross-river rail services in east and west London

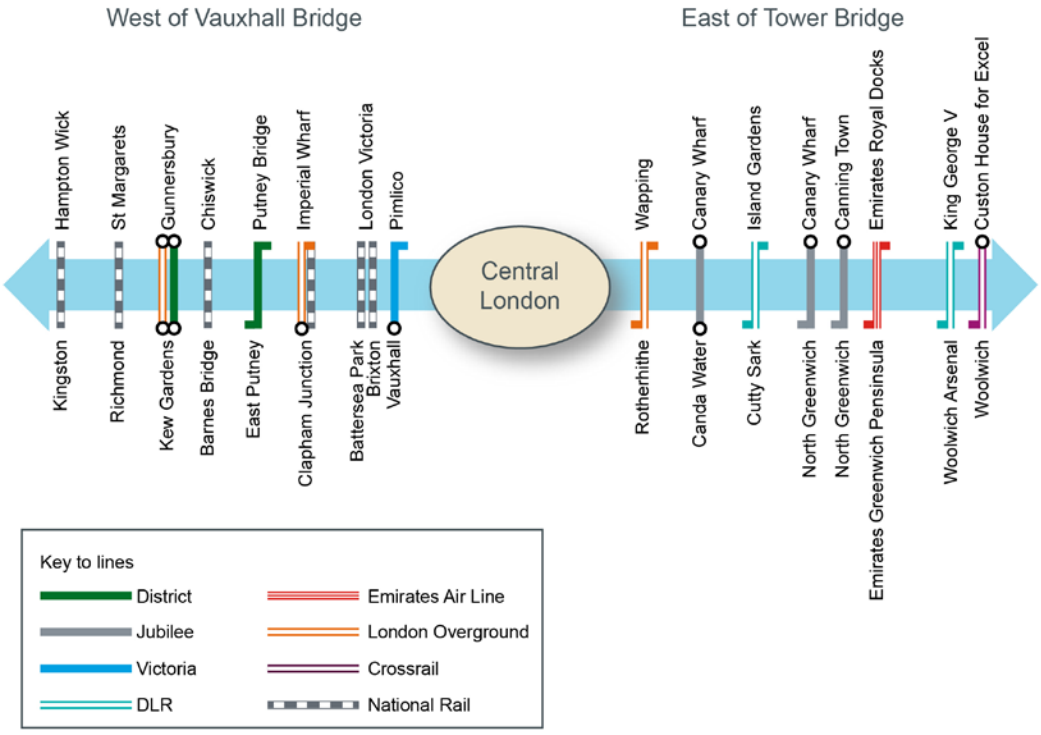
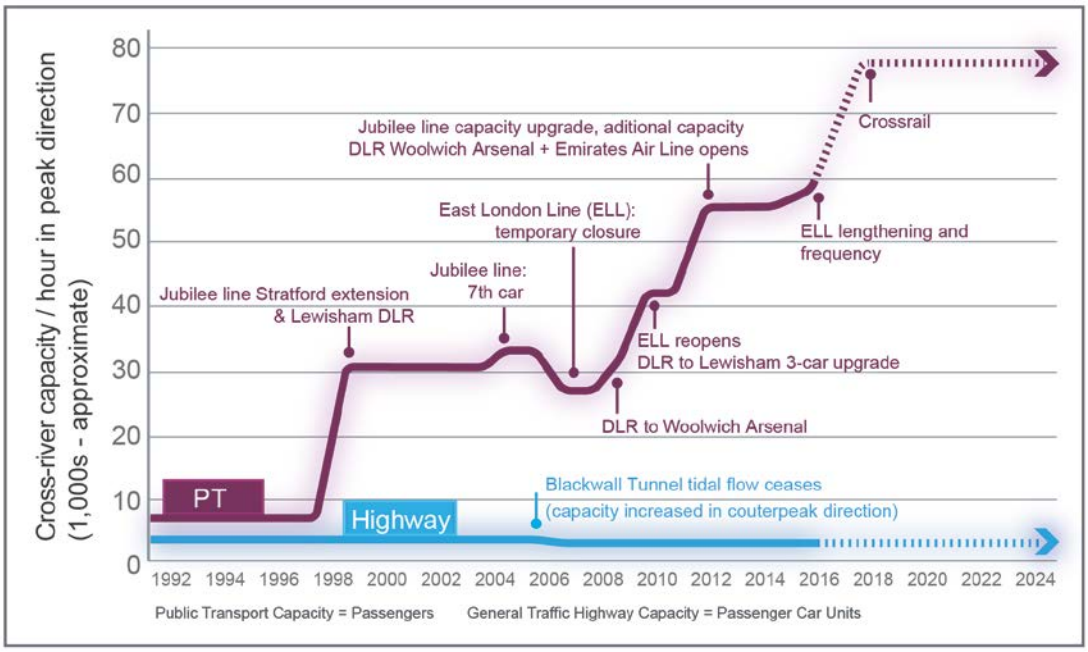
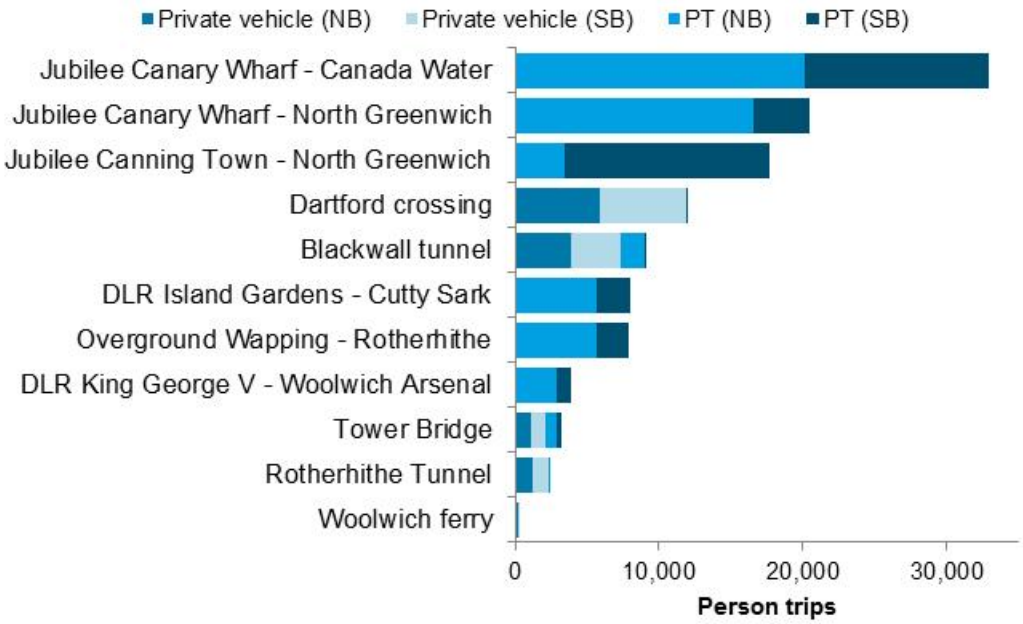


Figure 2-4: Increase in rail capacity east of Tower Bridge



2.2.13 This investment and prioritisation of rail investment has had a direct influence on the patterns of travel that have developed in east London in recent years. As shown in Figure 2-5 public transport trips overwhelmingly dominate cross-river travel for both northbound and southbound journeys.

Figure 2-5: AM peak hour (08:00-09:00) cross-river road and public transport person trips in east London (2012-13)[11]



2.2.14 The effect of this investment is also discernible in reported attitudes towards cross-river travel. In a recent survey for TfL, residents of the four London boroughs[12] in this region which are closest to central London identified the ability to travel by public transport as the second-most important factor in the work commute, and Underground/Rail modes were perceived as affordable by most respondents[13].

2.2.15 However, while only around 20 per cent of cross-river trips are now made by private highway transport, the absolute level of demand for road crossings has not fallen as a result of the increased public transport provision in the area. There remains a continued need for trips by road, particularly for commercial traffic such as vans and lorries – 85 per cent of all freight in London is carried by road. Not all trips can be transferred to public transport,

[11] HAM model validation observed flows, (2012)); LU Rail Origin Destination Surveys (RODS) (2012); Pedestrian and cyclist Thames screen line crossings, (2013); Scheduled coach services with an estimated average passenger occupancy of 48

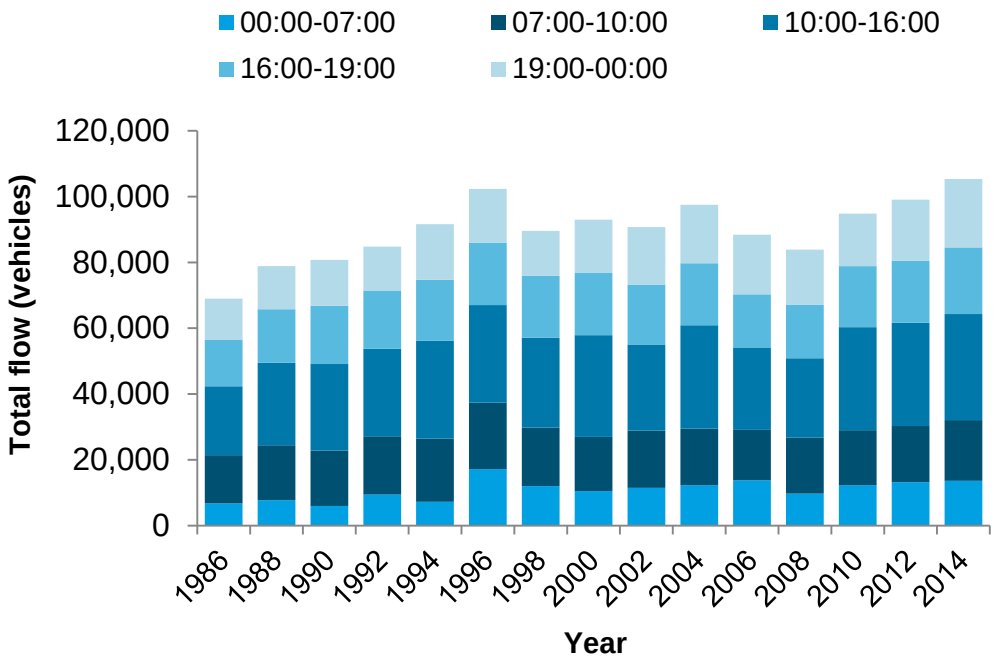
[12] Lewisham, Southwark, Greenwich and Tower Hamlets. The most important factor was travel time to place of work.

[13] Accent for TfL, 2015, River Crossings Residents Survey. Q21. The statement "I can't afford to travel to work by Underground/Rail" was agreed with by 16 per cent of respondents, 58 per cent disagreed.

walking and cycling, and increases to public transport capacity do not automatically lead to reduced vehicle traffic. This can be attributed to the significant population and employment growth that continues to be experienced in London which means that, despite a high and increasing public transport mode share, there remains a strong demand for cross-river trips by vehicle.

2.2.16 Figure 2-6 summarises average daily traffic flows through the Blackwall Tunnel from 1986 to 2014[14]. While there are variations between years the overall trend is clearly one of increasing traffic flows (the data is based on based on hourly sample counts rather than annual totals). It shows that demand for the Blackwall Tunnel was not affected by the vast increases to rail provision in east London described above, and indeed has been growing steadily since 2008. This can be attributed to the significant population and employment growth that continues to be experienced in London which means that, despite a high and increasing public transport mode share, there remains a strong demand for cross-river trips by vehicle.

Figure 2-6: Vehicle flows at the Blackwall Tunnel, 1986-2014



[14] Source: TfL screenline counts

2.3 The Blackwall Tunnel is east London's strategic highway crossing

2.3.1 In central and west London, there is a closely-spaced series of crossings which are well-connected to the road network. This means that there are genuine alternatives available for many journeys, and provides a good degree of resilience when any one of the crossings is congested, or closed (as Putney Bridge was for three months in late summer 2014).

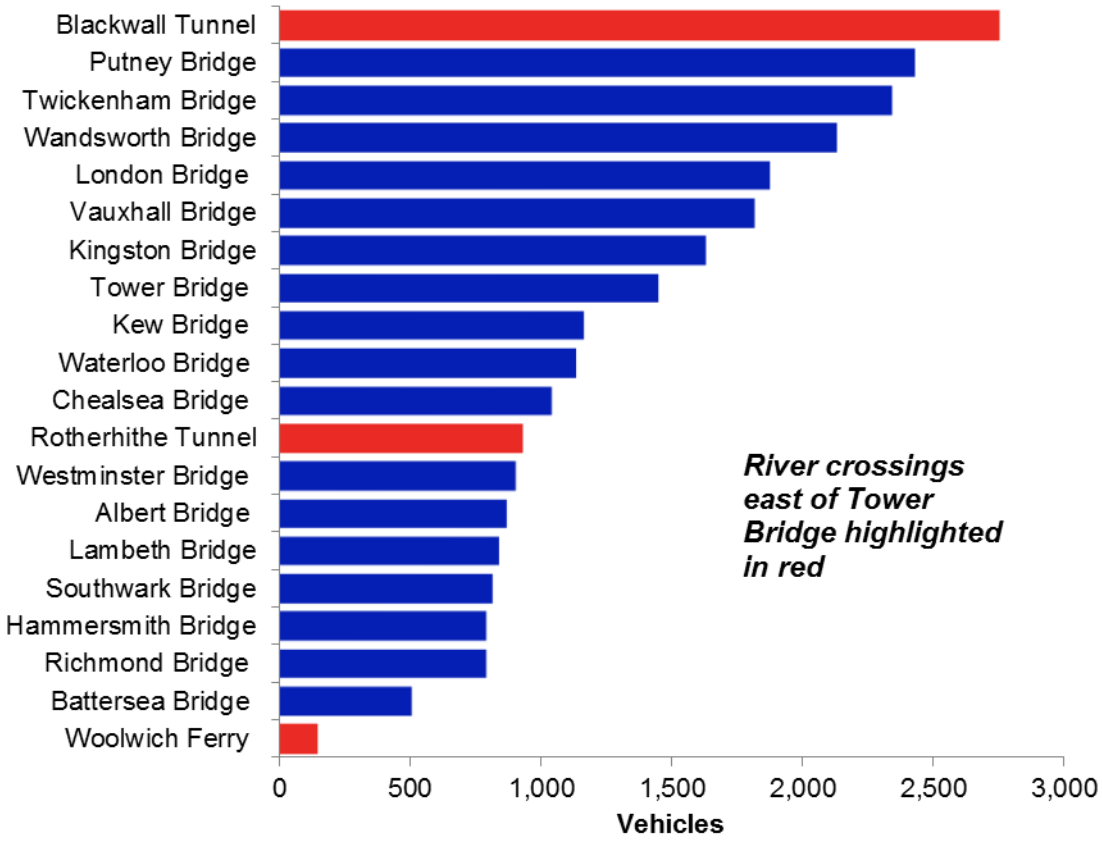
2.3.2 In east London however, the economic, historical, and topographical factors outlined above have led to a very different situation, in which the Blackwall Tunnel has become a single link of pivotal strategic importance in the highway network. The importance of the crossing amplifies the adverse effects of its problems.

2.3.3 The importance of the Blackwall Tunnel as a link in the east London road network can be demonstrated by considering its contribution as one of five crossings in the eastern part of the Thames[15]. It can be seen that the Blackwall Tunnel is carrying a disproportionate share of traffic: over 30 per cent of all private highway trips across the eastern Thames in the AM peak hour, the inter peak average hour, and the PM peak hour (if the Dartford Crossing is included in the calculation). If Dartford is excluded, the proportion increases to 60 per cent or more in each period; and this high figure persists despite significant congestion and closures at the Blackwall Tunnel.

2.3.4 In fact, as Figure 2-7 shows, the Blackwall Tunnel not only carries by far the most traffic of the three road crossings in east London (shown in the red bars), but also carries the most traffic of *any* of the road crossings in the Capital.

[15] The others are Tower Bridge, Rotherhithe Tunnel, Woolwich Ferry and the Dartford Crossing.

Figure 2-7: Weekday AM peak hour northbound traffic on GLA river crossings (2012)



2.3.5 The Blackwall Tunnel is clearly working hard in carrying significant volumes of traffic. This reflects, very largely, its position in the road network, carrying traffic through the heart of the intersection between the A2, A12 and A13 – inner east London's principal roads.

2.3.6 It also reflects the distance from other crossings in the east. The nearest alternative road crossings are the Rotherhithe Tunnel and the Woolwich Ferry, lying 7.5km to the west and 5km to the east respectively. These crossings do not provide suitable alternatives to the Blackwall Tunnel because they are principally local links, capacity-constrained, and are not located to connect major arterial routes.

2.3.7 These capacity constraints are a consequence of the design of the other east London links. Owing to its relatively narrow and bending shape, heavy goods vehicles are not permitted to use the Rotherhithe Tunnel, and it is unsuitable for buses (taller vehicles are not permitted to use the northbound bore of the Blackwall Tunnel either). The Woolwich Ferry has extremely low

capacity (around 200 passenger car units (PCU) per hour in each direction) and is already at capacity in the AM peak.

2.3.8 Still further to the west and east of the Blackwall Tunnel respectively are Tower Bridge (some 9km distance) and the Dartford Crossing (some 25km distance, with a user charge).

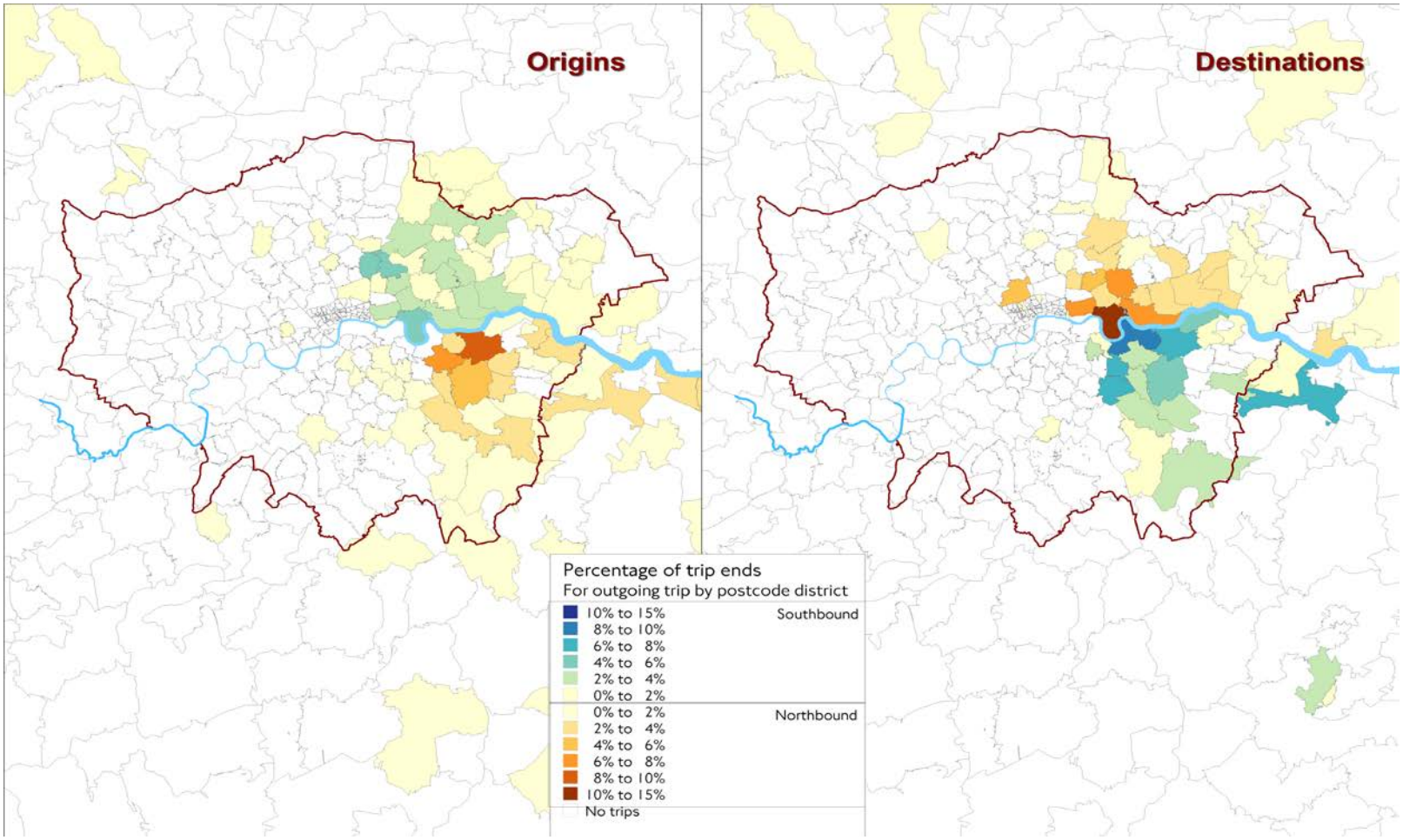
2.3.9 Using these crossings would mean traffic making longer trips, partly on local roads, adding to journey time. Despite the significant diversion involved in using the Dartford Crossing, (which is a strategic, orbital route outside London), it is sometimes used as an alternative to the Blackwall Tunnel (see Figure 2-17 later in this chapter), which highlights the lack of appropriate alternatives within London.

2.3.10 For traffic which has an origin or destination within the east sub-region of London, a crossing in the vicinity of the Blackwall Tunnel is the preferable route for most drivers. But within that broad area, trip ends are for the most part widely dispersed – notwithstanding a cluster centred on the Isle of Dogs.

2.3.11 As shown in Figure 2-8, around three of every four trips through the Blackwall Tunnel[16] had an origin and or destination in the local area (defined as the boroughs of Barking & Dagenham, Bexley, Greenwich, Havering, Lewisham, Newham and Tower Hamlets).

[16] Behavioural surveys undertaken from roadside sampling, TfL, 2012.

Figure 2-8: Origins and destinations of AM Peak period Blackwall Tunnel trips (Behavioural Survey 2012)



2.3.12 This evidence demonstrates that the Blackwall Tunnel is east London's primary strategic river crossing for vehicular traffic. It also acts as a major connection for traffic between east London and areas beyond London on the other side of the river, and so by extension operates as part of the strategic road network. Its ability to act as a strategic connection for bus and coach users, who also wish to cross the river at this location, is severely constrained by its design and capacity.

2.4 Transport problems at the Blackwall Tunnel

2.4.1 As we have seen, the Blackwall Tunnel has a singular strategic function in the east London highway network, but is constrained by being at capacity, its outdated design and the lack of proximate alternative crossings. However, its position means that it is well-connected to the strategic road network, indicating that any additional link must also provide these connections.

2.4.2 The next section examines the specific transport problems of the Blackwall Tunnel – congestion, closures and incidents and lack of resilience – in more detail. These problems are numbered for ease of reference but no hierarchy is intended.

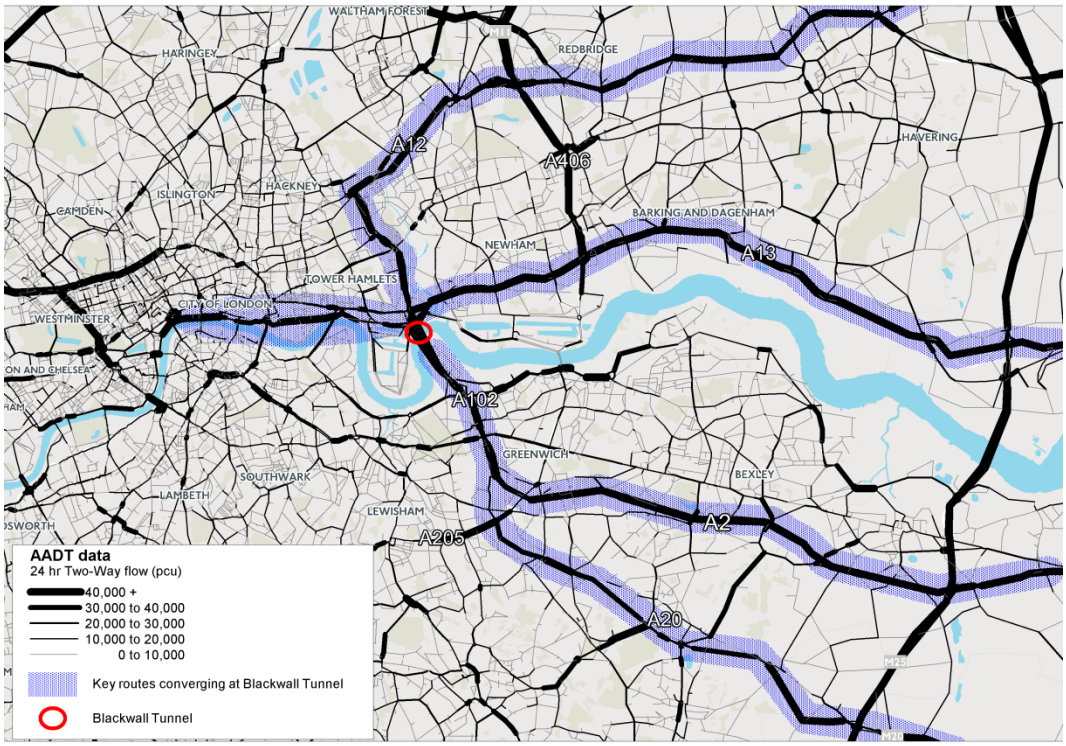
2.5 Transport problem 1 – congestion

Traffic volume

2.5.1 The strategic importance of the Blackwall Tunnel on the road network means it attracts far more traffic than it can accommodate. This is particularly the case for northbound travel in the AM peak and southbound travel in the PM peak, reflecting the fact that it connects predominantly residential areas to the south and south-east of the river with employment and commercial centres to the north, which gives rise to commuting, servicing and deliveries and other business trips.

2.5.2 This is illustrated in Figure 2-9 which uses black lines of differing width to show levels of traffic flow: the broad line at the Blackwall Tunnel indicates that it carries among the most traffic of all the roads in east London, and connects to other highly significant routes. It also illustrates that several strategic routes converge at the Blackwall Tunnel (shown circled in red).

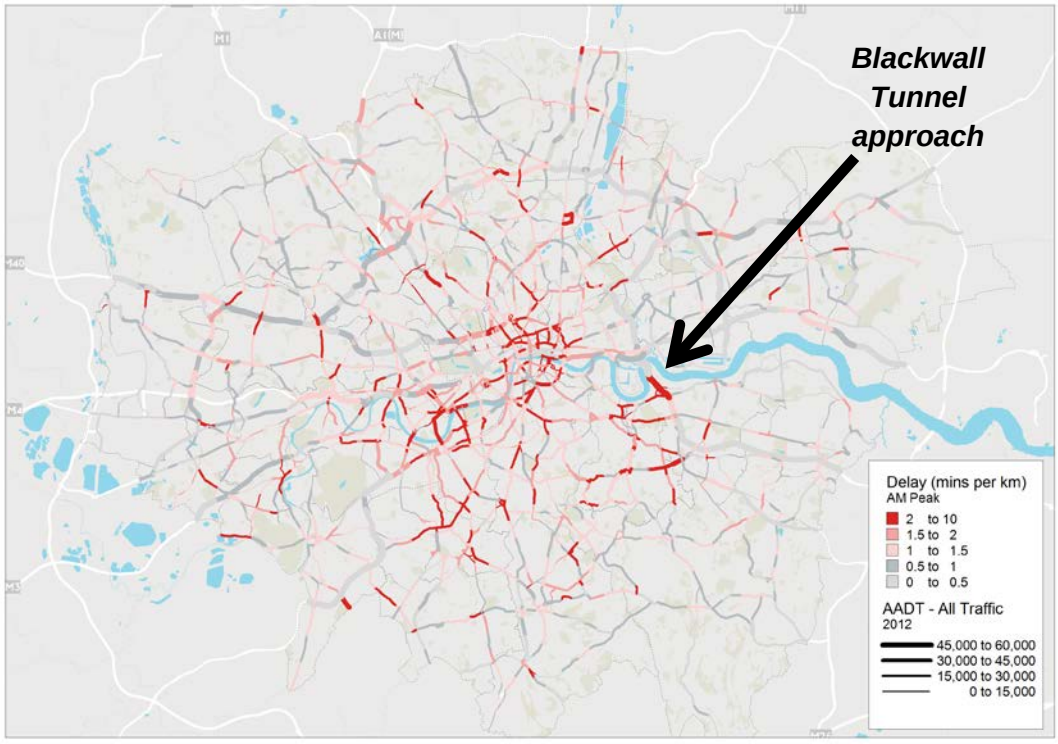
Figure 2-9: Two-way Annual Average Daily Traffic (AADT) on the strategic road network in east London[17]



2.5.3 The delay which results from this level of congestion in both the AM and PM peak periods is shown in Figure 2-10 and Figure 2-11. In the AM peak, the northbound approach to the Blackwall Tunnel is the most heavily congested major traffic route in London, with delays on average between two and ten minutes per kilometre. Although less marked, this pattern is also characteristic of the PM peak.

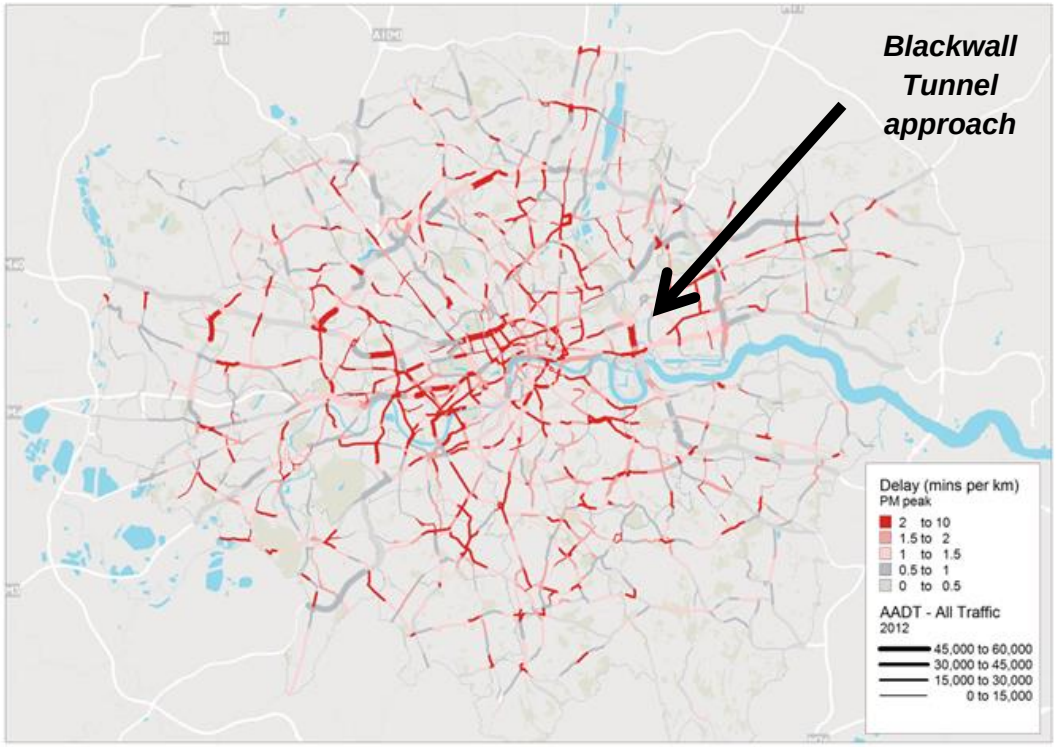
[17] Source: annualised RXHAM base year traffic model data.

Figure 2-10: AM peak average delay (September 2013 to August 2014) and AADT traffic flows (2012)[18]



[18] Source: TrafficMaster (using GPS data). The period covered is September 2013 to August 2014 for the delay data, and the flow data is from 2012.

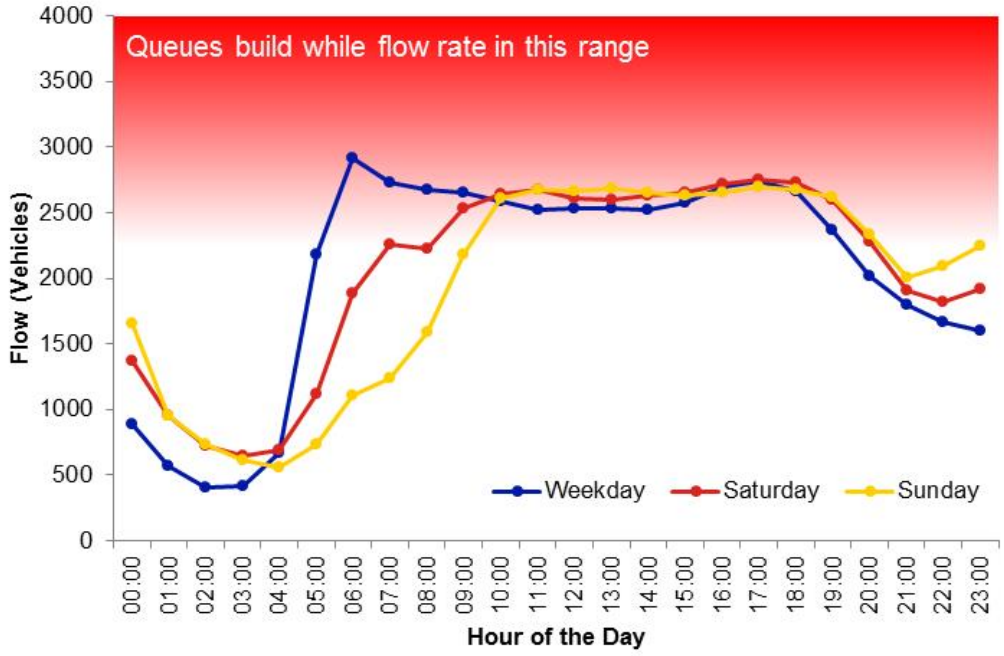
Figure 2-11: PM peak average delay (September 2013 to August 2014) and AADT traffic flows (2012)



Peak duration

2.5.4 The traffic problems of the Blackwall Tunnel are also manifested in the extended duration of the peak period at this location compared to most other links on the highway network. While most roads become busy from around 6:00 or 7:00, here, traffic builds up from 5:00 in the morning as motorists seek to avoid the extremes in congestion which affect the northbound bore from around 6:00 to around 10:00. Flow remains close to peak levels for much of the day, as can be seen in Figure 2-12 that even outside the busiest times, demand is close to or exceeds capacity through much of the rest of the day.

Figure 2-12: Blackwall Tunnel northbound - average hourly flows by day type[19]



Delay and journey times

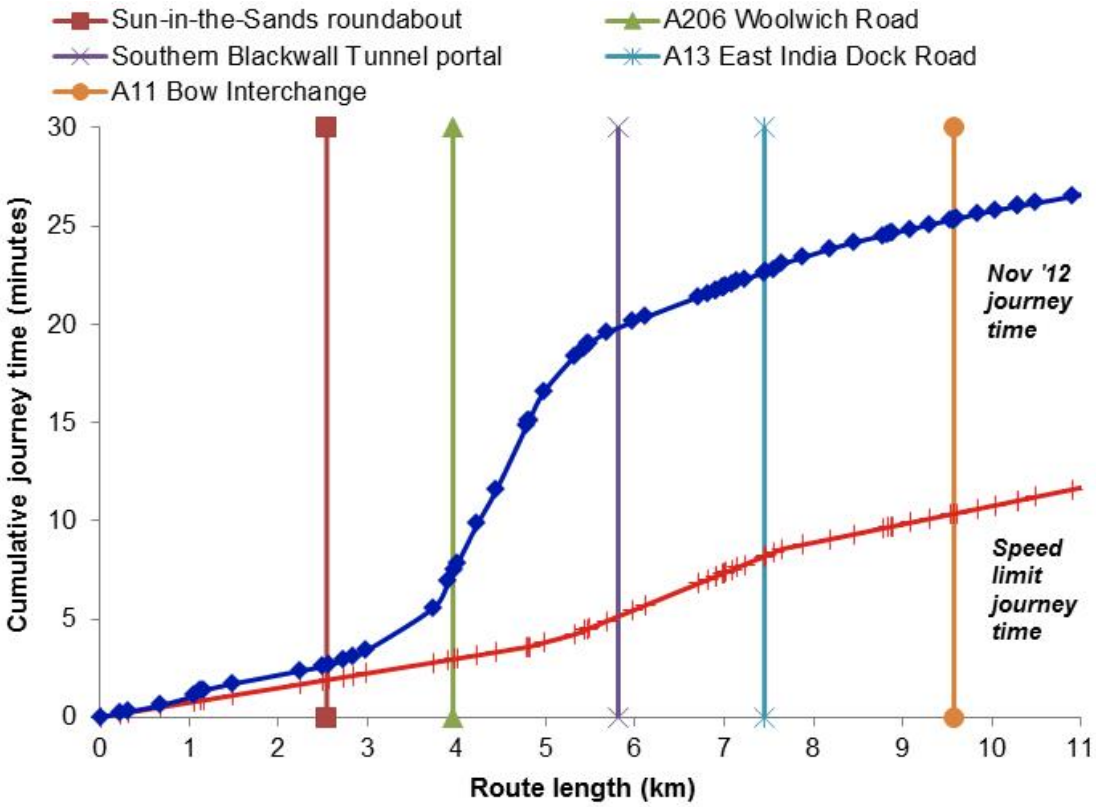
2.5.5 The result is that traffic on one of London's key strategic road links is routinely subject to significant delay. Journey times for trips along the A102 are very slow during peak periods. In the northbound direction in the AM peak, queues routinely stretch back from the tunnel around 3.2km to a point just north of the Sun-in-the-Sands Roundabout. In the PM peak southbound, queues regularly extend almost 2.7km to a point north of the Bow Interchange. In the worst-affected links on the approach roads, speeds fall to an average of less than 8kph (5mph)[20], compared to an average 18.7kph speed in Inner London[21].

2.5.6 It will be useful to identify where the congestion occurs on this route (which is typical of a northbound journey through the Blackwall Tunnel). This can be

[19] Blackwall Tunnel Flows, 01/12/2011 to 28/11/2013
[20] In the NB peak, between A206 j/w Woolwich Road and the Tunnel portal. SB peak, 1 km north of Bow interchange to A13 East India Dock Road. See Chapter 4 of the Transport Assessment.
[21] Inner London AM peak on TfL's 'network of interest'. Travel in London 8, TfL, 2015

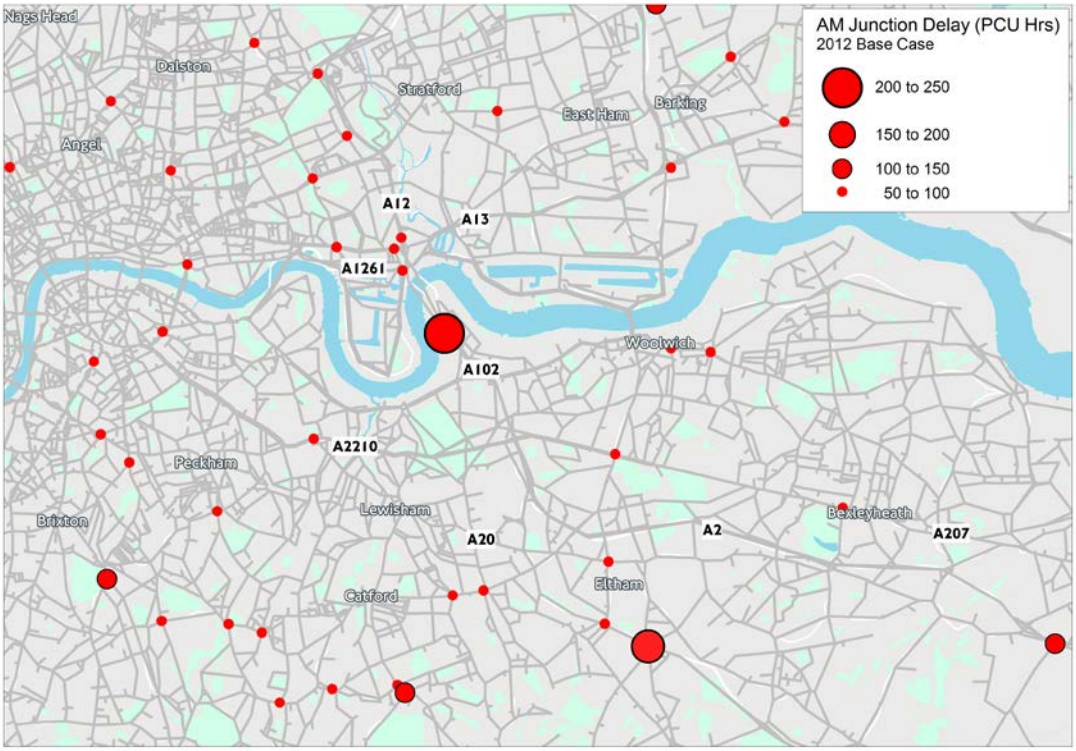
done by comparing the actual journey time with what the journey time would be if the journey was made at the applicable speed limit (i.e. was not subject to congestion and delay), and noting where the two sets of data diverge. This is shown in Figure 2-13 below. As can be seen the delay starts to appear at the A206 Woolwich Road and then continues as far as the end of the journey at Bow Interchange. A disparity around 15 minutes journey time is observed throughout the final 4km section of the route. It is important to note that this is an average of a month's data; the level of delay regularly significantly exceeds what is shown below.

Figure 2-13: Observed average weekday AM peak cumulative journey time northbound (Nov 2012) v unconstrained (speed limit) journey time



2.5.7 The location and magnitude of the delay which regularly occurs at the approaches to the Blackwall Tunnel, especially the northbound approach, can also be seen in Figure 2-14. The dots on the Figure show the magnitude of delay experienced on the road network for the AM peak hour, calculated using the number of affected vehicles and the duration of the delay experienced.

Figure 2-14: AM peak hour junction delay (2012)



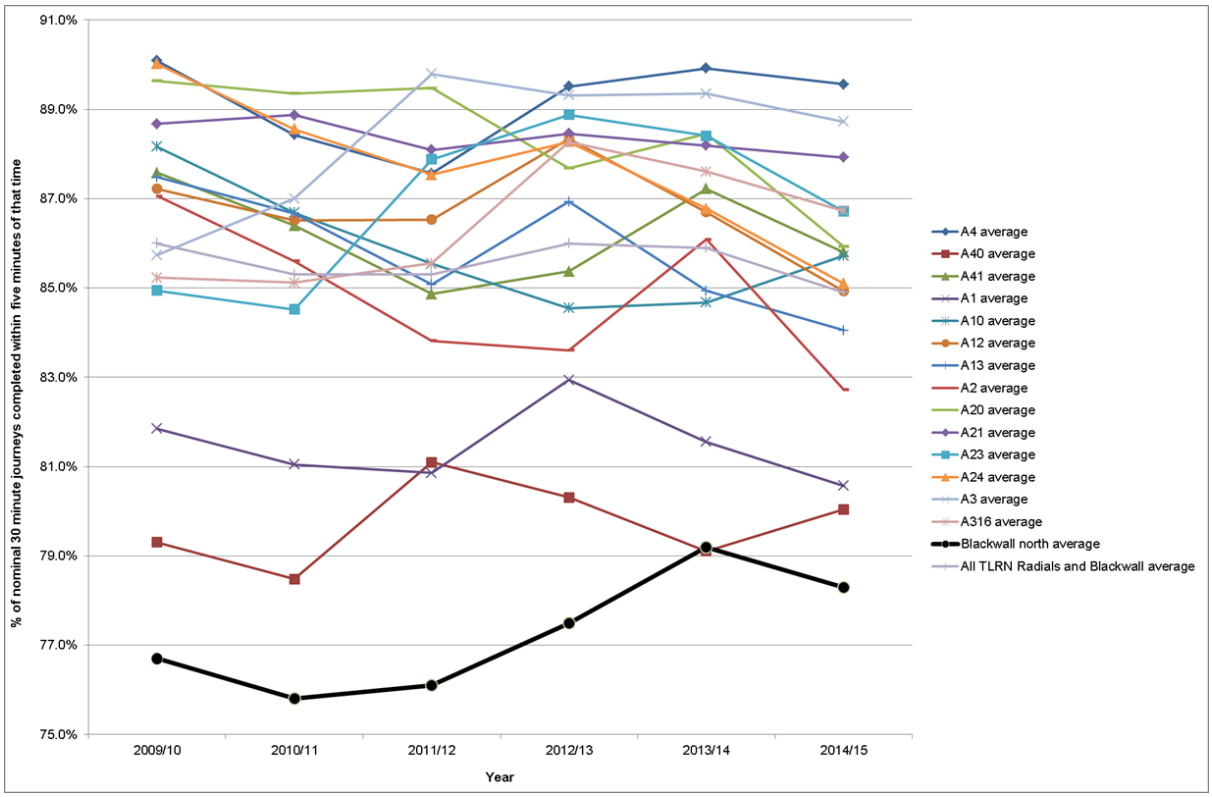
2.5.8 Data from recent surveys of travel behaviour suggests that 63 per cent of local residents who cross the river said that they changed the time of their journey to avoid congestion, and around half (52 per cent) said they sometimes used public transport to avoid driving across the river. Around half (49 per cent) said they sometimes travelled by a longer route to avoid using the Blackwall Tunnel[22]. This congestion clearly has a highly detrimental effect on users.

2.5.9 Another problem arising from this routine (but nonetheless unpredictable) delay is journey time unreliability. This makes it difficult for users to know what time to set off in order to arrive on time and is likely to be a particular problem for businesses concerned with deliveries and servicing and needing to schedule a series of trips throughout the day.

[22] River Crossings Residents Survey, Accent Market Research for TfL, 2015

2.5.10 TfL collects data on journey time reliability[23] for the entire Transport for London Road Network (TLRN) and has compared data from the radial corridors on the network with data collected at the Blackwall Tunnel. As shown in Figure 2-15 below, while it has improved over recent years, the performance of the Blackwall Tunnel has been worse than that of any other route in all but one year, and is significantly poorer than most.

Figure 2-15: AM peak direction journey time reliability (TLRN radial corridors)



2.5.11 Congestion at the Blackwall Tunnel has a far-reaching effect on the wider road network as well as on the local road network. This means that it is not only people trying to cross the river who are adversely affected: road users including bus passengers in the surrounding area also feel the effects of the problems of the Blackwall Tunnel. With around a quarter of all journeys originating outside Greater London, many of the vehicles using the crossing on their way to destinations within London also use the M11 or the A2. Owing to congestion, traffic will sometimes divert to other crossings which

[23] Measured as a percentage of nominal 30 minute journeys completed within five minutes of that time in the AM peak period

has a detrimental effect at the Dartford Crossing and the M25, both part of the strategic road network.

2.5.12 This effect is recognised in the third of the four reasons for the NSIP designation:

> *Current congestion at the Blackwall Tunnel is having a direct impact on the strategic road network.*

2.6 Transport problem 2 – closures and incidents

2.6.1 The design of the northbound bore of the Blackwall Tunnel, while suitable for the Victorian age in which it was built, acts as a serious constraint today. It does not meet modern tunnel design standards for size, safety or curvature.

2.6.2 Its narrowness means that vehicles over 4m (in the right-hand lane) and 2.8m (in the left) cannot be accommodated, which rules out larger lorries and double-deck buses. A 2m width restriction also applies. Both the north- and southbound bores are subject to Category E load restrictions, which is the most restrictive category. The Rotherhithe Tunnel (built a decade later in 1908) is unable to accommodate large vehicles at all.

2.6.3 However, unsuitable vehicles nevertheless continue to attempt to use the Blackwall Tunnel, and even those vehicles which are suitable for the Tunnel still experience an outdated and far from optimal link. As a consequence, the northbound bore of the crossing suffers an abnormally high rate of incidents, including collisions, shedding of debris, and, most frequently, the attempted use of the Tunnel by vehicles which are too tall to use it. In the period 2013-15 there was a total of 6,299 incidents (both north and southbound tunnels), an average of almost six per day. For just over half of all incidents, the nature of the problem means that TfL has to close the Tunnel in order to fully resolve it, which given the very high number of incidents, means frequent closures as shown in Table 2-1 below. On average there were 1,194 closures of the Blackwall Tunnel per year (three per day) in the years 2013-2015, almost three-quarters of these in the northbound tunnel. TfL has taken steps to reduce these incidents, but the fundamental design issues cannot readily be addressed. In contrast, the Dartford Crossing closes as a result of incidents for an average of just over 300 times per year[24].

[24] Highways England, Lower Thames Crossing route consultation 2016 information booklet

2.6.4 Although most closures are brief (the average duration of a northbound tunnel closure between 2013 and 2015 was just over five minutes, while for the southbound tunnel it was 8.2 minutes), because the volume of traffic is so high and exceeds the capacity of the tunnel for long periods of the day, even short closures can have significant and extended impacts, adding thousands of vehicle-hours of delays over the course of a year. They also add to the difficulty of accurately predicting the length of time a journey will take for both bus passengers and private vehicle users alike.

Table 2-1: Average Blackwall Tunnel closures per year 2013-2015

Type of incident resulting in closure	Number		% of total	
	N/b	S/b	N/b	S/b
Over height vehicle	483	0	55%	0%
Broken down vehicle	239	174	27%	55%
Road traffic incident	47	32	5%	10%
Other (pedestrians, debris, etc.)	108	111	12%	35%
Total	**877**	**317**	**100%**	

2.6.5 Occasional serious incidents such as accidents can lead to lengthier closures, in which case these impacts are greatly amplified. In November 2009, for example, the tunnel was closed for a day owing to a vehicle fire, causing extensive traffic problems in southeast London[25]. The effects of these closures are considered further in the next section.

2.6.6 TfL has also compared the closure rate of the Blackwall Tunnel with similar tunnels in the UK, both in terms of absolute number of closures and using a calculation which produces the number of vehicle km travelled per year in

[25] Tunnel closed at 17:40 on 29 November and re-opened at 17:59 on 30 November 2009

each tunnel[26]. On both measures, the Blackwall Tunnel is clearly prone to a much higher number of closures, almost four times that of the other tunnels with around 25 unplanned closures occurring for every million kilometres travelled.

2.6.7 So far, the Blackwall Tunnel has not been subject to an extended closure – weeks or months rather than the shorter closures described here. It is likely that at some point in the future a longer closure would be required, if not for maintenance then as a result of an incident, since despite best efforts, this remains a possibility in an ageing tunnel.

2.7 Transport problem 3 – lack of network resilience

2.7.1 The preceding sections have described the significant levels of delay experienced at the Blackwall Tunnel and the frequency of closures and incidents at the Tunnel. Together with continuing high levels of demand, the susceptibility of the Blackwall Tunnel to closures exposes a third distinct problem – a lack of resilience in the road network in the area of the Tunnel. In a transport context the term 'resilience' describes the ability of transport networks to provide and maintain an acceptable level of service in the face of both planned and unplanned incidents.

2.7.2 This lack of resilience becomes most apparent in the event of closures of the Tunnel which encourage significant numbers of vehicles to seek alternative routes. As we have seen, suitable alternative routes close to the Blackwall Tunnel in east London do not exist, because of the capacity constraints at the nearest crossings of the Rotherhithe Tunnel and the Woolwich Ferry.

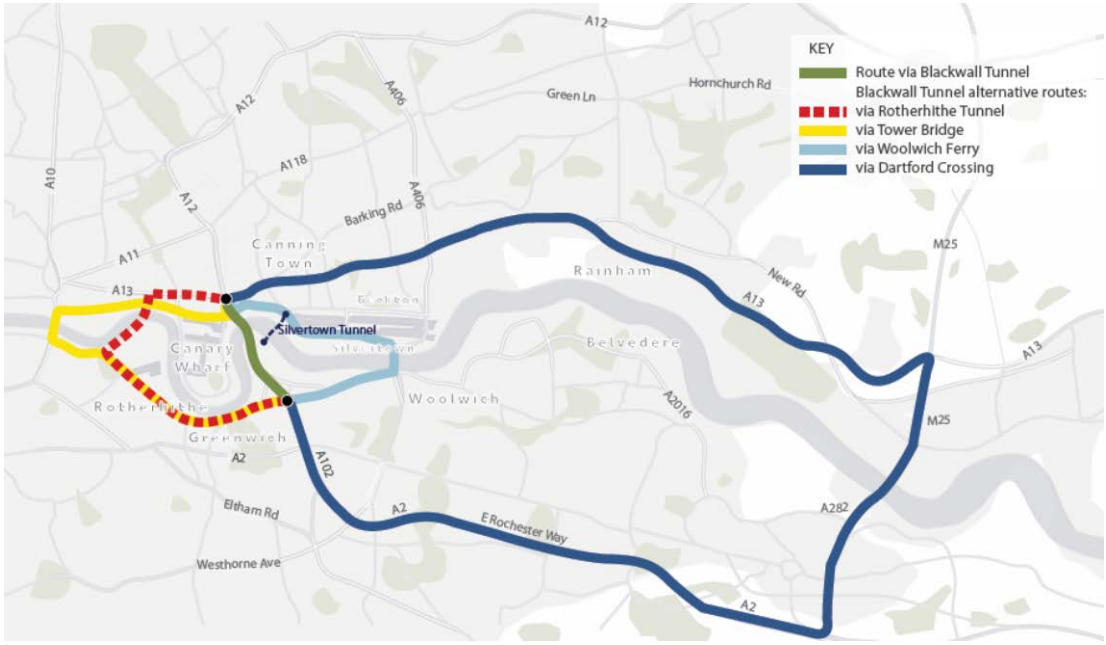
2.7.3 With a short closure, a queue forms at the approach to the Tunnel, but does not immediately cause widespread disruption on the road network. As the length of the closure increases, the queue increases and leads to widespread disruption over a bigger area.

2.7.4 As a result of these longer closures, many users of the Blackwall Tunnel have no viable options but to travel to the Dartford Crossing, which forms part of the M25 London Orbital Motorway. Since the Dartford Crossing does not have the capacity to accommodate these additional volumes of traffic, this can result in serious congestion on the M25, one of the UK's key

[26] Tunnels compared: Limehouse Link, Rotherhithe Tunnel, Tyne Tunnels, Mersey Tunnels (2014/15). See Appendix D of the Transport Assessment

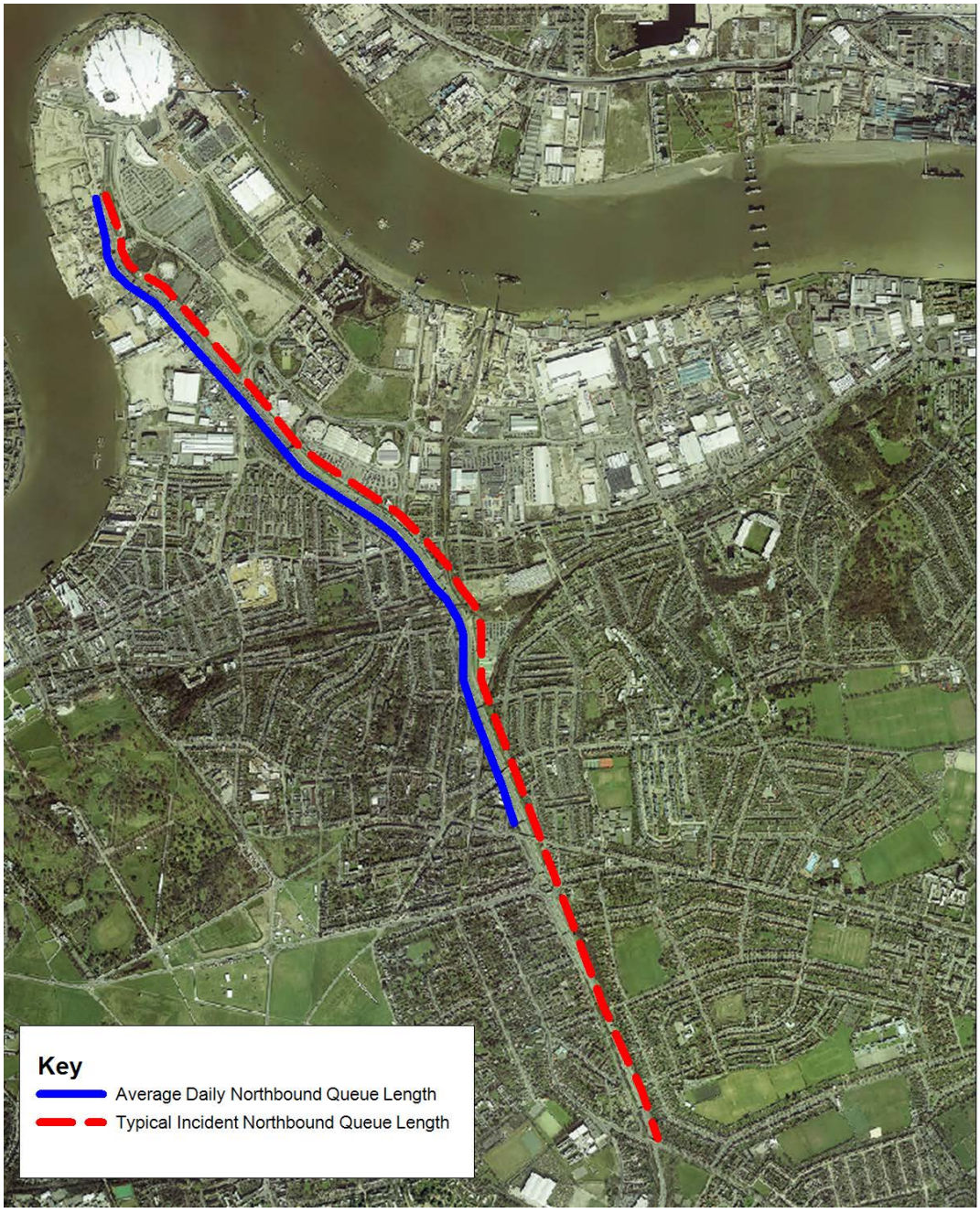
strategic roads, and on roads crossing the M25 in north Kent and south Essex (including the principal freight corridor between the Channel ports and the North of England). In these circumstances the strategic significance of the Blackwall Tunnel becomes plain.

Figure 2-16: Blackwall Tunnel diversion routes



2.7.5 Currently, most of the closures last for less than 15 minutes and queues build up as drivers wait for the reopening. While some drivers will divert to other crossings if they have sufficient warning, many spend time in queues, and bus services also are impacted (see section 2.9.10). Drivers continue to use the Blackwall Tunnel owing to the lack of alternative crossings, and continue to endure delays and congestion**.** Figure 2-17 shows the resulting 4.6km queue when a broken down vehicle caused a Tunnel closure of six minutes in the AM peak on a typical weekday.

Figure 2-17: Typical weekday morning peak queues northbound on a normal day and when there is an incident



2.7.6 Were a long-term closure of the Blackwall Tunnel to be required in future, which is always a possibility, drivers would have to plan their journeys to use other crossings or not make the journey at all. In this scenario, the impact on the wider road network and by extension the economic and environmental impacts would be significant. The impacts from the short closures of the

Tunnel and the likely reactions to any longer closures demonstrate that the Blackwall Tunnel lacks both short- and long-term resilience to traffic disruption and delay.

2.8 Transport problems at the Blackwall Tunnel have significant adverse impacts

2.8.1 The three transport problems of the Blackwall Tunnel are a problem now and will, in the context of forecast growth, become an even more pressing issue in future. It is also important to understand why these problems matter in the wider sense and why it is therefore necessary to take action to resolve them. To do this, some of the 'second-order' effects of the transport problems need to be considered: the economic, environmental and public transport impacts. To a greater degree than the traffic and transport problems, these effects are also detrimental to non-users of the Blackwall Tunnel.

2.8.2 The section 35 direction which designates the Silvertown Tunnel scheme as an NSIP[27] recognises the interaction of transport and economic growth. It gives four reasons for the designation, the first three of which are:

1. London as an engine of economic growth nationally;

2. the projected growth of London; and

3. current congestion at the Blackwall tunnel is having a direct impact on the strategic road network.[28]

2.8.3 In expansion of the second point the text reads:

'Current infrastructure is likely to be unable to absorb this additional capacity, leading to even greater congestion. Given the position of London as an economic driver nationally any decrease in efficiency in London's transport network may have a consequential detrimental impact nationally. The proposed development [the Silvertown tunnel scheme] is in part intended to address that congestion.'

[27] Letter from Justine Greening MP to Boris Johnson, June 2012
[28] The fourth point concerns the fact that although the Scheme is not automatically an NSIP owing to the administrative responsibilities, its size and nature makes it comparable to other NSIPs.

2.9 Economic effects

2.9.1 The three transport problems of congestion, closures and a lack of resilience described above translate into secondary effects on the economy. To understand the range and significance of these economic effects it is necessary to describe how businesses rely on the Blackwall Tunnel to operate effectively; and then to describe the significance of the transport problems and how these translate into impacts on business operations, as well as investigate whether these problems are acting as a disincentive to further investment in east London.

2.9.2 First, it is known that much of the current use in business hours is for work or commuting purposes. Nearly 45 per cent of all trips through the Blackwall Tunnel in 2012 were commuters, with a further 25 per cent travelling for other work purposes[29]. The Blackwall Tunnel therefore provides an important means for businesses to access their labour market, and for individuals to access jobs.

2.9.3 The Blackwall Tunnel is also a key route for goods vehicles, with businesses using it to deliver goods and services to customers and clients, as well as receiving deliveries to support business operations. In the morning peak, it also caries far more freight than Tower Bridge, the Rotherhithe Tunnel or the Woolwich Ferry, and only marginally less than the Dartford Crossing (in fact it carries more LGV traffic than Dartford)[30]. These trips are fundamental to the efficient functioning of the London economy – 85 per cent of all freight traffic is carried by road, with LGV movements expected to grow by 30 per cent between 2008 and 2031[31]. Goods vehicle trips are also very difficult to switch to other modes, so demand at major strategic links like the Blackwall Tunnel is very likely to remain high in future.

2.9.4 The importance of the Blackwall Tunnel as a strategic link for businesses is attested to by businesses themselves. A survey of 500 businesses was undertaken during summer 2015[32] to identify the extent of their markets, their suppliers, their growth expectations and specific constraints to their operations. Interviews were undertaken with businesses based in the

[29] TfL, 2012, RSI surveys
[30] HAM model Validation observed flows (2012)
[31] GLA, 2010, Mayor's Transport Strategy (section 4.2)
[32] WSP, 2015, Silvertown Tunnel business survey

London Boroughs of Barking & Dagenham, Bexley, Lewisham, Newham, Southwark and Tower Hamlets as well as the Royal Borough of Greenwich. The survey results show that the Blackwall Tunnel is viewed as the most important cross river link in East London, by half (52 per cent) of businesses, followed by the Dartford Crossing (24 per cent) and Tower Bridge (14 per cent).

2.9.5 Given the high level of agreement that the Blackwall Tunnel is the most important cross river link for businesses in East London, high levels of congestion can be reasonably assumed to have an impact on a wide range of businesses. Three quarters (74 per cent) of all businesses surveyed said that daily congestion at the Blackwall Tunnel is a disruption or constraint to their business. This is time which could be better spent on productive activities, rather than sitting in traffic.

2.9.6 The Freight Transport Association (FTA) has calculated that each minute of delay caused by congestion costs the operator £1; on this basis a delay of 20 minutes at the Blackwall Tunnel could add £20 to the cost of each individual vehicle's trip.

2.9.7 Whilst everyday levels of congestion impose predictable costs on businesses, poor journey time reliability through closures and incidents also poses significant additional problems for businesses which result in further costs. Nearly two thirds (62 per cent) of businesses stated that journey time predictability at the Blackwall Tunnel is poor. This makes it difficult for businesses to plan their operations with certainty and results in a range of inefficiencies including:

- Businesses having to build in extra time to allow for uncertainty when crossing the River Thames (32 per cent of all businesses surveyed);
- Businesses missing time critical deliveries which let down their customers and can affect future business opportunities (33 per cent);
- Staff are often late for meetings with customers when crossing the River Thames, which again has an impact on future opportunities (40 per cent); and
- Staff are often late for work (30 per cent say staff are late at least once a week, with the annual average cost of this estimated to be £26,000, enough to employ an additional member of staff).

2.9.8 With reduced congestion and improved journey time reliability, businesses would have more certainty over their route planning, have more control over

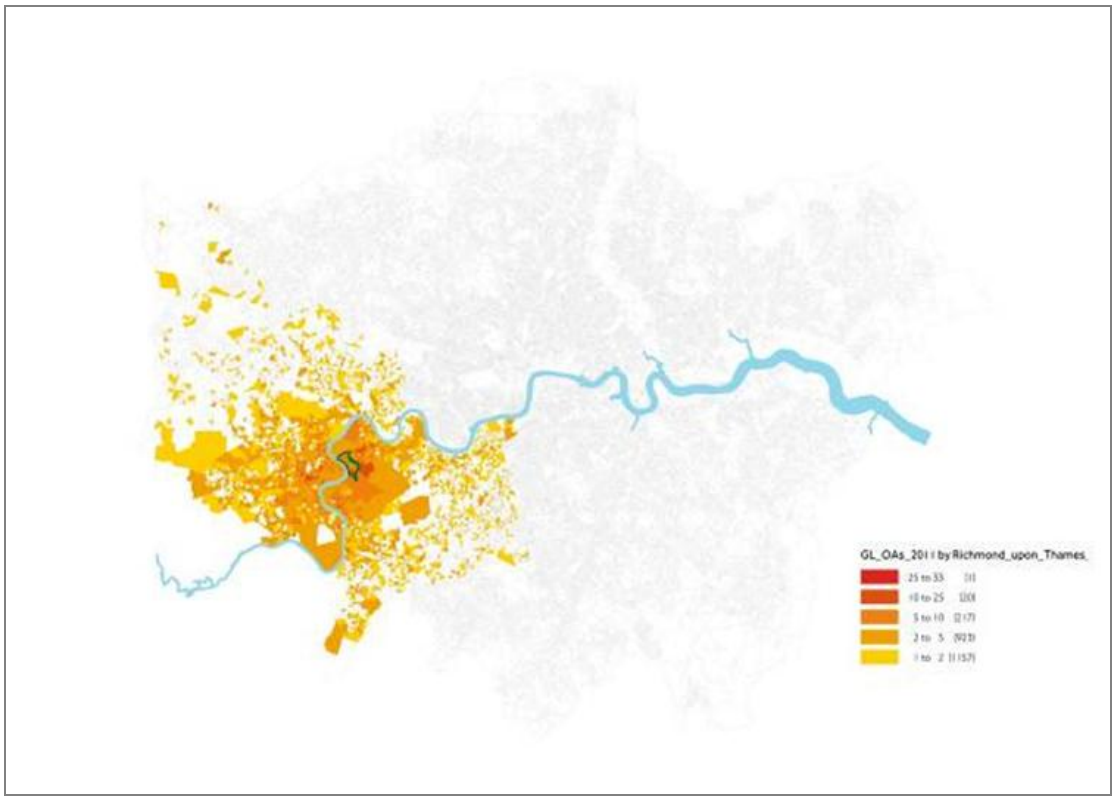
their costs and be able to pursue potential opportunities more effectively. Just over half of all businesses in east London reported that their business would be more likely to operate cross-river if journey times were made more reliable.

2.9.9 Poor levels of resilience and the lack of alternative routes also result in additional costs. The FTA has also calculated that the additional costs of fuel caused by having to take diversionary routes are some 50 pence per mile. On this basis a diversion from the Blackwall Tunnel to the Dartford Crossing could cost an extra £12 in fuel per vehicle. Additionally, when disruption at the Blackwall Tunnel leads to significant rerouting to the Dartford Crossing, congestion can affect commercial road users across the south-east of England, and impede regional, national and even international movements of goods.

2.9.10 Taken together, high levels of congestion, poor reliability and resilience at the Blackwall Tunnel therefore impose significant costs on the large number of businesses that rely on being able to cross the River Thames, with costs much higher than would be the case if the road network was functioning efficiently. These increased costs effectively result in a 'barrier effect' where the movement across the River Thames is seen as a constraint to the ability to access customers, suppliers, staff and jobs on the other side of the river.

2.9.11 This 'barrier effect' is clearly apparent in terms of the distribution of the labour market in East London. This can be seen by comparing the labour catchment areas for locations south and north of the River Thames. Figure 2-18 shows the labour catchment area of part of the London Borough of Richmond upon Thames (outlined in green) located south of the river. It can be seen that the river is no real barrier and has minimal impact on travel to work patterns.

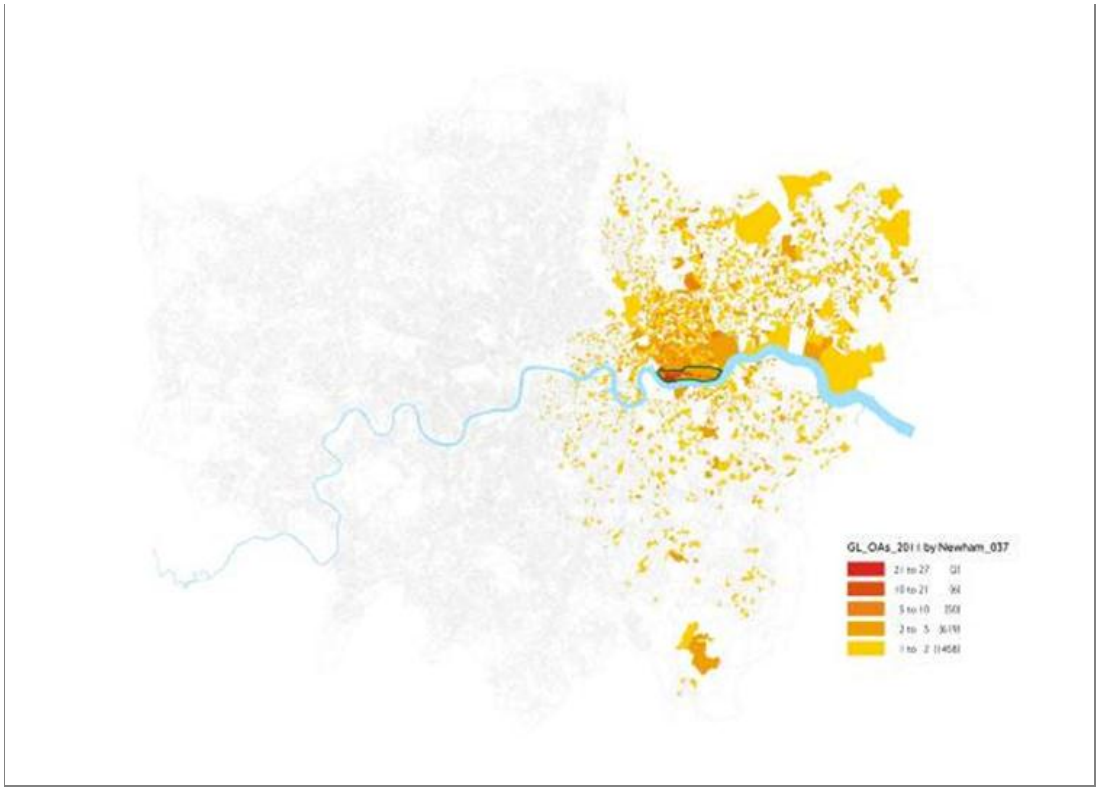
Figure 2-18: Place of residence[33] of those working in Richmond Town Centre 2011



A rather different picture emerges when looking at the labour market catchment of the Royal Docks in the London Borough of Newham as illustrated in Figure 2-19. This shows that there are very few people travelling from the south of the River. It is clear that in east London the river acts as a major barrier both to people seeking work and employers trying to recruit. The business survey identified that 60 per cent of those taking on staff had recruited more than 75 per cent of them from the same side of the river and over 40 per cent had recruited no-one from the other side of the river.

[33] Source: Nomis

Figure 2-19: Place of residence of those working[34] in Royal Docks 2011



2.9.12 Given the amount of potential employment growth that can be accommodated in East London, this is a major barrier to facilitating access to job opportunities for residents south of the river.

2.9.13 This 'barrier effect' is also evident in terms of access to customers. 26 per cent of all businesses surveyed believe that the problems at the Blackwall Tunnel have reduced the size of their potential customer base.

2.9.14 The net result of high levels of congestion, poor journey time reliability, poor resilience and a 'barrier effect' of the River Thames is an economy in East London that is not operating optimally and is not fulfilling its true potential. It is perhaps not surprising then that there is a strong consensus that current crossing options are not adequate (68 per cent), and that four in ten businesses feel that the current number and capacity of river crossings in east London act as a barrier to the development of their operations across the other side of the River. This rises to 49 per cent in the London Borough

[34] Source: Nomis

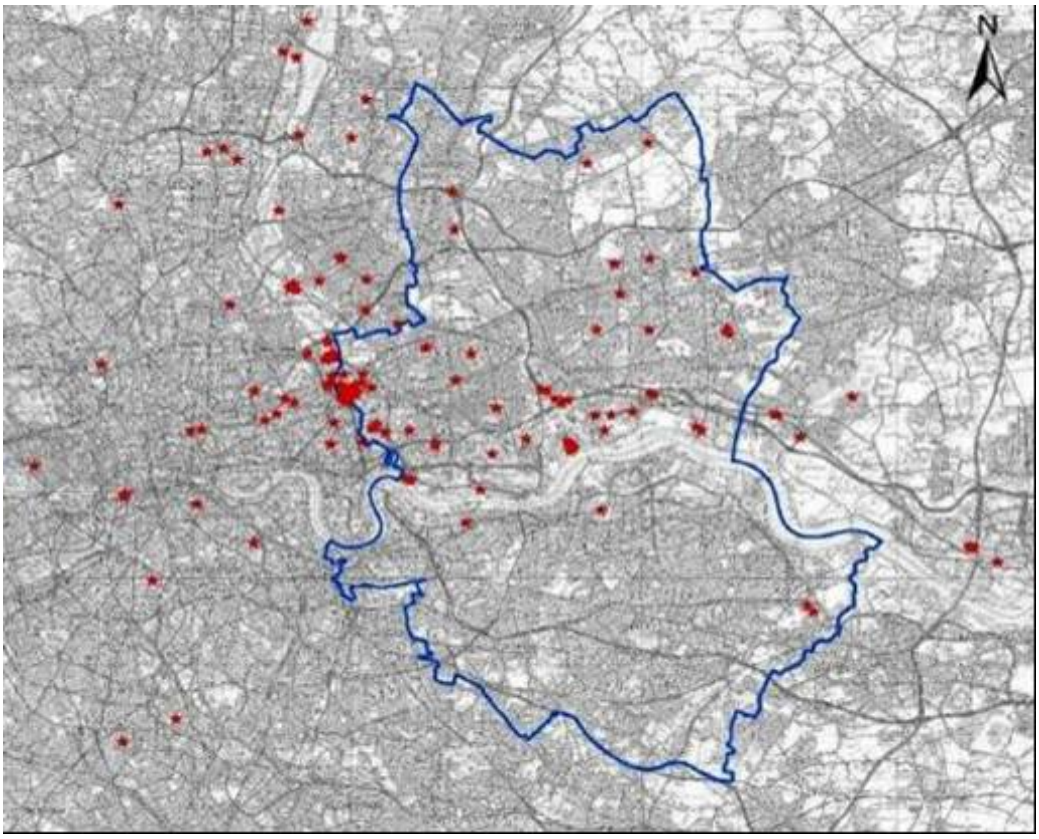
of Tower Hamlets and Royal Borough of Greenwich and to 53 per cent amongst respondents with £1m turnover or more.

2.9.15 The additional costs described here result in an environment which is less attractive for businesses to operate within. This is highly likely to have resulted in lower levels of inward investment and job creation than would otherwise have been the case had these costs and inefficiencies not existed.

2.9.16 Evidence that businesses have chosen not to locate in a given area is almost by definition difficult to find. However there is an example of this in the case of the relocations of businesses from what is now the Queen Elizabeth Olympic Park ahead of the London 2012 Games. The majority of these businesses did not choose new premises south of the River Thames, with many preferring to locate much further from their original Stratford home in outer east London and even in Essex (see Figure 2-20).

2.9.17 This suggests that businesses felt that the additional costs to access their customers, suppliers and labour market, which as we have seen are partly a result of the inadequacy of existing river crossings, would be too high if they went south of the River Thames.

Figure 2-20: Relocation of businesses formerly based at the Olympic site



2.9.18 The transport problems and their detrimental impact on the local economy described here are already being experienced by businesses across east London. In the context of continued population and employment growth, there is likely to be a compounding effect whereby escalating transport demand puts further strain on the Blackwall Tunnel (resulting in even more congestion and delay) and the economic effects of these problems are felt even more acutely, ultimately serving to impede rather than support forecast growth.

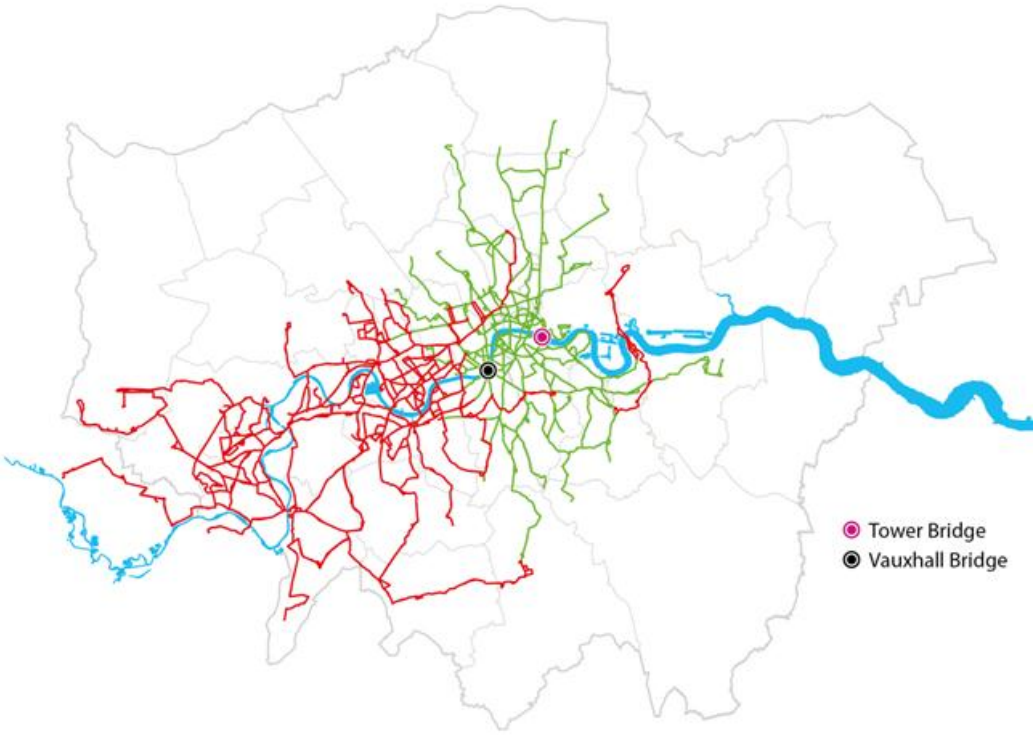
2.10 Public transport effects

2.10.1 The problems of the Blackwall Tunnel do not affect only private cars and commercial traffic: public transport users (and potential users) are also adversely affected by delays, congestion and journey time unreliability. There is one bus route through the Tunnel, running 24-hours per day at a frequency of 7-10 minutes in the daytime. Additionally, some 90 commuter coaches from Kent also use the northbound route in the morning peak. On

this measure, 11 per cent of person trips through the Blackwall Tunnel in the AM peak are by public transport[35].

2.10.2 Figure 2-21 highlights the extreme disparity in cross-river bus services operating between east and west London. There are 47 bus routes which cross the river west of Vauxhall Bridge and only a single route crossing the river east of Tower Bridge – the 108 between Stratford and Lewisham via the Blackwall Tunnel.

Figure 2-21: Cross-river bus services in London



2.10.3 Users of the 108 bus route routinely experience delay caused by congestion, and disruption owing to tunnel closures which cause delays to passenger journeys and increase the cost of operating the service TfL measures

[35] As set out in Silvertown Tunnel Transport Assessment (Data sources: Highway Assignment Model baseline traffic counts (2012); Bus Origin Destination Surveys for routes 42, 78, RV1 and 108 (2013); TfL: Pedestrian and cyclist Thames screenline crossings count (2013); Scheduled coach services with an estimated average passenger occupancy of 48; Other passenger occupancy assumptions from TAG data book).

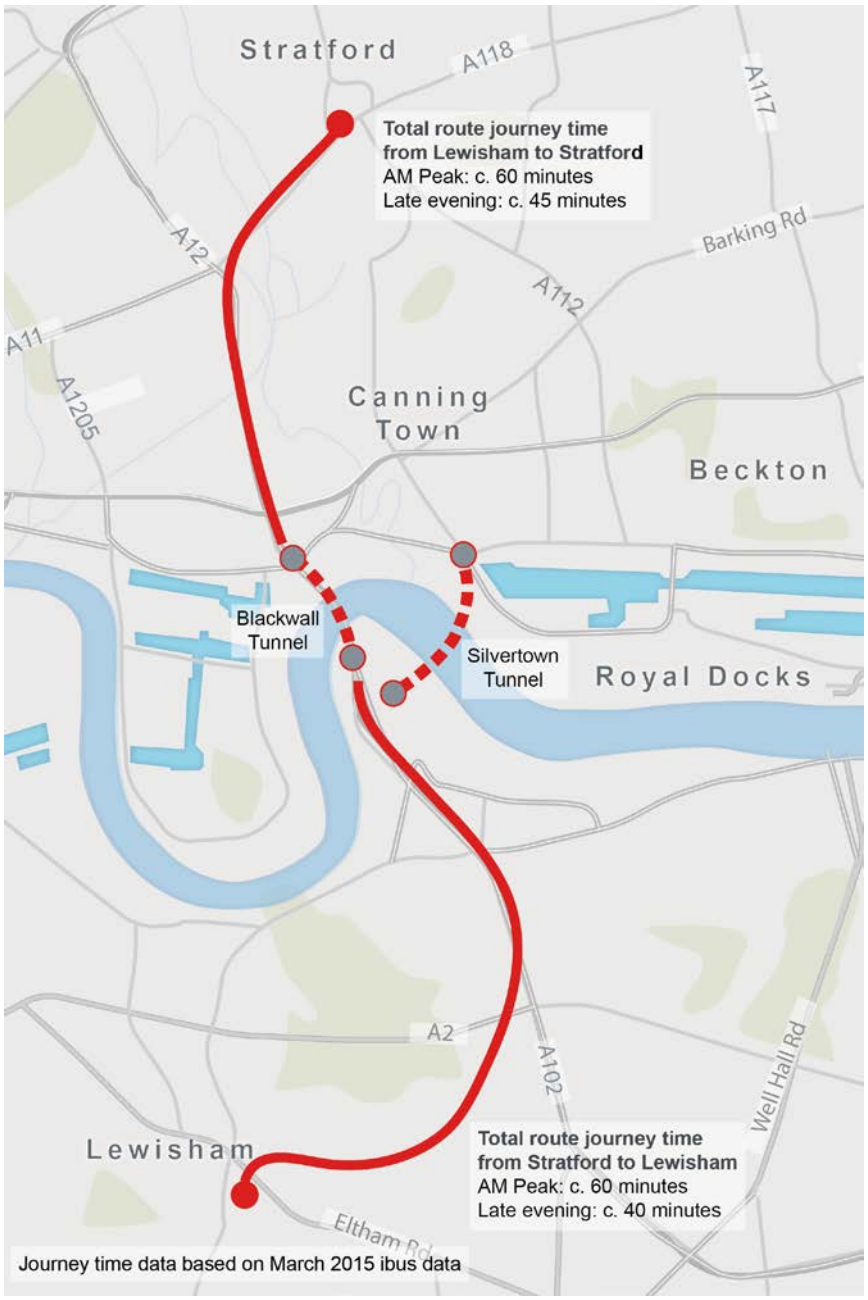
reliability for high-frequency bus routes (five buses per hour or higher) based on the time waited by passengers at stops in excess of the average scheduled wait time. This is known as the excess wait time (EWT) and is measured in minutes. EWT on the route 108 for the period from 3 July 2013 to 2 July 2014 was 1.21 minutes, which was 25% longer than the average EWT for all high frequency bus routes in RB Greenwich and LB Newham[36] for the same period. This figure is an annual average and EWT during the peak periods would be higher. Overall journey times in the peaks are affected by day to day congestion as well as incident related congestion.

2.10.4 Figure 2-22 shows the journey time difference of Route 108 in the AM peak compared to more free-flowing conditions between 22:00 and 23:00. The northbound end-to-end journey takes an additional 20 minutes in the AM peak compared to the late evening and the southbound journey an additional 15 minutes. TfL's ongoing customer satisfaction surveys consistently demonstrate that journey time is the most significant driver of customer satisfaction for bus users.

2.10.5 Under present conditions, a journey across the river by bus is not a realistic proposition for many prospective passengers. It may also act as a deterrent to bus usage even for routes which do not actually cross the river.

[36] LB Newham was selected over LB Tower Hamlets as being more representative because Tower Hamlets includes parts of the Central Activities Zone

Figure 2-22: Route 108 journey time



2.10.6 The experience of the traffic constraints affecting this bus service, together with the Tunnel's low headroom which prevents the operation of double-deck vehicles, undermine TfL's ability to provide further bus services across the river in this location. Consultation respondents have indicated that additional cross-river bus services would be an important element of any new river crossing and it is likely that there is significant unmet demand for these services.

2.10.7 The congestion effects of tunnel closures are also experienced by bus services which do not cross the river. Some bus services terminating at North Greenwich bus station experience a consequential drop in average speeds, delay and excess journey time as a result of closures of the crossing leading to traffic congestion on the approach roads.

2.10.8 TfL has looked at the performance of one such route - the 132[37] - on occasions where congestion has built up owing to closures of the Blackwall Tunnel. On 16 January 2014, for example, a 34 minute closure in the AM peak led to bus speeds on this route reducing to almost half their usual average over the course of the day, with a much more significant decrease (to around 5mph) in the period immediately following the closure.

2.10.9 The impact on bus services when there is an incident at the Blackwall Tunnel also has an impact on delay for local bus services. Data from December 2015 when the northbound tunnel was closed for about an hour during the AM peak shows that not only the 108 but also services in the wider area are affected. For the 177 between Thamesmead and Peckham the combined delay for both directions averaged 65 minutes and for the 472 between Thamesmead and North Greenwich Station the combined delay for both directions averaged 44 minutes. This means that bus journeys took considerably longer than normal and passengers had to wait for longer to board a bus at their stop.

2.10.10 Commuter coach services to and from Kent have long been users of the Blackwall Tunnel, and those using them are subject to the same problems as bus users.

2.10.11 Operators report[38] that it is becoming more difficult to run reliable timetabled peak-hour services, since the variability of delay at the Blackwall Tunnel is high. The impact of journey time unreliability on services is illustrated by this comment on the website of one operator, Buzzlines:[39]

> *Both services are timed to arrive at Canary Wharf at the same time – 07:45, so that passengers on the 737C wanting to continue into central London can change coaches. Arriving in London that early also means we*

[37] The full route is Market Place/ Bexleyheath Clock Tower – North Greenwich station
[38] TfL research, 2015
[39] http://www.buzzlinestravel.co.uk/services/commuter-travel?wa=14 Accessed 17 December 2015

beat the worst of the congestion that tends to build up in peak hour on the Blackwall Tunnel Approach.

2.10.12 Services are also made relatively less attractive by the significant delays, and by the difficulty of reliably estimating likely journey times. In addition to this, unpredictable journey times make it difficult for coach operators to meet their obligations to the Traffic Commissioner and to TfL (through the London Service Permit scheme[40]).

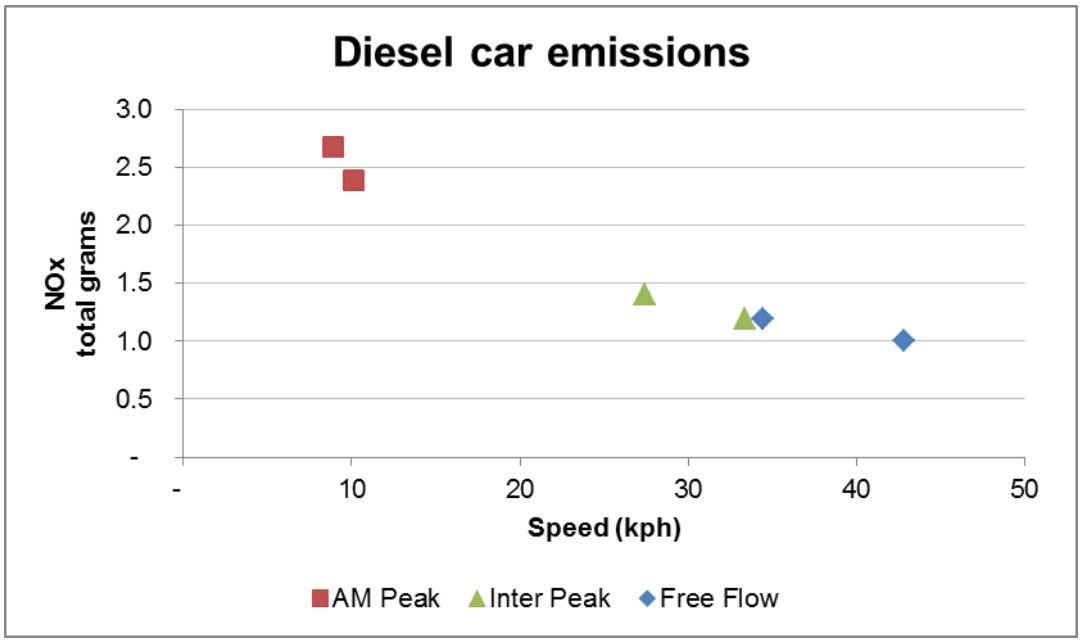
2.11 Environmental effects

2.11.1 All motorised traffic produces emissions: on a per-vehicle basis, slow-moving and congested stop-start conditions lead to more pollutant emissions than free-flowing conditions and uncongested speeds. Exhaust emissions contribute to poor air quality locally and higher CO_2 emissions from transport.

2.11.2 Figure 2-23 shows how total emissions from a modern car driven through the northbound bore of the Blackwall Tunnel[41] vary depending on the time of the day, demonstrating the impact of congestion on engine efficiency. A diesel car has been analysed since these have become more prevalent in the fleet and typically have higher air quality pollutant emissions than petrol vehicles.

[40] A permit required to operate a bus or coach service in London
[41] TfL drive cycle test using average speeds on northbound approach to Blackwall Tunnel, 2014

Figure 2-23: Blackwall Tunnel northbound diesel car emissions (2014)



2.11.3 Congested conditions therefore exacerbate the already significant environmental impacts of large flows of traffic travelling along the A2 and A102, which is one of London's most polluted road corridors.

2.12 The problems now and in the future

2.12.1 London has an excellent track record in achieving substantial mode shift from private to public transport; since 2000 the public transport mode share for London has increased by 11 percentage points[42]. At the same time, public transport modes have all seen increases in trip rates[43]. In 2013, public transport mode share overtook private transport mode share for the first time, a trend which has continued in 2014, the most recently available year of data[44].

2.12.2 There are many reasons for this trend towards public transport. A fundamental reason is the sustained and substantial investment in public

[42] Travel in London 8, TfL, 2015 (journey stage based mode share)
[43] Drivers of Demand for Travel in London, TfL, 2014
[44] Travel in London 8, TfL, 2015. The trip-based mode share was 37.2 per cent for public transport, 36.5 per cent for private transport, 2 per cent cycling and 24 per cent walking

transport that has taken place over this period, as outlined above. Demographic factors have also been important. What is certain is that this trend has continued even with population growth. Although overall trips have increased as the population grows, public transport trips have increased much more than private transport trips. In this way, the mode share for public transport has continued to increase.

2.12.3 The maintenance of this trend is important because, as shown in forecasts supporting the London Plan policies, London's population will continue to grow, and east London will accommodate much of this growth. GLA forecasts are that London will grow by around 1.2m people between 2011 and 2031 (see Figure 2-24: Population growth projection (2011-2031) and Figure 2-25 below). The boroughs in the east and south east sub-regions are expected to accommodate 37 per cent of this growth, and the three Silvertown Tunnel host boroughs plus the London Borough of Barking and Dagenham, to accommodate 23 per cent of London's growth.

Figure 2-24: Population growth projection (2011-2031)

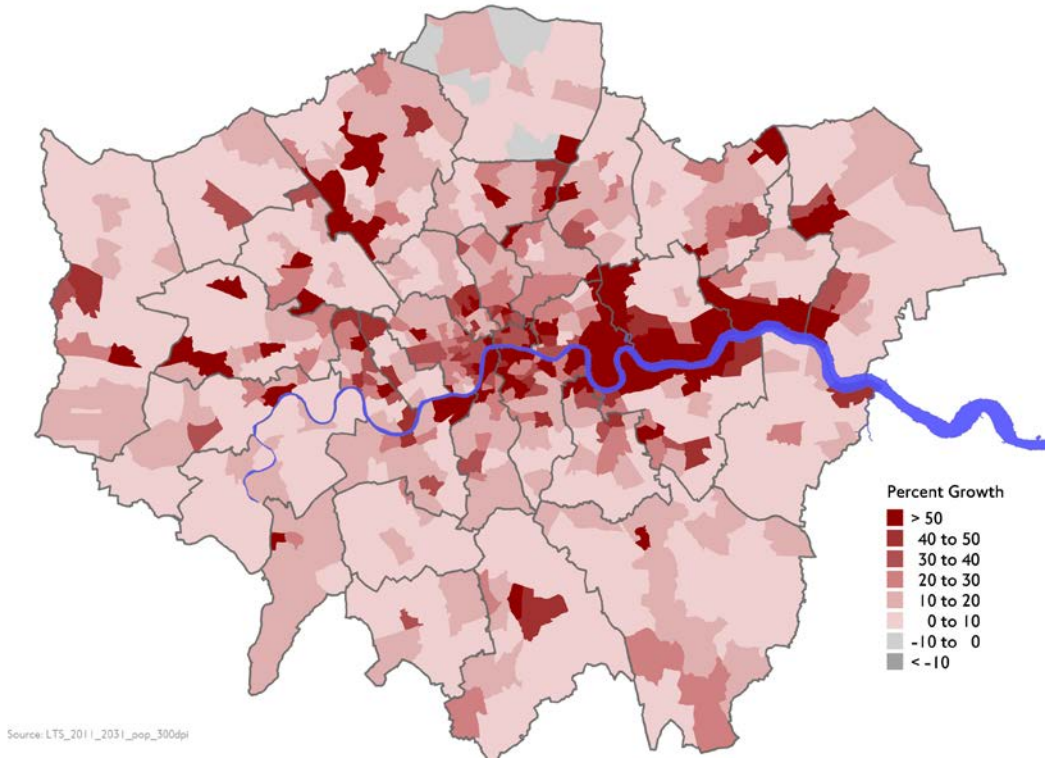
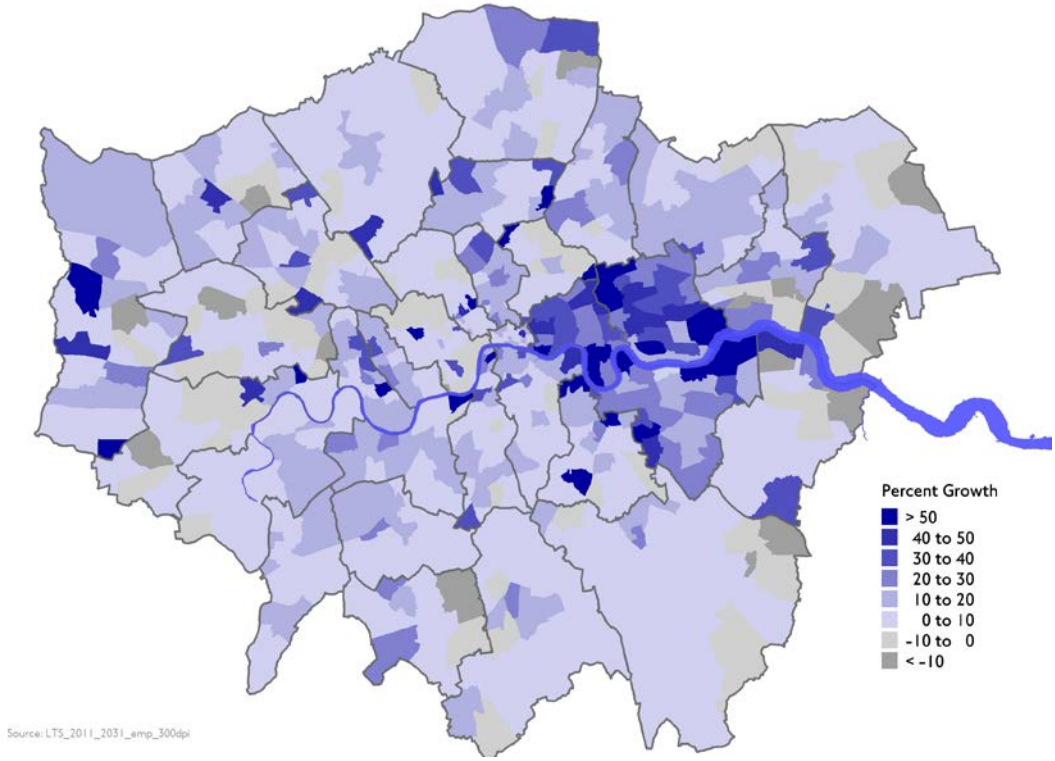


Figure 2-25: Employment growth in London (2011-2031)



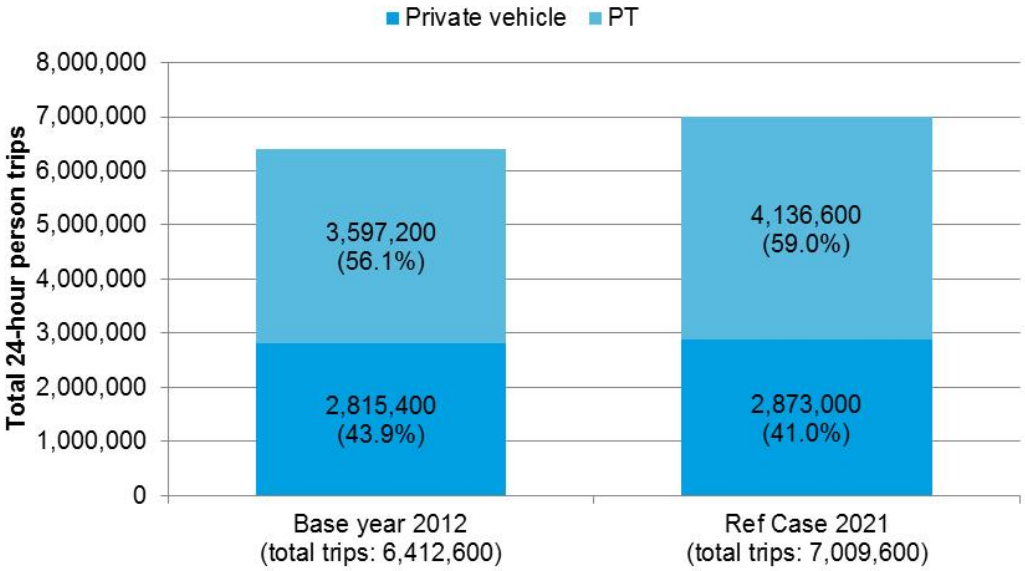
2.12.4 As a consequence of this increased population and employment, the overall number of trips will increase. Forecasts used in the development and assessment of the Silvertown Tunnel scheme represent a point within a range of plausible planning scenarios developed by the GLA for each future year, and have been supported by extensive sensitivity testing.

2.12.5 Around three million more trips are expected to take place each day by 2031, an increase of around 15 per cent on the baseline 2008 rate. Because growth is so concentrated in the east and south-east, the increase in trip-making there is likely to be even bigger – up to around 30 per cent on 2008 levels[45].

2.12.6 While many of these additional trips will be accommodated on public transport, a proportion of these additional trips will inevitably be made by private vehicle. The Mayor's Transport Strategy (MTS) sets out a clear commitment to sustainable transport and a continued increase in public transport, walking and cycling mode share (Policy 11). This has so far been achieved. Figure 2-26 below compares the mode shares for the base year of 2012 with the Reference Case (without the Scheme) in 2021. As can be seen, the majority of new trips in the east sub-region in 2021 are anticipated to be made by public transport. However, the growth in absolute numbers of trips is such that even with further growth in the public transport mode share, a relatively small increase in highway travel is inevitable. Nevertheless, the public transport mode share is expected to increase from its current level to around 59 per cent in 2021.

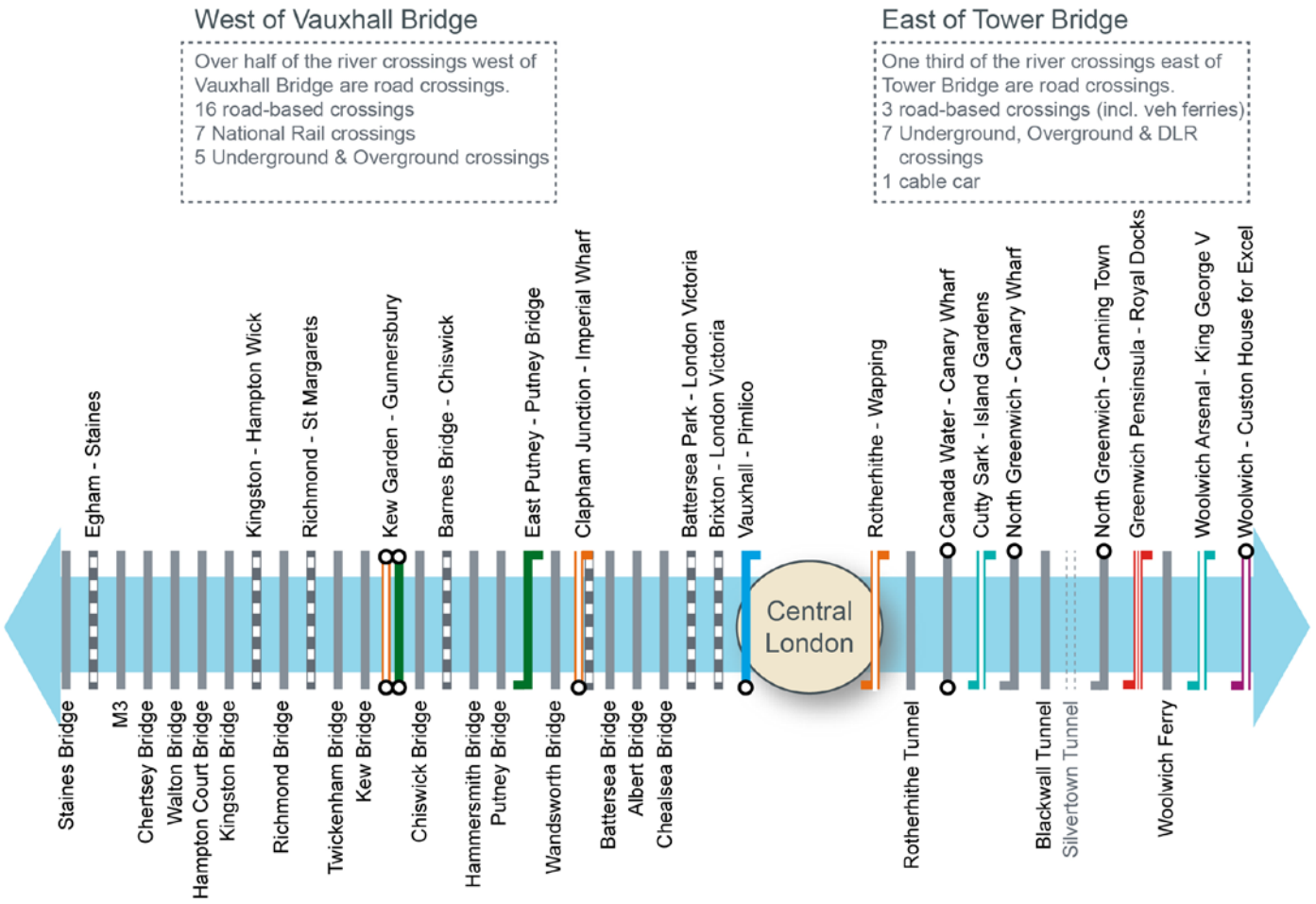
[45] TfL, East London Challenges and Opportunities (2010)

Figure 2-26: Total trips by mode in east and south-east sub-region, 2012 base year and 2021 Reference Case (24 hour period)



2.12.7 It is worth reiterating in this context the significant investment in rail-based cross-river transport which has characterised east London in the past twenty years. Public transport links constitute a much greater proportion (two-thirds) of all crossings in east London than is the case in west London (where they account for less than half of all cross-river links). This is shown in Figure 2-27.

Figure 2-27: River crossings mix and mode share



2.12.8 The forecast of significant employment and population growth in east London that has been described means that the need for this road crossing is even more pressing.

2.12.9 The Blackwall Tunnel passes under the River Thames in proximity to three of the most active Opportunity Areas in London: the Greenwich Peninsula and the Royal Docks (designated an Enterprise Zone in March 2011) between them have the potential to accommodate 13,000 new jobs and 24,500 new homes. The Isle of Dogs has the potential to accommodate 110,000 jobs and 10,000 new homes.

2.12.10 It is important, however, to recognise that the road traffic problems described here are causing economic and environmental problems today. The case for the Silvertown Tunnel scheme is not made exclusively in response to the need for accommodate forecast growth, though the adverse consequences of not acting on these problems will be much greater in the context of this growth. The problems of the Blackwall Tunnel could threaten the viability of the east and southeast sub-regions to develop as planned.

2.12.11 'Doing nothing', taking no action on the problems of the Blackwall Tunnel, is therefore not a realistic option. TfL has thoroughly assessed the potential interventions which could serve to solve the particular problems identified at this location. The following chapter describes these and shows why the proposed Scheme is the optimal solution. It is worth highlighting again that these are long-standing problems which, although they may seem now like part of the landscape, are not intractable and can be solved without adverse effects.

2.12.12 Plans for a new road crossing in the vicinity of the Blackwall Tunnel date back to at least the mid-1990s, and land was safeguarded for this purpose in 1995 and then again in 1997[46]. Much of the land around the safeguarded area is now high-density residential, and more development is forthcoming both on the Peninsula and at Royal Docks. Although the safeguarding[47] means that it is feasible now to build a tunnel, competing demands for space will make this more difficult in the future. Without timely action, the land

[46] Government Office for London: Safeguarding direction under articles 10 and 27 of the Town and Country Planning (General Development Procedure) Order Act 1995 relating to potential corridors for east Thames river crossings, transferred to the Mayor of London in 2001
[47] See 5.2

needed for the Tunnel at the north and south sides of the River Thames will be used for new buildings and the opportunity to construct the Silvertown Tunnel could be permanently lost.

3. STRATEGIC ASSESSMENT OF OPTIONS

3.1 Overview

3.1.1 This chapter describes how TfL assessed the diverse crossing needs in east London and developed proposals for the Silvertown Tunnel scheme within a broader River Crossings programme responding to these. It summarises the various options considered for road-based crossings, walking and cycling, and public transport.

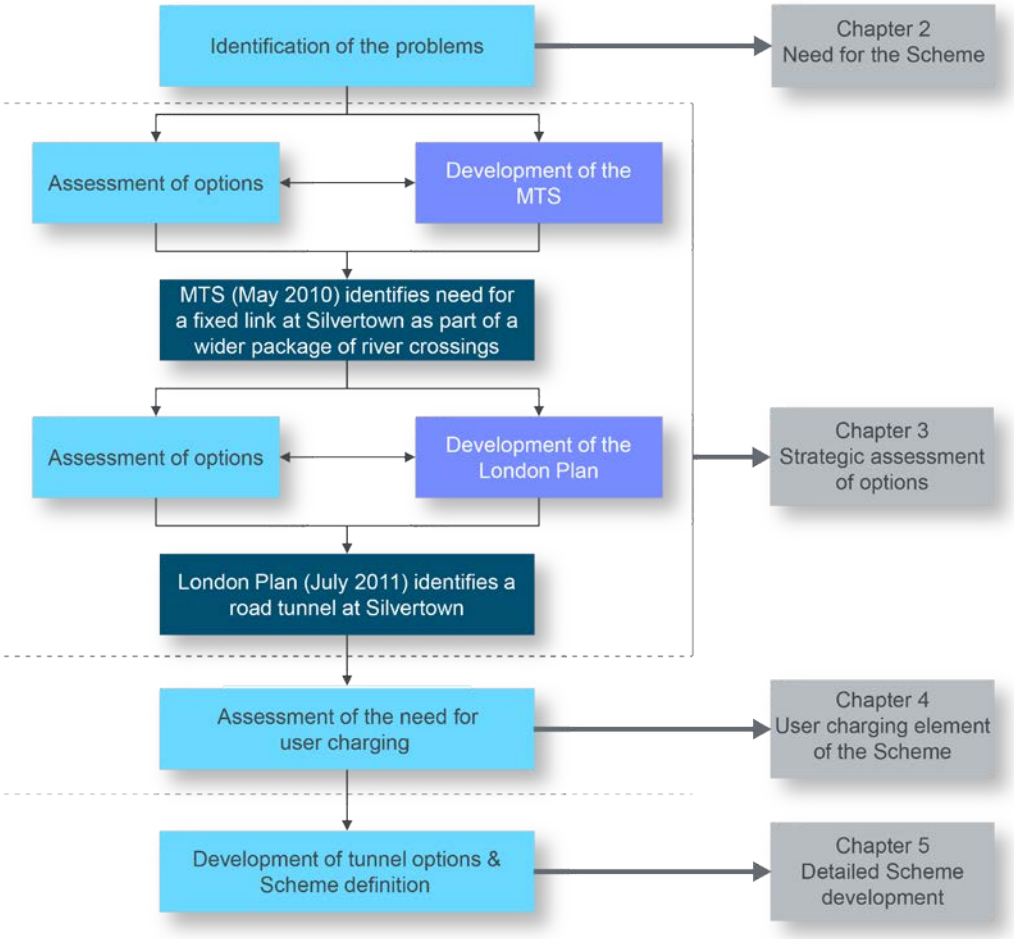
3.1.2 This chapter also explains how this work informed the Mayor's Transport Strategy, and how the further development of options followed this policy.

3.1.3 As well as providing a chronological account of this development, it sets out the findings of a 'back-check' of options, undertaken in preparation for statutory consultation and added to further for DCO submission. This is provided in a summary box at the end of each section in this chapter and is set out in more detail in Appendix A.

3.1.4 The evolution of objectives which shaped the direction of the River Crossings programme and Silvertown Tunnel scheme is also described.

3.1.5 Figure 3-1 gives an overview of the development of the Scheme together with the setting of relevant policy.

Figure 3-1: Optioneering process



3.2 Summary of option development process

Early work

Pre 2009

3.2.1 Feasibility assessments for an additional river crossing in the vicinity of the Blackwall Tunnel have been carried out since the early 1990s. In many instances, these assessments were linked to the development of the Thames Gateway Bridge and also included options such as a Blackwall Tunnel third bore and fixed link crossing at Charlton.

3.2.2 In 1995 and 1997 land for a cross-river link at Silvertown was safeguarded under a direction from the Secretary of State/Government Office for London. Following the establishment of the GLA and TfL in 2000 the safeguarding was transferred to the Mayor of London/TfL in 2001 to bring it within the

scope of the Mayor's planning functions under the Town and Country Planning (Mayor of London) Order 2000.

3.2.3 An early objective of the newly-formed TfL was to prepare a transport strategy on behalf of the Mayor, which was published in 2001. Informing the development of this first MTS was a TfL position paper on Thames Gateway River Crossings which referenced the need for three new crossings including:

- a rail crossing at Woolwich (implemented in form of the DLR);
- the Thames Gateway Bridge (progressed until discontinued by the Mayor in 2008); and
- a Silvertown Link in form of a bridge or tunnel crossing.

3.2.4 The first MTS identified (in section 4Q.28) the need for

'a road bridge or tunnel between Silvertown and North Greenwich'

as part of the above referenced package of three river crossings.

3.2.5 This is consistent with the first London Plan published in 2004 which supports new river crossings in Policy 3C.15 and cross-references the MTS policy on river crossings and the Silvertown Link.

3.2.6 Feasibility studies focusing on tunnel and bridge options were carried out during this time, though it is worth noting that correspondence from the Port of London Authority (PLA) in 2002 and 2006 states that only a tunnel (not a bridge) would be acceptable.

2009 onwards

3.2.7 In preparation for the production of his Transport Strategy and London Plan, the newly elected Mayor of London, Boris Johnson, directed TfL in 2009 to undertake a review of the need for river crossings in east London.

3.2.8 This review first considered how far existing crossings were adequate and what future needs might arise given the context of growth in east London, and in light of the Mayor's decision not to proceed with the previously promoted Thames Gateway Bridge scheme. The work undertaken was

summarised in an update to the TfL Planning and Corporate Panel[48] in July 2009[49].

3.2.9 The Panel Update set out eight objectives:

- to improve the efficiency of the highway network in the London Thames Gateway, especially at river crossings, and provide greater resilience for all transport users;
- to provide improved connections for local traffic and to discourage potential use of new crossing(s) by longer distance traffic that should be using national routes such as the M25;
- to support the needs of existing businesses in the area and to encourage new business investment in London through reduced and more reliable journey times, and better access to markets and the labour market;
- to support the provision of and access to public transport services in the London Thames Gateway and, in particular, to improve access to new rail links being provided in the area and provide opportunities for more orbital public transport journeys;
- to promote walking and cycling by providing improved links across the Thames;
- to integrate with and support local and strategic land use policies including existing and future developments and to help improve the quality of the built environment in east London;
- to ensure that any proposals are acceptable in principle to key stakeholders, including affected Boroughs; and
- to identify options that are capable of being delivered, achieve value for money for TfL and the wider GLA (reinforcing existing and planned investment in the area e.g. Crossrail, DLR extensions and site remediation and environmental upgrades).

[48] The Panel was responsible for providing the Commissioner with advice and assistance in relation to TfL's strategic objectives. The full terms of reference can be accessed here: http://content.tfl.gov.uk/10-Membership-Board-Committees-and-Panels.pdf
[49] TfL,2009, Planning and Corporate Panel: Update on East London River Crossings review

3.2.10 The Panel Update grouped options for addressing the objectives into three categories:

i. options for improving local access for pedestrians and cyclists at North Greenwich/Isle of Dogs;

ii. options for providing congestion relief around the Blackwall Tunnel and road network resilience; and

iii. options to improve accessibility and route choice where no fixed highway links exist.

3.2.11 In relation to the second category, which relates most directly to the Scheme that TfL is now promoting, the Panel Update included options for a highway bridge or tunnel at Silvertown (which was recommended for further investigation), together with a third bore of the Blackwall Tunnel, and a possible highway tunnel under the Thames at Charlton.

3.2.12 It concluded that there would be significant technical challenges in constructing a third bore of the Blackwall Tunnel as there is insufficient space to allow tie-in to the road network while meeting current standards for tunnel gradient and visibility. It was hence not recommended as an option for further work.

3.2.13 Regarding a new tunnel at Charlton it was concluded that the proximity to the Thames Barrier would present a major risk and that there would be substantial property impact, both to planned development on the northern bank and existing employment sites on the southern banks. It was hence also not recommended for further work.

3.2.14 These conclusions were subsequently endorsed by the Mayor together with a decision to continue developing the option of a bridge or tunnel at Silvertown as a long-term solution to provide relief to the Blackwall Tunnel and support business and regeneration.

3.2.15 The Panel Update also highlighted the potential benefits of managing demand for the Blackwall Tunnel and a new crossing at Silvertown through user charges and maximisation of public transport use, and noted the potential role of user charges in helping fund the crossings.

Development of the Mayor's Transport Strategy

3.2.16 All of the above work informed the development of the second MTS. The consultation draft MTS was published on 12 October 2009 and was subject

to public consultation until 12 January 2010, and prior to that underwent consultation with the London Assembly and Functional Bodies of the GLA.

3.2.17 Two proposals in the draft MTS are relevant to the Silvertown Tunnel scheme: Proposal 39 on river crossings and Proposal 130 on managing demand for travel. These were as follows in the draft version of the MTS

Proposal 39

The Mayor, through TfL, and working with the London boroughs and other stakeholders, will take forward a package of river crossings in east London, including:

a) a new fixed link at Silvertown, to provide congestion relief to the Blackwall Tunnel and provide local links for vehicle traffic

b) an upgraded Woolwich ferry and consideration of a new vehicle ferry at Gallions Reach to improve connectivity

c) local links to improve connections for pedestrians and cyclists;

d) consideration of a longer term fixed link at Gallions Reach to improve connectivity for local traffic, buses, cyclists and to support economic development in this area

e) new rail links including High Speed One domestic services, Crossrail and the DLR extension to Woolwich, reducing road demand, and so road congestion at river crossings, where possible

f) support for Government proposals to reduce congestion at Dartford

Proposal 130

The Mayor, through TfL, and working with the London boroughs and other stakeholders, if other measures are deemed insufficient to meet the strategy's goals, may consider managing the demand for travel through pricing incentives (such as parking charges or road user charging schemes). This would depend upon there being a reasonable balance between the objectives of any scheme and its costs and other impacts. Any scheme would need to take account of local conditions, as well as the impact on surrounding regions, and to be fair and flexible relating charges to the external costs of travel with sensitivity to time of day, and with scope for discounts or exemptions for specific user groups. The Mayor will also consider imposing charges or tolls to support specific infrastructure improvements, such as river crossings.

3.2.18 TfL's analysis of consultation responses and its recommendations to the Mayor with regard to any changes to the Proposals, Policies or the surrounding text are set out in its Report to the Mayor[50]. Proposal 39 was modified slightly (in part e) as a result of the consultation. The final version is shown below.

Proposal 39

The Mayor, through TfL, and working with the London boroughs and other stakeholders, will take forward a package of river crossings in east London, including:

a) a new fixed link at Silvertown, to provide congestion relief to the Blackwall Tunnel and provide local links for vehicle traffic

b) an upgraded Woolwich ferry and consideration of a new vehicle ferry at Gallions Reach to improve connectivity

c) local links to improve connections for pedestrians and cyclists;

d) consideration of a longer term fixed link at Gallions Reach to improve connectivity for local traffic, buses, cyclists and to support economic development in this area

e) The encouragement of modal shift from private cars to public transport using new rail links including High Speed One domestic services, Crossrail and the DLR extension to Woolwich, reducing road demand, and so road congestion at river crossings, where possible

f) support for Government proposals to reduce congestion at Dartford

3.2.19 Changes were also made to the surrounding text. The text at paragraph 392 was modified to include 'new and enhanced passenger/cycle ferries, new fixed links, or innovative solutions such as cable cars' and a new paragraph (393) was added which set out a commitment to encourage switch from cars to public transport, walking and cycling on cross-river links and to reduce freight traffic in peak hours. Paragraph 397 was added stating that there are a range of funding options for the Schemes including tolling, which could both pay for the Scheme and manage demand. As can be seen, this text is

[50] https://www.london.gov.uk/priorities/transport/publications/mayors-transport-strategy

reflected in the current proposal in which user charging is an intrinsic element.

3.2.20 Proposal 130 did not change as a result of consultation.

3.2.21 A fixed link at Silvertown (and the wider River Crossings Programme) are therefore enshrined in the MTS as approved by the Mayor in May 2010 and described in Proposal 39. Proposal 130 also provides that the Mayor will consider imposing user charges to support specific infrastructure improvements such as river crossings. These two proposals form the transport policy basis for the further development of the Silvertown Tunnel with a user charge.

3.2.22 The MTS also confirmed that despite substantial investment in the many public transport, walking and cycling schemes it contained, and the resulting forecast for a significant reduction in private highway mode share (from 43 per cent to 37 per cent) by 2031, absolute levels of traffic and congestion in London were likely to grow as a result of very significant population and employment growth.

Development of the London Plan

3.2.23 The draft London Plan was published alongside the MTS in October 2009. Because there were different legal procedures leading to its adoption – including an independent examination – its development followed a longer timeframe and the Plan was adopted in July 2011. This meant that the adopted Plan reflected TfL's further work with regard to the preferable form of Silvertown crossing which had been identified broadly as a 'fixed link' in the MTS.

3.2.24 The 2009 consultation draft London Plan contained the following:

Policy 6.4 | Enhancing London's transport connectivity

B The Mayor will work with strategic partners to improve the public transport system in London, including cross-London and orbital rail links to support future development and regeneration priority areas, and increase public transport capacity by:

[…]

k) Providing new river crossings[51]

3.2.25 Following the consultation, Early Draft Changes (EDC)[52] to the London Plan were published in May 2010. These included additional text at Paragraph 6.37 concerning the Mayor's wish to investigate the provision of additional road-based river crossings in east London (Policy 6.4 remained unchanged). Later in 2010, an Examination in Public (EiP) was held.

3.2.26 In parallel, Mott MacDonald carried out a sustainability appraisal[53] of a range of river crossings options, including tunnel and bridge options at Silvertown. The study concludes a tunnel to be a more favourable option compared to a bridge in terms of sustainability impacts.

The greatest issue of the bridge is the generated noise from traffic crossing the river as the ramp and bridge will pass existing residential housing in close proximity. The negative effect created by the traffic noise is also likely to have an impact on the planned future residential development proposed as part of the Greenwich Peninsula Masterplan.

3.2.27 Following the EiP, Further Suggested Changes (FSC) to the London Plan were published in October 2010. At this point the policy with regard to river crossings changed from being a link to a tunnel, as shown in the extract from Para 6.18B below (relevant line in bold).

Para 6.18B

The Mayor is developing proposals for further new and enhanced river crossings in east London to improve accessibility and the resilience of local transport networks, support economic growth in the area and link local communities (see also paragraph 6.37). These will complement the Jubilee Line crossings, DLR Lewisham and Woolwich extensions, the re-opened crossing of the extended East London Line and the further cross-river public transport capacity provided by Crossrail and will include:

- *a new cable car-based crossing linking Greenwich Peninsula with the Royal Docks;*

[51] The preceding clauses are a list of public transport (particularly rail) improvements, including Crossrail, the Tube upgrades and DLR and Tramlink enhancements.
[52] www.london.gov.uk/sites/default/files/archives/mayor-planning-london-plan-review-docs-early-suggested-changes-schedule-may2010.pdf
[53] Mott MacDonald, 2009, New Thames River Crossing, Work Package 3 – Sustainability Appraisal

- *a new **road-based tunnel crossing** between the Greenwich Peninsula and Silvertown (see paragraph 6.37);*
- *consideration of ferry-based options east of a crossing at Silvertown; and*
- *consideration over the longer term of a fixed link at Gallions Reach*

These will help ensure a range of pedestrian, cycle and road-based Thames crossings.

3.2.28 In December 2010 a final version of the draft Replacement London Plan was published, incorporating all the changes put forward before and during the EiP (the Consolidated Draft Replacement Plan)[54]. This included Policy 6.4 and the Paragraph 6.18B, both of which make clear the commitment to a road tunnel at Silvertown. The final stage in the approval of the Plan came in March 2011 with the publication of the Panel Report[55], which endorsed the policies for river crossings.

Further development of the River Crossings programme

3.2.29 Following the publication of the London Plan, TfL continued to enhance its understanding of the use and problems of east London's river crossings, and the possible ways of addressing these.

3.2.30 This included revisiting options which it had considered previously to give further confidence that the appropriate options had been identified, and addressing comments raised through consultation and discussion with stakeholders by setting out detailed consideration of a range of alternative options. A further consideration was the new Emirates Air Line cable car, which was implemented in June 2012, and rendered the construction of a high level fixed bridge using the safeguarded land at Silvertown unfeasible.

3.2.31 TfL summarised this work in two reports published to support a non-statutory consultation on east London river crossings which began in October 2012:

[54] www.london.gov.uk/priorities/planning/london-plan/the-london-plan-july-2011-archive
[55] www.london.gov.uk/sites/default/files/Panel-report-Vol-1.pdf. See particularly paras 6.14-15 and 6.21

- East London River Crossings: Assessment of Options[56]; and
- East London River Crossings: Assessment of Need[57].

3.2.32 These reports set out TfL's process for determining its preferred solutions, including the objectives used and the options considered.

3.2.33 The 2012 Assessment of Need provided a refined interpretation of the transport problems at the Blackwall Tunnel, highlighting two specific issues:

- the imbalance between highway network capacity and demand around the Blackwall Tunnel, which results in significant congestion; and
- the unreliability of the Blackwall Tunnel, and the limited ability of the surrounding road network to cope with incidents when they occur.

3.2.34 The 2012 Assessment of Options considered the following options:

- do nothing;
- congestion charging at the Blackwall Tunnel;
- public transport;
- Silvertown vehicle ferry;
- Woolwich vehicle ferry;
- Gallions Reach vehicle ferry;
- third bore at Blackwall Tunnel;
- Silvertown lifting bridge;
- Silvertown bored tunnel;
- Silvertown immersed tube tunnel;
- Woolwich bridge;

[56] TfL, 2012, East London River Crossings Assessment of Options
[57] TfL, 2012, East London River Crossings Assessment of Needs

- Woolwich tunnel;
- Gallions Reach local bridge; and
- Gallions Reach local tunnel.

3.2.35 A back-check of these options is included in Appendix A.

3.2.36 The work considered options in two ways. The first approach was to assess the options against a set of specific programme objectives, which were an evolution of those which had been set in 2009:

- to improve the efficiency of the highway network in the London Thames Gateway, especially at river crossings, and provide greater resilience for all transport users;
- to support the needs of existing businesses in the area and to encourage new business investment;
- to support the provision of public transport services in the London Thames Gateway;
- to integrate with local and strategic land use policies;
- to minimise any adverse impacts of any proposals on health, safety and the environment;
- to ensure where possible that any proposals are acceptable in principle to key stakeholders, including affected boroughs; and
- to achieve value for money.

3.2.37 The second approach used in the 2012 Assessment of Options was to apply TfL's Strategic Assessment Framework (SAF), a standard assessment, which produced a qualitative assessment of how the options performed against the challenges and outcomes set out in the MTS.

3.2.38 This Assessment of Options concluded that addressing the various problems of a long section of the Thames in east and south-east London would require a package of measures rather than a single solution. It recommended that TfL should take forward a number of options in the River Crossings programme:

- bored tunnel at Silvertown;
- user charging at the Blackwall Tunnel;

- new vehicle ferry at Gallions Reach;
- a new vehicle Ferry at Woolwich; and
- a new local road bridge or tunnel at Gallions Reach (in conjunction with Silvertown).

3.2.39 The package of measures which most closely met the Mayor's policies and the SAF investment criteria comprised the Silvertown Tunnel, a ferry at Gallions Reach and user charging at the Blackwall Tunnel (in combination with the new infrastructure).

3.2.40 Accordingly, the October 2012 consultation put forward proposals for a new highway tunnel at Silvertown, together with user charges at both the Blackwall Tunnel and Silvertown Tunnel, alongside the options for Gallions Reach. Publishing the options assessment as part of the consultation materials gave stakeholders and the public an opportunity to comment on TfL's refreshed assessment of the needs and options for new river crossings, including the Silvertown Tunnel.

Development of the Silvertown Tunnel as a standalone scheme

3.2.41 The October 2012 consultation found strong support for the Silvertown Tunnel scheme, and TfL began to develop it as a standalone project, while continuing to develop other components of the programme separately.

3.2.42 Work has continued on these separate components, in parallel with the Silvertown Tunnel. Options which continue to be assessed under the River Crossings programme – but outside the scope of the Silvertown Tunnel scheme – include bridge, tunnel and ferry options at a number of locations along the Thames, such as at Gallions Reach and Belvedere. These crossings would be multi-modal and could potentially incorporate fixed rail links; meanwhile others would be dedicated pedestrian and cycle crossings. A summary of the overall programme can be found in Connecting the Capital.[58]

[58] TfL, 2015, Connecting the Capital, Our plan for new river crossings for London http://content.tfl.gov.uk/connectingthecapital-newrivercrossingsforlondon-dec-2015.pdf

3.2.43 TfL set out the resulting work in a further – Silvertown-specific – Needs and Options report which it published for consideration during the 2014 consultation on the Scheme[59] .

3.2.44 This 2014 Silvertown Needs and Options report restated TfL's assessment of the need for the intervention, and summarised TfL's assessment of the following specific options:

- do nothing;
- congestion charging at the Blackwall Tunnel;
- DLR extension to Falconwood;
- Silvertown vehicle ferry;
- third bore at Blackwall Tunnel;
- Silvertown lifting bridge;
- Silvertown bored tunnel; and
- Silvertown immersed tube tunnel

3.2.45 The 2014 report assessed options against newly-defined objectives[60] for the project itself, and in particular against the first three which were used to assess the different strategic options (the remaining objectives mirror the earlier programme-level objectives):

PO1: to improve the resilience of the river crossings in the highway network in east and southeast London to cope with planned and unplanned events and incidents;

PO2: to improve the road network performance of the Blackwall Tunnel and its approach roads;

PO3: to support growth in east and south-east London by providing improved cross-river transport links for business and services (including public transport);

[59] Jacobs, 2014,Silvertown Crossing Assessment of Needs and Options
[60] The final set of Project Objectives (which differs slightly) is given at the end of this chapter

PO4: to integrate with local and strategic land use policies;

PO5: to minimise any adverse impacts of any proposals on health, safety and the environment;

PO6: to ensure where possible that any proposals are acceptable in principle to key stakeholders, including affected boroughs; and

PO7: to achieve value for money.

3.2.46 Publishing this report enabled TfL to summarise the work already undertaken and to invite further comment. The report concluded that the existing river crossings in east London are inadequate to cater for current and forecast future demand for cross-river road traffic movement; they are operating at or over capacity and there are severe resilience problems, particularly at the Blackwall Tunnel. While public transport, walking and cycling are important schemes in their own right, they do not address the congestion and resilience problems at the Blackwall Tunnel.

3.2.47 Again, the consultation found considerable support for the proposed Silvertown Tunnel scheme. Overall support for a new river crossing at Silvertown was high, with 83% of respondents (3,608) individuals agreeing that a new crossing is needed and could address the issues of congestion and future population growth.

3.2.48 There were also a variety of comments on the process by which TfL identified its preferred solution. In order to address these comments and concerns TfL presented a further back-check of options (including those that were previously assessed and additional options identified by respondents to various consultations) in the Preliminary Case for the Scheme[61] published as part of the 2015 statutory consultation on the Silvertown Tunnel. To complete this back-check, TfL assessed the options against the project objectives as they now stand:

PO1: To improve the resilience of the river crossings in the highway network in east and southeast London to cope with planned and unplanned events and incidents;

[61] TfL, 2015, Silvertown Tunnel Preliminary Case for the Scheme

PO2: To improve the road network performance of the Blackwall Tunnel and its approach roads;

PO3: To support economic and population growth, in particular in east and southeast London by providing improved cross-river transport links;

PO4: To integrate with local and strategic land use policies;

PO5: To minimise any adverse impacts of any proposals on communities, health, safety and the environment;

PO6: To ensure where possible that any proposals are acceptable in principle to key stakeholders, including affected boroughs; and

PO7: To achieve value for money and, through road user charging, to manage congestion.

3.2.49 In completing this back-check, TfL has put particular emphasis on the three core transport problems of the Blackwall Tunnel which were described in Chapter 2: congestion, closures and incidents, and a lack of resilience. An updated narrative summary of the back-check is presented in a box at the end of each section below, and is presented in full in Appendix A.

3.2.50 The following section sets out in more detail TfL's assessment of the options considered over the course of the process described above, including the updated back-check. Where relevant, it also includes information from technical studies considering the feasibility and benefits of specific options in detail. Additional information on public transport alternatives and alternative locations further east has now been included in response to further comments made in the 2015 statutory consultation.

3.3 Summary of options considered and findings

Road-based crossing options

3.3.1 Over the course of the development of the Silvertown Tunnel scheme within the River Crossings programme, TfL assessed a variety of different highway crossing options as potential solutions to the problems at the Blackwall Tunnel.

3.3.2 Options highlighted in the update to the TfL Planning and Corporate Panel in July 2009 were a third bore of the Blackwall Tunnel, a road bridge or a road tunnel at Silvertown, and a road tunnel at Charlton.

3.3.3 The update recommended against the option of a third bore of the Blackwall Tunnel on the basis that it was unfeasible without major impacts on existing development and extensive civil engineering. The road tunnel at Charlton was not recommended given likely significant property impacts and feasibility risks due to proximity to the Thames Barrier (see Section 3.2.13). The 2009 Update recommended the option of a bridge or tunnel at Silvertown for further work on the basis that it could directly address the Blackwall Tunnel's congestion and resilience issues and appeared technically feasible.

3.3.4 Following the publication of the MTS and London Plan, TfL investigated the option of a bridge or tunnel at Silvertown further, examining a variety of options for implementing it (bored tunnel, lifting bridge, and immersed tube tunnel). The introduction in June 2012 of the Emirates Air Line cable car had rendered a high-level bridge in this location unfeasible. Findings were summarised in the 2012 options assessment report. This concluded that the bored tunnel should be developed further, while it did not recommend the immersed tube tunnel option due to environmental, land, and cost impacts, or a lifting bridge which would directly conflict with the local Masterplan and fail to provide the needed resilience.

3.3.5 As noted above, the 2012 options assessment also considered a variety of other schemes, including some which had been considered previously and discounted. It assessed the potential of ferries, bridges and tunnels at alternative locations, and the possibility of a third bore of the Blackwall Tunnel, as well as of bridges and tunnels at alternative locations.

3.3.6 The report found that ferries at Silvertown, Woolwich or Gallions Reach would do little to address the problems at the Blackwall Tunnel due to their low capacities.

3.3.7 The report also found that bridges and tunnels at alternative locations (Woolwich, Gallions Reach) could offer only slight to moderate benefits for the problems at the Blackwall Tunnel. In light of this modest performance, the options of a bridge or tunnel at Woolwich were not recommended for further work on the basis of severe local impacts (for the bridge) and very significant costs (for the tunnel). The option of a bridge or tunnel at Gallions Reach was recommended for further work on the basis of its general connectivity benefits – though the report highlighted the greater potential of a crossing at Silvertown to address the acute issues at the Blackwall Tunnel.

3.3.8 The option of a third bore at the Blackwall Tunnel was not recommended on engineering feasibility grounds (see Section 3.2.12).

3.3.9 Subsequent to this, the 2014 Assessment of Options report produced for consultation on the Silvertown Tunnel scheme considered the following highway based options, once again including some which had previously been recommended for rejection but which had subsequently been raised through consultation and discussion with stakeholders:

- vehicle ferry at Silvertown;
- third bore at the Blackwall Tunnel;
- lifting bridge at Silvertown;
- immersed tube tunnel at Silvertown; and
- bored tunnel at Silvertown.

3.3.10 The 2014 assessment set aside a number of options which had been considered in the 2012 assessment, those which were geographically remote from the Blackwall Tunnel, on the basis that these were not directly related to meeting the strategic highway objectives at the Blackwall Tunnel.

3.3.11 The 2014 report assessed the Silvertown vehicle ferry option as performing negatively with regard to resilience and growth, with a slight positive effect on road network performance, and it was not recommended.

3.3.12 Echoing previous reports, the 2014 report did not recommend the option of a third bore at the Blackwall Tunnel on the basis that it could only partially address congestion and resilience problems, would be very difficult to manage, and was of uncertain feasibility due to development of tall buildings on piled foundations in the vicinity.

3.3.13 The 2014 report did not recommend the option of a lifting bridge on the basis that while it could partially address congestion and resilience problems, it would introduce its own resilience issues with regular closures for passing shipping, thus undermining its effectiveness. The report also noted that any lifting bridge would have a considerable physical and visual impact on surrounding urban areas, would not be compatible with the London Plan's vision for the Peninsula, and would be contrary to local planning policy. With a high-level bridge already confirmed as being unsuitable in this location, this confirmed that no bridge option would offer an appropriate solution.

3.3.14 In relation to tunnel options, the 2014 report assessed both an immersed tube tunnel at Silvertown and the option of a bored tunnel. It found that both would be capable of effectively addressing the objectives of the project. It

also noted that the extent of congestion relief would depend on the introduction of user charges as the approach roads could not cope with both tunnels operating at capacity. The assessment flagged that of the two, the immersed tube tunnel was likely to have more problematic impacts on the local urban area and river environment.

3.3.15 More detail on the selection of the preferred form of the Silvertown Tunnel is given in Chapter 5.

BACK-CHECK of road-based options (see Appendix A)

A full back-check assessment of road-based options is included in Appendix A. The outcome of the assessment for key options is also summarised here.

Do nothing

The Blackwall Tunnel has a singular strategic function in the east London highway network but it is capacity constrained, outdated in design which limits certain movements and there is a lack of proximate alternative crossings to provide resilience. This combined with the growth forecast for this part of London, means that at the Blackwall Tunnel, demand relative to capacity will increase significantly at peak times. The resultant levels of delay and congestion on the approaches to the Blackwall Tunnel would be significantly higher than current levels. Furthermore, the design limitations of the existing tunnel and the level of congestion on its approaches at peak times means that it is highly uneconomic and unreliable to provide the step change in public transport connectivity across the river at this point by bus. The 'Do nothing' option is hence not a feasible alternative. These points are supported by transport model tests which are described in greater detail in Chapter 5 of the Transport Assessment.

Locations further east

This back-check review further confirms that options located some distance to the east of the Blackwall Tunnel (namely at Charlton, Woolwich, Gallions Reach and Belvedere) would not – by virtue of their location – be able to fully satisfy the objectives of reducing congestion and closures at the Blackwall Tunnel and providing resilience to mitigate closures.

Day-to-day conditions

As set out in Chapter 2, there is significant demand to cross the river in the vicinity of the existing Blackwall Tunnel owing to its connections to strategic

roads – this is likely to remain the case. In light of the patterns of origins and destinations of existing Blackwall Tunnel users, the more easterly crossing options would be poor substitutes for many journeys which currently use the Blackwall Tunnel. An additional problem is that, unlike the Blackwall Tunnel, there is no connection to the Strategic Road network at these other locations, making them more difficult to access and therefore likely not to be able to achieve a significant reduction in traffic or congestion at the Blackwall Tunnel.

TfL has assessed a number of additional scenarios using its transport models following the statutory consultation to test these points. These indicated that implementing fixed link crossings at Gallions Reach and Belvedere would, as expected, lead to only a modest reduction in traffic flow at the Blackwall Tunnel during the off-peak periods as well as a small reduction of demand throughout the day. The reductions forecast are too small to have a material impact on delay which would remain at around 10 to 17 minutes during the peak periods and directions (compared to 13 to 22 minutes delay in the reference case i.e. the 'do nothing' scenario).

As would be expected, the models suggest that introducing a charge at the Blackwall Tunnel in addition to implementing crossings at Gallions Reach and Belvedere would reduce delays at the existing crossing to around 2.5 to 5.5 minutes. This reduction in delay is hence largely derived as a result of the user charge at the Blackwall Tunnel rather than the introduction of the new crossings. This is supported by the tests of implementing a user charge at the Blackwall Tunnel only without introducing additional infrastructure. Furthermore, in this scenario substantial volumes of displaced traffic are expected to impact local roads and parts of the strategic route network, (an impact which is not seen to the same extent with the Silvertown Tunnel scheme or indeed with these schemes in combination with the Silvertown Tunnel scheme). If the impact of just one of these new crossings (i.e. if only Gallions Reach were in place but not Belvedere or vice versa) on Blackwall was considered, the delay relief would be somewhat less that what has been described above.

Frequency of Blackwall closures

As the impact on congestion is limited, and the diversion routes are long, crossings further east are unlikely to have a material effect on the number of incidents. Vehicles, including larger vehicles would continue to seek to cross the River at the Blackwall Tunnel if the diversion route is long and onerous. Some of these diversion routes are unsuited to heavy goods vehicles. It is

desired that traffic from Kent to east London would remain on the strategic corridor and not divert via residential areas or town centres. It would thus continue to be signposted the Blackwall Tunnel from the A2.

Impact of Blackwall Tunnel closures

When Blackwall Tunnel closures do occur, strategic traffic would have to divert through the urban/suburban areas of south east London to access a crossing further east if that is the only alternative to the M25 or central London. This would have the effect of frequent and severe congestion across many areas if high volumes of traffic are attempting to use suburban roads to get to Thamesmead from the A2/A102.

Summary

The modelling undertaken supports the view that crossings at Gallions Reach and Belvedere (including in combination with implementing user charges at the Blackwall Tunnel) could not fully address the problems of congestion at the Blackwall Tunnel and, they are clearly of limited benefit in relation to closures and resilience. Full details of this analysis are included in Traffic Forecasting Report – Sensitivity Testing (Document Reference 7.9). These 'east of Silvertown' crossings have different objectives to the Silvertown Tunnel and are worthwhile crossings in their own right, supporting London's growth and helping drive London's economy by providing better connections across the Thames in this part of the Capital. The crossings would deliver significant increases in access to both economically active people and access to jobs in the AM peak hour (both over 400,000) across large parts of RB Greenwich, LB Tower Hamlets, LB Hackney and LB Enfield, while the majority of LB Bexley, LB Newham, LB Barking and Dagenham, LB Waltham Forest, LB Redbridge and LB Havering, would see similarly large increases. This increase in north-south access would help support growth across large areas of east and south east London.

<u>Vehicle ferries</u>

The back-check also confirms that vehicle ferries cannot offer an effective solution to the problems at the Blackwall Tunnel. Their limited capacity and slow journey times mean they would not attract enough traffic to meaningfully address the congestion problems (even in conjunction with demand management measures). The same characteristics render them incapable of providing effective resilience, because they could not accommodate the significant demand resulting from incidents or closures of the Blackwall Tunnel (and so would not address resilience). The Blackwall

Tunnel has a capacity for around 3,000 vehicles per hour in the peak direction, with a ferry (in a two-ferry configuration) only being able to accommodate around 200 vehicles per hour in normal conditions.

Fixed road-based crossings close to the Blackwall Tunnel

A new fixed highway connection close to the Blackwall Tunnel would deliver significant resilience, allowing even traffic which is on the final approach to reroute with minimal diversion in the event of closures. Built to modern standards and capable of accommodating overheight vehicles, it would directly reduce the frequency of closures of the Blackwall Tunnel.

Of the main options considered for a fixed crossing in this location (third bore of the Blackwall Tunnel, or a high level bridge, lifting bridge, or tunnel at Silvertown), a third bore of the Blackwall Tunnel would entail ongoing operational difficulty as it would need to be operated tidally[62], while a lifting bridge would be problematic in a similar way as it would need to open for shipping.

In contrast, the option of a tunnel or high level bridge at Silvertown could both address the congestion and resilience problems of the Blackwall Tunnel by providing capacity and connectivity close by. However, a high level bridge at Silvertown would be deeply incongruous with the development of the Greenwich Peninsula and Royal Docks and would conflict with relevant masterplan (it would also be unfeasible in the context of the Emirates Air Line in this location) – this means that a tunnel at Silvertown offers the best solution to address the issues of the Blackwall Tunnel in a way that complements and supports the vision for this rapidly growing site.

However, there is an important caveat for options which improve highway conditions. Implemented in isolation, there is a tendency for benefits to be eroded over time as drivers take advantage of reduced journey times and increased convenience i.e. generating induced traffic. This means that the eventual solution should also entail a means of managing traffic demand e.g. user charging.

[62] Tidal flow refers to a road where a lane or lanes can sometimes carry traffic in one direction and at other times in the opposite direction, to help with traffic flow.

Walking and cycling options

3.3.16 TfL explored the potential for walking and cycling-based solutions to address the identified needs for river crossings in east London in its 2009 studies, which considered pedestrian and cycle crossings at a number of different locations (from North Greenwich to Canary Wharf, from Rotherhithe to Canary Wharf, from North Greenwich to Silvertown and at Gallions Reach).

3.3.17 Although this work did not identify any potential for pedestrian and / or cycle improvements in themselves to address the specific problems of the Blackwall Tunnel, TfL considered the possibility of incorporating provision for pedestrians and cyclists in its detailed consideration of highway options with greater potential to address the problems of the Blackwall Tunnel.

3.3.18 The option of including provision for pedestrians and cyclists in the context of a highway bridge crossing appeared to have potential merit, but the bridge option was subsequently rejected (as set out above).

3.3.19 Meanwhile TfL noted from an early stage that although it might be feasible to incorporate provision for pedestrians and cyclists within a tunnel crossing, it would be of questionable benefit because of the poor and potentially intimidating ambience of a 1.4km tunnel exposed to high levels of road noise (the Panel Update of 2009 referred to the likelihood that a tunnel would be less attractive than a bridge to pedestrians and cyclists). This was strengthened in further examination of the option in 2010[63], which pointed out in addition that lengthy pedestrian tunnels had the potential for significant safety risks, and that permanent staffing might therefore be required.

3.3.20 The 2009 studies did highlight the potential to promote walking and cycling by providing improved links across the Thames, and accordingly, MTS Proposal 39 included reference to 'local links to improve connections for pedestrians and cyclists'. This provided the policy support for the Emirates Air Line cable car which subsequently opened in summer 2012, following a public consultation on the scheme in 2010 where 87 per cent of respondents agreed that "it would provide a great way to get across the River Thames"[64].

[63] Mott MacDonald, October 2010, Silvertown Tunnel Option – Addendum To Volume 1
[64] Accent for TfL, August 2010, Cable Car consultation analysis. The consultation ran from 5 July to 2 August 2010. Sum of 'strongly agree' (66 per cent) and 'agree' (21 per cent). Base: 1,065

3.3.21 The options assessments undertaken following the publication of the MTS did not identify any potential for walking and cycling options in and of themselves to address the problems of the Blackwall Tunnel, though TfL has continued to consider the possibility of incorporating provision for pedestrians and cyclists within the fabric of highway crossing options. More recent consideration of the issue has confirmed that issues of ambience, safety and security would be likely to greatly undermine the potential benefits of such a facility.

3.3.22 More broadly as part of the river crossings programme and following the support for this in the MTS, TfL has also continued to progress improvements for pedestrians and cyclists and is currently supporting Sustrans in developing a proposal for a Rotherhithe-Canary Wharf bridge for the use of pedestrians and cyclists.

BACK-CHECK of walking and cycling options (see Appendix A)

TfL's recent back-check against the project objectives confirms that walking and cycling measures in and of themselves would be highly unlikely to achieve the significant reduction in demand needed to address the congestion and closure problems of the Blackwall Tunnel. Furthermore a walk or cycle crossing could not offer a realistic alternative in case of incidents or closures and hence would not provide any additional resilience.

TfL has reconsidered the potential to include provision for pedestrians and cyclists within the structure of the Silvertown Tunnel itself. The length of the Tunnel means that a poor and potentially intimidating ambience is inevitable, and there is concern over safety and security implications. In the context of the existing Emirates Air Line which follows broadly the same alignment but ties more directly into the local centres of activity, it would likely prove unattractive to most potential users. Additionally, cost impacts would likely be very significant: in the region of £70m for one bore and £150m for both bores in additional cost.

It is considered that there are more cost-effective ways of improving connections for pedestrians and cyclists in this area. These include:

- EAL – Alongside the Scheme, TfL is proposing to produce a future EAL fares strategy document in consultation with local Boroughs, which would be published ahead of the opening of the Silvertown Tunnel. The objective of this strategy will be to set out fare options for the EAL. There are a number of possible options including discounts on existing fares or annual passes for regular users. This will be supported by further

analysis of the needs of EAL users and potential EAL users, with a view to bringing forward additional measures where appropriate to ensure the EAL is fulfilling its role as a local crossing. As the setting of fares for the Emirates Air Line is a Mayoral decision, the final decision will be made by the future Mayor. However, the EAL fares strategy will be used to inform that decision.

This is in addition to TfL's proposals for the Silvertown Tunnel scheme, which include improvements to pedestrian and cycle access across Tidal Basin roundabout at the northern portal, designed to improve access to the EAL from the west, and enhance the role of the EAL as a local crossing.

- North Greenwich to Canary Wharf Ferry – In addition to the existing North Greenwich pier, additional piers are currently proposed at Canary Wharf East which is due to be delivered by Spring 2017, and at North Greenwich West which is due to be delivered as part of the Greenwich Peninsula Masterplan. It is expected that that these piers will accommodate River Bus services, with an added potential to provide a dedicated cross-river ferry service for pedestrians and cyclists between Greenwich Peninsula (west) and Canary Wharf (east). We expect initial feasibility work on such a service to commence in mid-2016.
- Rotherhithe to Canary Wharf crossing – Initial work led by Sustrans has confirmed the feasibility of developing a new crossing in this location. TfL is therefore planning to undertake further engineering work and market engagement to seek industry experts' advice and input to this project and test what can be delivered using the most cost effective solutions. In recognition of the time it could take to bring forward plans for a new crossing, secure the funding and construct, TfL is also examining options for introducing a new ferry service in this location in the short term. This would help meet an immediate need and establish a link that could be replaced by a fixed crossing in due course.

Public transport options

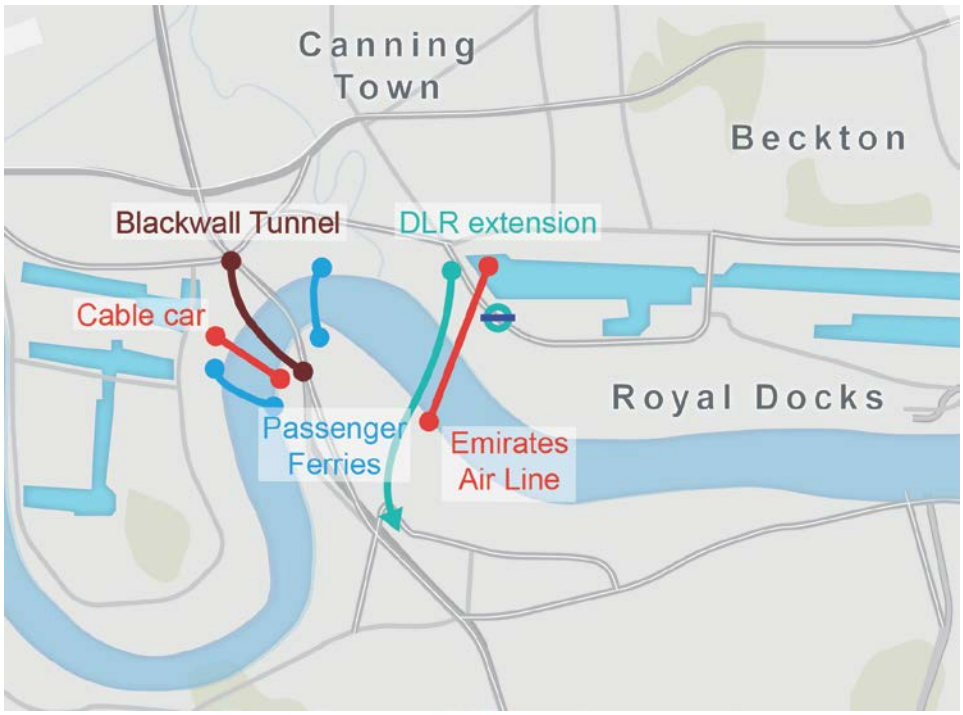
3.3.23 As outlined in Section 2.2.11 there has been a period of sustained investment in public transport capacity across the whole of east London over the past 20 years. This includes the opening of the following crossings as well as subsequent capacity upgrades on these lines:

- Jubilee Line Extension to Stratford;
- DLR to Lewisham;
- DLR to Woolwich;
- re-opening of the East London Line and its inclusion in the London Overground network;
- Emirates Air Line; and
- Crossrail (due to open in 2018).

3.3.24 Furthermore, in developing its work on River Crossings, TfL has assessed a variety of public transport options, in addition to the substantial package of public transport improvements put forward in the MTS.

3.3.25 Figure 3-2 shows the public transport river crossing options considered in the vicinity of the Blackwall Tunnel (TfL also considered the implementation of public transport crossings further east, at Gallions Reach and at Belvedere).

Figure 3-2: Public transport alternatives around the Blackwall Tunnel



3.3.26 The 2009 update to the Planning and Corporate Panel included considerations in relation to a cable car or a passenger ferry between North Greenwich and Canary Wharf, an upgrade of the ferry service between the

O2 and East India DLR station, a light rapid transit crossing at Gallions Reach, and a cable car, a passenger ferry, or a bus/pedestrian/cyclist bridge at Gallions Reach.

3.3.27 The Mayor endorsed the recommendations of the 2009 paper to continue work and investigation on the a number of passenger ferry services (North Greenwich to East India, Rotherhithe to Canary Wharf, North Greenwich to Canary Wharf) as well as demand management options which promote the DLR links between Woolwich and Stratford as short term measures.

3.3.28 TfL is actively pursuing these ferry options. In addition to the existing North Greenwich pier, additional piers are currently proposed at Canary Wharf East which is due to be delivered by Spring 2017, and at North Greenwich West which is due to be delivered as part of the Greenwich Peninsula Masterplan. It is expected that that these piers will accommodate River Bus services, with an added potential to provide a dedicated cross-river ferry service for pedestrians and cyclists between Greenwich Peninsula (west) and Canary Wharf (east). The initial feasibility work on such a service is expected to commence in mid-2016.

3.3.29 Plans also exist for new ferry service between Rotherhithe and Canary Wharf in the short term and for a dedicated pedestrian and cycle bridge in the long term. TfL is in the process of planning to undertake market engagement to seek industry experts' advice and input to this project and test what can be delivered using the most cost effective solutions.

3.3.30 While many of these options have merit, and indeed work on some is being progressed separately, the early work did not highlight potential for these options in and of themselves to meaningfully address the problems of the Blackwall Tunnel.

3.3.31 The 2012 Assessment of Options reported on TfL's further assessment of the potential to address the problems of the Blackwall Tunnel by implementing further new public transport infrastructure, targeting private car trips which have the greatest potential to switch to alternative modes of transport.

3.3.32 Before identifying specific options, the 2012 report noted that as a result of very substantial investment in recent years, a large proportion of the London-based car drivers currently using the Blackwall Tunnel already have good public transport access (the implication being that these users would be unlikely to be encouraged to use public transport by the provision of further infrastructure – for example because of the time or purpose of their travel).

3.3.33 It also discounted the option of providing additional capacity on existing fixed public transport lines on the basis that there was forecast to be available capacity on the relevant cross-river links in peak periods into the future. In addition, it discounted bus-only options on the basis that on their own these would not be able to generate a step change in driver behaviour of a scale necessary to address the problems at the Blackwall Tunnel. However it stated that enhanced bus services would be an important benefit enabled by the Silvertown Tunnel.

3.3.34 The 2012 report identified an extension of the DLR to Eltham as the only public transport scheme which in principle had the potential to lead to a significant shift away from the car to public transport. The concept of a DLR extension had been put forward by stakeholders and other consultation respondents.

3.3.35 The report assessed its potential to address congestion at the Blackwall Tunnel as neutral, based on the very diffuse pattern of origins and destinations of Blackwall Tunnel users, and analysis that indicated only 4% of existing tunnel users would be within its catchment (and of these even fewer would be capable of taking advantage of the new connection it offered).

3.3.36 The ability to address reliability and resilience issues was also assessed as neutral. In a transport context, the term reliability relates to the variability in a user's journey that they are unable to predict. The term resilience here describes the ability of transport networks to provide and maintain an acceptable level of service in the face of incidents and planned closures, and a lack of resilience can lead to and exacerbate a lack of reliability. The factors which negatively impact on the reliability and resilience of the existing cross-river highway network in east and south-east London can be summarised as follows:

- lack of alternative crossings and the distance between them;
- the capacity of existing crossings to meet demand; and
- the susceptibility of existing crossings to closure

3.3.37 It is considered that while a DLR crossing may provide an alternative for some trips, there would still be a substantial number of trips continuing to require the Blackwall Tunnel. Furthermore, it does not contribute to reducing the susceptibility of the Blackwall Tunnel to closures especially those related to overheight incidents.

3.3.38 Additionally, the 2012 report noted the significant feasibility issues with the connection at Canning Town, estimated high costs (in the region of £1bn), as well as the negative impacts on the capacity to support development in the Royal Docks because some services would need to be diverted.

3.3.39 TfL revisited this option in the Assessment of Needs and Options for the 2014 Silvertown Tunnel consultation, which again came to the conclusion that a DLR extension would be unable to materially address the problems of the Blackwall Tunnel. The report concluded that a DLR extension would have a minimal impact on the project objectives as it was dependent on current Blackwall Tunnel users living within the catchment of the proposed route to switch modes and a maximum of 5.6% of current Blackwall Tunnel users could be expected to switch to the new DLR route. A further problem identified for a DLR option was that it would require land which has been identified for other uses, including housing.

BACK-CHECK of public transport options (see Appendix A)

There has been a period of sustained investment in public transport capacity across the whole of east London over the past 20 years. Led by the regeneration of Docklands, six new rail crossings of the Thames in east London have been implemented, with a further crossing to come in the form of Crossrail. This investment will have led to almost a tenfold increase in the capacity of the cross river rail network east of Tower Bridge. TfL continues to develop opportunities for further public transport crossings in this part of London including public transport elements as part of the crossings at Gallions Reach and Belvedere. Furthermore, TfL is proposing an extension of the London Overground service from Barking to Barking Riverside. In addition a further extension across the Thames to Thamesmead and Abbey Wood has been identified worthy of future consideration. These projects are being progressed independently of the Silvertown Tunnel scheme rather than as an alternative, as it would not address the issues of congestion and road network resilience at the Blackwall Tunnel which the Silvertown Tunnel is seeking to address.

In developing this Case for the Scheme, TfL has again considered the potential for public transport connections to address the problems of the Blackwall Tunnel.

A key issue for public transport-based options is that they would offer almost no benefit for highway network resilience. In the event of closures of the Blackwall Tunnel, large numbers of vehicles already part-way through their journeys would still need to find alternative road-based routes across the

river as there would be no practical prospect of switching to alternative modes of transport instead. This would leave a critical objective of the Scheme and the river crossings programme unmet.

While there might appear to be potential to address the congestion at the Blackwall Tunnel through provision of alternative modes of transport, the recent history of substantial increases in public transport provision shows that in fact this has not succeeded in reducing highway trips through the Blackwall Tunnel (in fact, as set out in Chapter 2, despite large increases in the provision and use of public transport, the amount of traffic using the Blackwall Tunnel has generally increased steadily since 1986). It is also worth noting that without some additional form of demand management (most likely user charging) any reductions in traffic achieved might be rapidly offset as improved traffic conditions would tend to encourage car use.

In response to comments received in the statutory consultation TfL has carried out additional transport modelling to test these points. These model tests are based on the same assumptions as the Reference Case (including user charge levels, where applicable) and do not include the Silvertown Tunnel scheme or bus improvements facilitated by that scheme.

The test includes an extensive package of cross-river public transport improvements including a DLR extension from Canning Town to Falconwood, an Overground extension from Barking to Barking Riverside and Abbey Wood, a Greenwich Waterfront Transit scheme as well as several over rail-based extensions and enhancements[65]. TfL is investigating and developing plans for a number of these schemes in their own right, independently of the Silvertown Tunnel scheme.

The public transport package tested represents several billion pounds' worth of investment – far more extensive than the Silvertown Tunnel scheme. An active decision was made to test a comprehensive package of public transport schemes, rather than a single scheme, as this sets out a best-case scenario for public transport interventions to address the problems at the Blackwall Tunnel.

Despite the substantial provision of public transport infrastructure, which

[65] Further details on this model test are set out in Traffic Forecasting Report – Sensitivity Testing (Document Reference 7.9)

model outputs show would be well used including some sections where there would be standing passengers, results (for 2031) show no discernible drop in traffic flow at the Blackwall Tunnel. The northbound AM peak would see only a very small reduction in delay in this scenario. There would be no material change in delay during the other time periods and directions.

These results follow a similar pattern to that observed over recent years (described above), and further suggest that the scope to materially reduce congestion at the Blackwall Tunnel through investment in alternative public transport connections is likely to be limited.

TfL also modelled a scenario in which these cross-river public transport improvements were accompanied by a user charge, as per the Assessed Case, at the Blackwall Tunnel (and no Silvertown Tunnel). In this scenario, the model estimates that actual flow at the Blackwall Tunnel would fall by 10 per cent (northbound inter-peak) to 15 per cent (southbound AM peak and inter-peak). Demand for the crossing would also fall by 10 per cent to 20 per cent at different times of day. Consequently there would be greater delay savings compared to the situation without a user change at the Blackwall Tunnel, though a delay of around four minutes and 12 minutes would remain in the northbound AM peak and southbound PM peak respectively. This is also supported by the tests of implementing a user charge at the Blackwall Tunnel only without introducing additional infrastructure.

Comparing the results of this latter scenario to a model test of implementing a user charge at the Blackwall Tunnel without additional infrastructure (i.e. no Silvertown Tunnel and no cross-river public transport improvements) shows that the modelled fall in flow, demand and delay is largely the result of the user charge at the Blackwall Tunnel rather than the introduction of cross-river public transport.

The results for these tests are set out in greater detail in the Traffic Forecasting Report – Sensitivity Testing (Document Reference 7.9).

It can therefore be concluded that public transport alternatives would not solve the problem of congestion at the Blackwall Tunnel, and as noted above would not address the issue of resilience.

However, there is clearly merit in ensuring that there are good public transport options available for as many journeys as possible. Due to the comparative ease of implementation and route flexibility buses are the ideal public transport solution to meet rapidly emerging demand and to provide orbital connections between south-east and east London. A successful

cross-river bus network relies on an efficient and resilient cross-river road network in order to provide fast and reliable journey times and to be attractive to (potential) customers. The problems of congestion, closures and resilience at the Blackwall Tunnel therefore need to be addressed first, in order to be able to run an efficient bus network at this location.

Locking in the benefits – user charging and other options

3.3.40 Consideration of the role of road user charges to manage demand and address the problems of the Blackwall Tunnel has been central to TfL's assessment of options from the earliest stages of TfL's work on river crossings.

3.3.41 The 2009 Planning and Corporate Panel update identified user charging as a potential complement to a highway-based solution, where it would bring an ability to manage traffic demand. The 2009 update also highlighted user charging as a potentially effective means of funding new infrastructure.

3.3.42 The MTS included specific reference to the role of user charging in managing demand and raising revenue to support the introduction of new highway river crossings.

3.3.43 In light of consultation feedback, options appraisals following the publication of the MTS also considered whether road user charging could in itself address the problems of the Blackwall Tunnel.

3.3.44 The 2012 Assessment of Options report noted that charging could potentially reduce congestion at the Blackwall Tunnel, but could not address the problem of resilience. The report recommended that user charging should not be taken forward as a measure in isolation, but that it should be considered alongside a new highway crossing option.

3.3.45 The 2014 Assessment of Needs and Options report also assessed the option of road user charging in isolation, again concluding that it could not fully address the issues at the Blackwall Tunnel, but noted that it would make an effective complementary measure to a new tunnel at Silvertown.

BACK-CHECK of user charging and other options (see Appendix A)

TfL's recent back-check of options, drawing on the evidence generated in its development of the Silvertown Tunnel scheme, confirms that demand management in the form of road user charging has a key role to play in

addressing the problems of the Blackwall Tunnel.

Some respondents to the 2015 consultation suggested that TfL should charge Blackwall Tunnel either in advance of or in place of a charged Silvertown Tunnel, and further testing has been done on this approach. The conclusions of the original work, not to pursue charging at the Blackwall Tunnel in isolation (without the introduction of a new crossing) remain.

A key issue for this option is that it would offer almost no benefit for highway network resilience. In the event of closures of the Blackwall Tunnel, large numbers of vehicles already part-way through their journeys would still need to find alternative road-based routes across the River. This would leave a critical objective of the Scheme and the river crossings programme unmet.

Model tests of charging at the Blackwall Tunnel, without implementation of the Silvertown Tunnel, show that while traffic flow at the Blackwall Tunnel reduces, a delay of around 2.5 to six minutes remains in the peak periods. Further results from this test can be found in the Traffic Forecasting Report – Sensitivity Testing (Document Reference 7.9).

As noted above, even options which offer the prospect of meaningfully reducing congestion at the Blackwall Tunnel would only be likely to deliver temporary relief, as improved conditions would over time encourage more trips to be made.

User charges also represent a highly effective means of both maximising and maintaining the congestion-reduction benefits of new highway infrastructure, and could be tailored to achieve a number of desirable outcomes. For example, a system of discounts could be used to encourage the use of cleaner vehicles, or discourage the use of more polluting vehicles.

Charging also represents a very promising means of raising revenue to help fund the costs of new highway infrastructure, and once this is recouped could help to deliver further transport improvements.

The most recent consultations on the Silvertown Tunnel scheme elicited recommendations from some respondents that user charges should be considered at adjacent crossings to help mitigate an anticipated increase in traffic demand at the Woolwich Ferry and the Rotherhithe Tunnel. However, assessments and model tests do not indicate a clear need for such a measure. In order to implement a charge at the adjacent crossings, clear evidence that this is required would be necessary; in fact the modelling outputs do not indicate a significant increase in demand for the adjacent

crossings at peak times nor major adverse impacts on the highway network. Further detail on this can be found in the Transport Assessment (Document Reference 6.5) Appendix E.

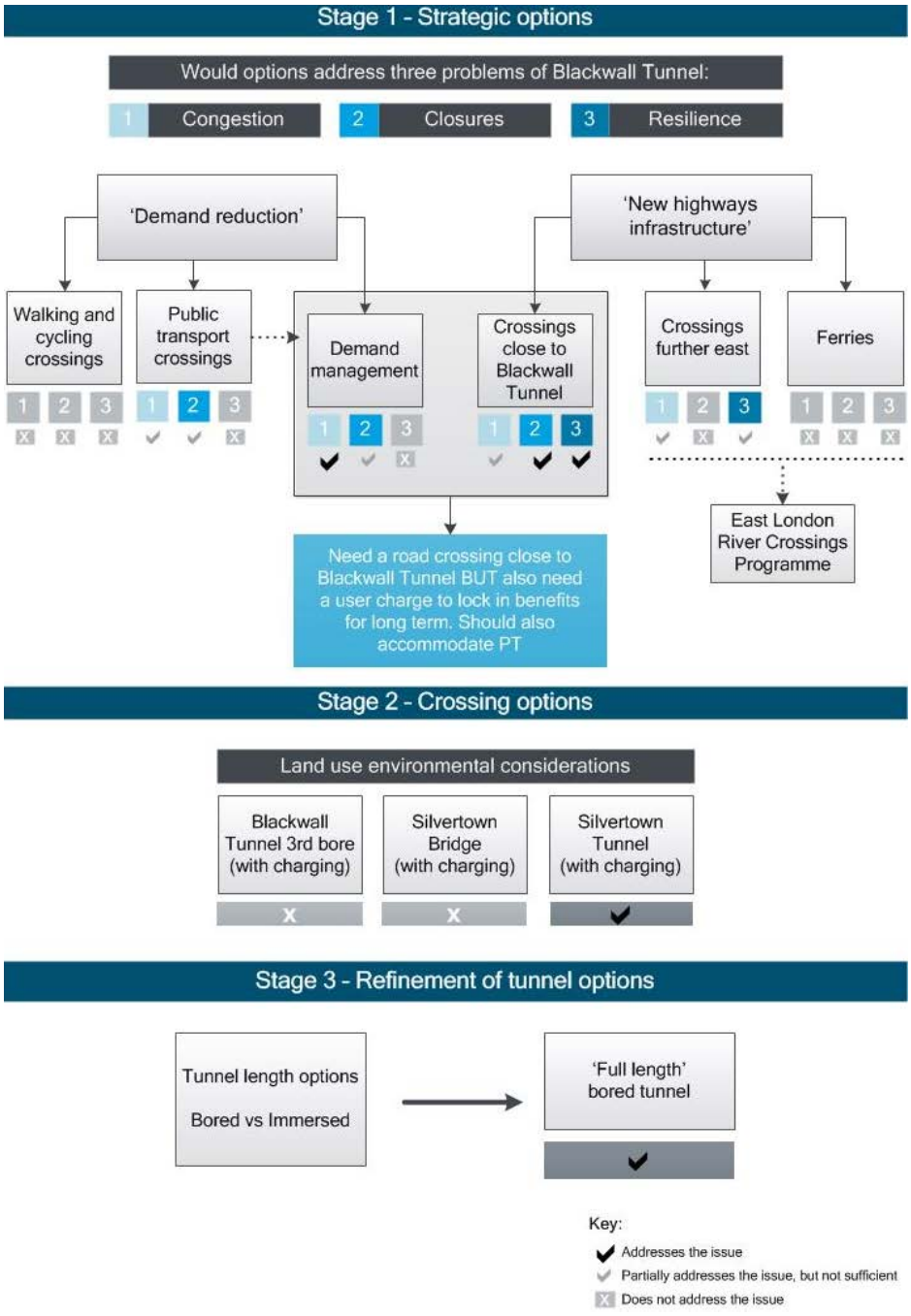
Back-check – overview

3.3.46 Given the conflict of bridge options at Silvertown with relevant local plans, and the inability of a third bore of the Blackwall Tunnel to effectively provide resilience (as well as its doubtful feasibility); a tunnel at Silvertown continues to represent the most appropriate means of providing new highway capacity.

3.3.47 However, TfL's back-check review, conducted in preparing this Case for the Scheme, indicates that no single approach would fully address all of the three identified transport problems at the Blackwall Tunnel. Hence, a blended solution, combining the resilience benefits of this additional highway link close to the existing crossing and the demand management benefits of user charging represent the most appropriate means of addressing the problems of the Blackwall Tunnel.

3.3.48 Figure 3-3 summarises the findings of TfL's back-check review.

Figure 3-3: Overview of back-check appraisal



3.4 The East London River Crossings Programme

3.4.1 This chapter has described how TfL undertook extensive options appraisal for river crossings in east London in order to develop the policies in the MTS and London Plan. The options assessment was informed by statutory consultation and TfL's engagement with stakeholders, and the changing circumstances with regard to land-use in the area.

3.4.2 The work identified a range of needs for river crossings in east London. The options to address these needs were set out in Proposal 39 of the MTS and became the River Crossings programme, which was later split into the Silvertown Tunnel scheme and the East of Silvertown programme. In order to address the problems of the Blackwall Tunnel, a tunnel at Silvertown, with user charging to manage demand and provide funding, was identified as the right option.

3.4.3 Proposal 39 comprised six elements. Table 3-1 shows the progress against each.

Table 3-1: Progress on the River Crossings Proposal

Proposal 39	Progress to date
a. A new fixed link at Silvertown, to provide congestion relief to the Blackwall Tunnel and provide local links for vehicle traffic	• Consulted on Oct-Dec 2014. A statutory consultation ran from Oct-Nov 2015. • Consulted on in the two River Crossings consultations in 2012. • Could open in 2022/23
b. An upgraded Woolwich ferry and consideration of a new vehicle ferry at Gallions Reach to improve connectivity	• Part of East of Silvertown programme. • Consulted on in River Crossings consultations. • Life extension works underway
c. Local links to improve connections for pedestrians and cyclists	• Emirates Air Line cable car opened in summer 2012. • Supporting Sustrans developing Rotherhithe-Canary Wharf bridge proposal. • Working on a number of passenger ferry proposals including North Greenwich to Canary Wharf (east) and Rotherhithe to Canary Wharf (west)
d. Consideration of a longer term fixed link at Gallions Reach to improve connectivity for local traffic, buses, cyclists and to support economic development in this area	• Part of East of Silvertown programme, being developed in parallel with a fixed link at Belvedere • Has been consulted on. • Could be delivered by 2025

Proposal 39	Progress to date
e. The encouragement of modal shift from private cars to public transport using new rail links including High Speed One domestic services, Crossrail and the DLR extension to Woolwich, reducing road demand, and so road congestion at river crossings, where possible	• DLR Woolwich Arsenal (2009), DLR capacity enhancements (2010) • London Overground (2010) • HS1 Ebbsfleet-Stratford (2009) • Crossrail (2018) • Public transport mode share has increased in London over past decade (up eleven percentage points since 2000).
f. Support for Government proposals to reduce congestion at Dartford	• Free-flow charging was implemented in spring 2015. • DfT developing plans for Lower Thames Crossing

3.4.4 As noted in Chapter 2, east London will see the largest share of the substantial increase in population, housing and employment anticipated in the Capital in the coming years. TfL is planning for the impacts of this growth and to overcome poor cross-river connectivity, with a clear focus on east London. For this reason there is a programme of river crossings, which would improve connections for pedestrians, cyclists, public transport and road users. Details of this are set out in Connecting the Capital.[66]

3.4.5 These crossings would improve the reliability and resilience of the road network – which is key to businesses in London. They would transform connectivity, bringing in investment and opening up London's opportunities. They would also provide for the expansion of public transport connections and encourage more active travel. In terms of fixed links, the Silvertown Tunnel is assumed to open in 2022/3[67], closely followed by crossings at Gallions Reach and Belvedere by 2025. Separately, Highways England is progressing plans for a new Lower Thames crossing and consulted on an option at Gravesend/Tilbury in early 2016.

3.4.6 Delivery of this programme would mean that by 2025, east of Tower Bridge to the London boundary there would be eight rail crossings, five road based river crossings (including public transport elements) with two further road crossings east of London, four dedicated pedestrian and cycle links including the existing foot tunnels at Greenwich and Woolwich, the cable car and the bridge at Rotherhithe, and two dedicated passenger ferries. This would deliver a level of cross-river connectivity that is near comparable with west London and provide the level of capacity required to accommodate cross-river road traffic.

[66] TfL, 2015, Connecting the Capital, Our plan for new river crossings for London http://content.tfl.gov.uk/connectingthecapital-newrivercrossingsforlondon-dec-2015.pdf

[67] The use of 2012 as a base year and 2021 as a future year for the Assessed Case (with the Scheme in place) conforms to WebTAG guidance on the selection of base and forecast years.

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4. USER CHARGING ELEMENT OF THE SCHEME

4.1 Introduction

4.1.1 Chapter 3 outlined the Scheme optioneering process in the context of the development of the MTS and the London Plan. Proposal 130 of the MTS states that pricing incentives may be considered to manage demand provided they achieve a reasonable balance between objectives, costs and impacts. This is in alignment with the National Networks National Policy Statement (NNNPS) which refers to user charging to fund new capacity and/or manage demand (paragraph 3.26).

4.1.2 The assessment exercise outlined in Chapter 3 concluded that a road tunnel with user charges was the right option to address the transport problems at the Blackwall Tunnel and set out the Project Objectives. As noted, Project Objective PO7 makes direct reference to user charging.

4.1.3 This chapter explains in more detail why and how, based on these policies, the user charge forms an integral part of the Silvertown Tunnel scheme and how future conditions that could impact on the charge parameters would be monitored. It shows how TfL has developed, in consultation with the host boroughs, a framework for setting and varying the user charges which involves representatives from local boroughs.

4.2 The reasons for charging

4.2.1 TfL proposes to charge for the use of the Silvertown and Blackwall Tunnels for two reasons:

- to help manage the demand for both crossings; and
- to help pay for the new tunnel.

4.2.2 These reasons reflect the need to deliver the project objectives (set out in Chapter 3), in particular PO1, PO2, PO3 and PO7. With regard to managing demand, the Silvertown Tunnel on its own (without a user charge) would add highway capacity which would go only part of the way towards addressing the three transport problems of the Blackwall Tunnel. It has been well documented in recent years that the provision of additional highway capacity to address congestion in urban areas can prove to be of short-lived benefit. This reflects an effect known as ‘induced traffic’ in which the increased convenience of driving (owing to reduced journey times, for example)

attracts additional traffic to the point where queues initially relieved return to their former levels. At this point, congestion on the road network in the vicinity of the crossings would increase, offsetting the benefits (in terms of congestion relief and improved resilience) of the Scheme.

4.2.3 This potential adverse impact can be managed effectively through a user charge, which would act to suppress demand and could therefore be used as a powerful and flexible tool to ensure the benefits of the additional capacity are secured.

4.2.4 Controlling traffic demand and the consequent environmental effects is the main reason for the user charge. A secondary reason for the user charge is to provide a means of helping to pay for the design and construction and operation of the Scheme. Charging users would also ensure that those who benefit most directly from the Scheme would help to fund it in return.

4.2.5 Charging would generate a relatively stable long-term source of revenue that can support both the servicing and repayment of construction finance (either publicly or privately raised) and ongoing operation and maintenance costs. It is an approach that has been adopted on ‘crossing’ schemes around the world and there is an established market for financing on this basis (Mersey Gateway Bridge is a recent UK example).

4.2.6 TfL has considered the potential to use other sources of funding. These include sources within the Mayor/TfL’s remit such as a Mayoral Community Infrastructure Levy (CIL) or a Business Rate Supplement, both of which have been used to pay for Crossrail, a London-wide project. It would be unlikely that the application of a London-wide CIL would be justified for the Silvertown Tunnel, which is a local scheme, albeit one with widespread benefits to London and the UK.

4.2.7 The Silvertown Tunnel is not directly linked to any specific development (unlike, for example, the Northern Line (London Underground) extension) which means there is no opportunity to use a Borough CIL or developer contributions mechanism. It is possible that some funding could be achieved from commercial streams, such as sponsorship, and these will be explored. However, this approach would not be sufficient on its own to meet the Scheme costs.

4.2.8 Crucially, none of these alternative funding options would manage traffic demand and since this is the most important function of the user charge, the Scheme would still require a user charge to apply in addition to any other funding.

4.2.9 Setting a charge means that drivers (and potential drivers) must decide if they are willing to pay to make this journey and if not, respond by switching to another mode, changing the time or route of their journey or not making the journey at all. Although its objectives differ from the present Scheme, the central London Congestion Charging scheme is an example in London of how pricing can effectively incentivise behaviour change[68].

4.2.10 There are a number of other benefits that arise from managing traffic through user charging. Charging would help to encourage people to consider public transport as an alternative option, as well as making buses more attractive by enabling better journey time reliability due to the reduced congestion and creating opportunities for more cross-river bus services. It would also have a role in improving air quality through reduced congestion.

4.3 Comments made about user charging in consultations

4.3.1 Based on the reasons set out in section 4.2, TfL first presented the concept of user charging at the Blackwall and Silvertown Tunnels as part of the Scheme in the second non-statutory consultation on the river crossings programme (Oct 2012- Feb 2013). As noted in Chapter 3 the policies enabling user charging had previously been consulted on in the development of the MTS and the London Plan.

4.3.2 While there was a high level of support for the option of a new road tunnel between Silvertown and the Greenwich Peninsula (76 per cent support), just over half of those responding using the questionnaire expressed opposition to a user charge for the new crossings and Blackwall Tunnel, with 55 per cent opposing it, while a third of respondents supported the charge.[69]

4.3.3 Many of the free-text comments on this issue highlighted a particular concern over the possibility of charging for the use of the Blackwall Tunnel,

[68] In the initial years post implementation, congestion reduced by 20-30% in the Congestion Charging Zone. While levels of congestion in London in central London are now close to pre-charging levels, traffic levels in central London continue to fall and the reason that congestion has not fallen at the same rate is attributable to a number of factors including reallocation of road space to prioritise public transport, increased pedestrianisation and increased dedicated road space for cycling, and extensive utilities and development works. Without the charge, traffic levels would rise and congestion would be worse, with resulting adverse economic impacts on London.

[69] 40 per cent strongly opposed and 15 per cent opposed; 19 per cent supported and 14 per cent strongly supported. The remainder did not know, did not answer or neither supported nor opposed (2012-13 consultation).

which is at present free to use. An overview of the reasons as to why TfL considered a user charge to be appropriate and necessary, despite the strong opposition, was published in the *Responses to Issues Raised* report for this consultation[70].

4.3.4 TfL next consulted on the Scheme, including a user charge at both tunnels, in 2014 and in the 2015 statutory consultation. Again there was some opposition to the user charge: 57 per cent of respondents stated opposition and 37 per cent supported it (2014 consultation). The statutory consultation in 2015 did not contain closed questions other than support for the Scheme in general, but user charging was the theme most often commented-on in the responses received (64 per cent of all respondents made a comment). Most of these comments were in opposition to the proposed user charges, often stating that a contribution had already been made via council tax, 'road tax' or similar.

4.3.5 In response to these comments, TfL has carried out further work to examine the need for a charge, including understanding the implications of not having any charge.

4.4 Silvertown Tunnel without a user charge

4.4.1 Without a user charge, the benefits of additional capacity put in place by the new tunnel would be short-lived, owing to an effect known as 'induced traffic' in which the increased convenience of driving (owing to reduced journey times, for example) attracts additional traffic to the point where queues initially relieved return to their former levels.

4.4.2 This would lead to there still being significant delay at the crossing and to continued adverse impacts on the wider road network in terms of congestion, journey time and journey time reliability. This in turn would undermine the resilience benefits brought about by having an additional tunnel.

4.4.3 There would also be negative secondary impacts in terms of the economy, environment and public transport if no charge is applied. Businesses would continue to experience journey time delay and unreliability. The opportunity to run more and better public transport would be lost if demand is not

[70] *TfL River Crossings Programme: Responses to Issues Raised,* Transport for London (2013) https://consultations.tfl.gov.uk/rivercrossings/consultation/user_uploads/responses-to-issues-raised.pdf

managed at the Silvertown and Blackwall Tunnels, as certainty about journey times is needed in order to run bus and coach services effectively and attract customers.

4.4.4 The threat of induced traffic can be managed effectively through the imposition of the user charge, which will act to suppress demand and is thereby a powerful and flexible too to ensure that the benefits of the Scheme are secured for the long-term.

4.4.5 This is backed up by the results from strategic modelling. Using its transport models, TfL has assessed the effects of a new tunnel at Silvertown implemented without a user charge at both Blackwall and Silvertown Tunnels (known as the 'no charge scenario').

4.4.6 The results confirm expectations in terms of inducing traffic demand, as described in section 4.2.2 above. In the absence of user charging, there would be a significant increase in demand at the Blackwall and Silvertown Tunnels and consequential negative impacts on the surrounding road network in terms of additional traffic generated and continued long queues in the peak periods.

Traffic demand

4.4.7 Under the 'no charge' scenario, there would be a substantial increase in demand at the Blackwall and Silvertown Tunnels in both the peak and off-peak periods. This suggests that without a user charge in place the additional capacity provided by the Silvertown Tunnel would attract additional traffic. In the context of the highly constrained road network in London, this would not represent a sustainable solution. With a user charge, as demonstrated by the Assessed Case, the Scheme has the potential to increase the throughput of traffic in this area without causing overall increases in demand, through a combination of new capacity and demand management.

Delay

4.4.8 Delay at the tunnel portals is another important metric to consider. It would be expected that an increase in traffic and demand would result in continued delay at the crossings. This is backed up by the transport model tests which show that while the implementation of a tunnel at Silvertown without a user charge would reduce delays against the Reference Case, a significant amount of delay in crossing the river here would remain, particularly in the PM peak (this largely reflects the increase in demand referred to above). In the Assessed Case severe delay would be effectively eliminated.

Wider network impacts

4.4.9 It is not only the traffic conditions experienced by those using the crossing that would be worse under a no charge scenario. The effects of conditions at the Blackwall Tunnel (and in future the Silvertown Tunnel as well) would be felt across the wider network and would affect even those who do not use the crossing as the increase in demand will have a knock-on impact on the wider road network.

4.4.10 The model outputs supporting the above points are included in the Traffic Forecasting Report – Sensitivity Testing (Document Reference 7.9).

4.5 Charging scope

4.5.1 In the Assessed Case, both the Blackwall Tunnel and the Silvertown Tunnel are charged. It is important to apply a charge at both Tunnels in order to prevent drivers continuing to favour the existing tunnel despite its constraints and not making optimum use of the new infrastructure.

4.5.2 Given the close proximity of the tunnels, drivers would be very likely to opt for an uncharged tunnel if one was available. This would mean that the additional capacity and resilience added by the new tunnel would not be fully realised. In this scenario, a situation similar to the existing problems of the Blackwall Tunnel – congestion, delay and unreliable journey times – would persist and the Scheme's objectives would not be realised.

4.5.3 This effect could even be exacerbated with a charge at only one tunnel. The tunnels share an approach road on the south side and traffic queuing for the uncharged tunnel could hamper access to the charged tunnel. As is currently the case (uncharged Blackwall Tunnel), the adverse congestion and environmental effects would be experienced across the wider network.

4.5.4 TfL has carried out transport modelling to test the effects of scenarios where one or both of the two tunnels is uncharged and compared the effects to those seen in the Assessed Case (in both instances, the baseline is the Reference Case for 2021). When a user charge is applied at the Silvertown Tunnel only, the reductions in actual flow would not be as great as those experienced in the Assessed Case. Furthermore, unlike in the Assessed Case, the model suggests that demand flow would increase compared to the Reference Case which means traffic would still be queuing to access the tunnels. The model further shows that substantial delay of around eight and 11 minutes would remain in the northbound AM peak and the southbound PM peak respectively.

4.5.5 In a scenario where a user charge is applied only at the Blackwall Tunnel, unlike in the Assessed case, there is an increase in demand flow as well as actual flow, and travel time is not improved to the same degree (and in some cases is worse than in the Assessed Case).

4.5.6 More information about this modelling is given in the Traffic Forecasting Report – Sensitivity Testing (Document Reference 7.9).

Charging adjacent crossings

4.5.7 There are no proposals to impose user charges at the two adjacent crossings, the Rotherhithe Tunnel or the Woolwich Ferry, as part of this Scheme. It is not expected that a significant number of drivers would divert to either of these to avoid the charges at the Blackwall and Silvertown Tunnels. Further information on TfL's assessment of this approach is provided in the 'Back-check – user charging' box in section 3.3

4.5.8 Provided the environmental considerations set out are met (see in section 4.7 below are addressed, variations to the user charge could be made in order to manage any displacement effects that arose in future. TfL's traffic monitoring would be able to discern any such effects.

4.6 The design of the user charge in the Scheme

4.6.1 The DCO confers a general power on TfL to impose charges on vehicles using the Silvertown Tunnel and the Blackwall Tunnel. The power allows TfL to:

- set the initial user charges prior to the Scheme opening to traffic;[71]
- keep the charges under review; and
- vary the charges having regard to the Project Objectives and the traffic and environmental factors set out in the Charging Policy (Document Reference 7.11).

4.6.2 As well as giving flexibility over the level of the charges, the charging power would enable TfL to set and vary other aspects of the charges such as the times of day when charges apply, the classes of vehicles that different

[71] This is the date when the Silvertown Tunnel opens. From this time user charges would apply at both it and the Blackwall Tunnel.

charges apply to, and the discounts and exemptions that are available. This means that user charging remains a powerful and flexible tool for managing the Scheme and its impacts in the long-term.

4.6.3 The approach to setting user charges in the opening year and making variations to user charges in subsequent years is set out in the DCO and in the Charging Policy (Document Reference 7.11). The charges (including the charge levels, the hours charged, the vehicles charges, discounts and exemptions and other factors related to user charging) that apply will be set out in a document known as the Statement of Charges that would be published by TfL whenever the charges are set or varied.

4.6.4 The flexible user charge is itself the most important mitigation measure for the effects of the Scheme: by directly controlling traffic demand and effects the user charge will manage consequential environmental and other related effects. TfL anticipates that charging would be a long-term measure, continuing at least for as long as its traffic management effects were required[72].

4.6.5 The approach to the long-term application of user charging in the Scheme has been designed in such a way as to ensure continued benefits from the Scheme while remaining flexible enough to respond to the rapidly-changing conditions in east and south east London.

4.6.6 In order to inform decisions on setting and varying the user charges, data on the outcomes of the Scheme will be collected as set out in the Monitoring Strategy (Document Reference 7.6)[73]. Data would be collected for the themes identified as being most affected by the operation of the Scheme including user charging: traffic; air quality; noise; carbon and socio-economic effects[74]. The Monitoring Strategy will take effect three years prior to the Scheme opening and continue for a further three years (with the potential to extend by a further two years).

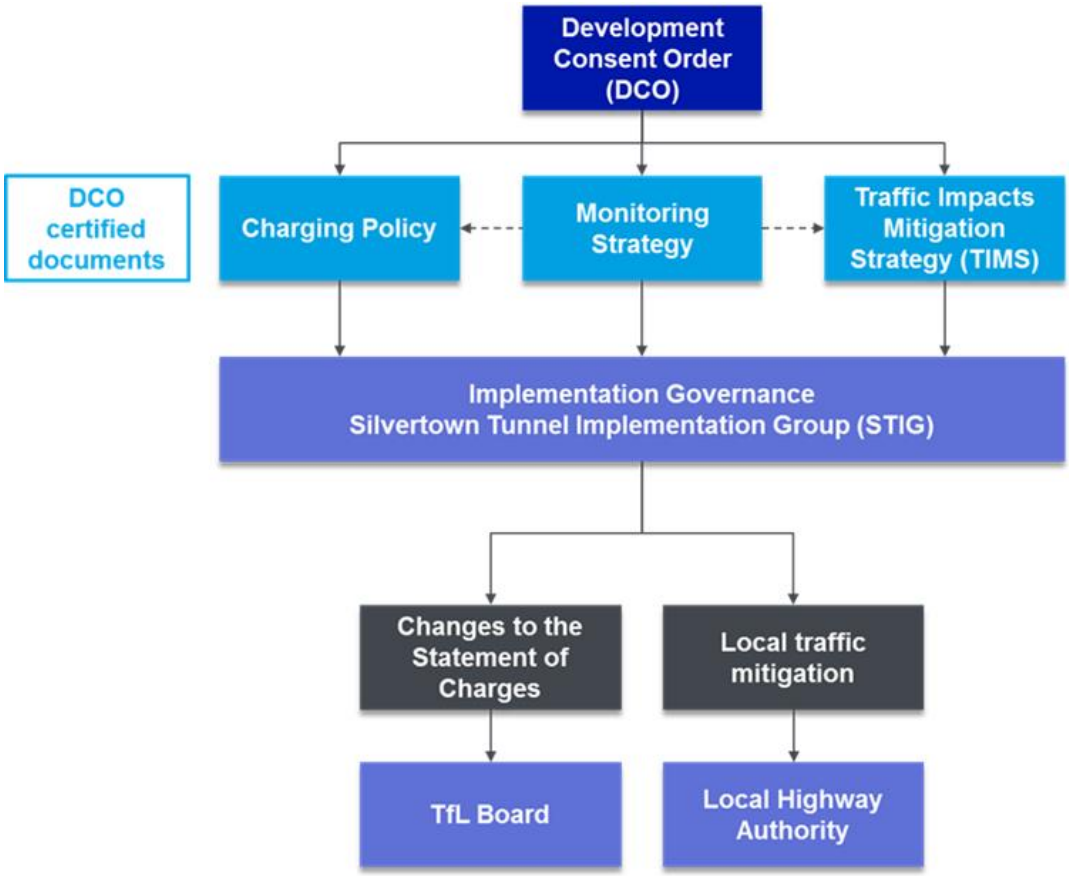
[72] In this respect, user charges differ from tolls (which are set in order to pay for infrastructure and so have a fixed end date).
[73] A Preliminary Monitoring and Mitigation Strategy was included in Appendix C of the Preliminary Case for the Scheme. This has now been updated with feedback received from the host boroughs and other stakeholders during and after the statutory consultation, and has been reissued as a Monitoring Strategy (MS) and Traffic Impacts Mitigation Strategy (TIMS)
[74] An Annual Monitoring Report would be made available to the public.

4.6.7 As well as making variations to the user charge, other mitigation measures (beyond those already embedded in the Scheme) could be taken if necessary in response to localised traffic impacts on the network The process for identifying and implementing these localised mitigation measures is set out in the Traffic Impacts Mitigation Strategy (TIMS) (Document Reference 7.7). These local mitigations could be on TLRN or borough roads, and include for example changes to signal timings or the provision of noise barriers at certain locations.

4.6.8 A governance process to oversee the implementation of the Charging Policy (Document Reference 7.11), the Monitoring Strategy (Document Reference 7.6) and the TIMS (Document Reference 7.7) will be put in place in the DCO. An important component of this will be the Silvertown Tunnel Implementation Group (STIG). STIG will comprise representatives from local boroughs and TfL. Its role is to evaluate outputs from the monitoring and make recommendations to TfL on any mitigation required.

4.6.9 The approach is summarised in Figure 4-1 and explained in more detail below.

Figure 4-1: Relationship between documents and governance for charge-setting



4.7 Setting the initial user charges and varying the user charges

4.7.1 TfL will set and subsequently vary the charges so as to support the delivery of the Scheme's objectives and will keep the level of charges under review.

4.7.2 In setting and varying the charges, TfL must have regard to the likely impacts of the charges on:

- Traffic;
- the environment; and
- population, economy and growth.

4.7.3 The Charging Policy (Document Reference 7.11) sets out the procedure for setting the initial charges, and for subsequent variations of the charges. In both cases, monitoring data will be available to TfL and the Silvertown

Tunnel Implementation Group to help inform the level of charges or potential changes to them.

4.7.4 The opening year charge will be set in advance of Scheme opening. TfL will re-run the strategic traffic model for the Scheme followed by a re-assessment of the expected impacts of the potential charge compared to those set out in the Environmental Statement (ES) (Document Reference 6.1). This assessment will comprise topics likely to be impacted by the charge such as air quality and including carbon, noise and socio-economic impacts.

4.7.5 TfL would only approve the initial charges where the assessment shows that the proposed charges would not be likely to give rise to environmental effects which are materially worse than the environmental effects of the charges assessed in the ES (Document Reference 6.1).

4.7.6 For subsequent future variations to charges, TfL must have regard to the traffic, environmental and socio-economic effects of the potential changes. Revisions to the charges must also comply with applicable legislation and policies and with TfL's network management duty.

4.7.7 Regardless of any real terms variations, the user charges (and associated costs such as registration fees and penalty charges) will increase from time to time to account for inflation. This change will happen automatically and without consultation.

4.7.8 TfL will publish a Statement of Charges not less than 56 days in advance of charges taking effect. TfL will ensure that the applicable charges are understandable and clear to potential users. It will use a variety of communication and marketing channels to raise awareness of charge variations. Full details on the process of setting and varying the charge are presented in the Charging Policy (Document Reference 7.11).

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5. DETAILED SCHEME DEVELOPMENT

5.1 Development of the Silvertown Tunnel scheme

5.1.1 This chapter describes the detailed development of the Silvertown Tunnel scheme, focusing on the physical design of the Scheme. The starting point is the policy position of the London Plan supporting a highway tunnel at Silvertown.

5.1.2 As with the strategic options appraisal set out in Chapter 3, this section contains both a summary of the appraisals undertaken in the past and a back-check of options which has been undertaken more recently.

5.1.3 Table 5-1 summarises the river crossings consultations held to date, including the statutory consultation on the proposed Scheme.

Table 5-1: Overview of river crossings consultations undertaken

Consultations	Proposals
River Crossings (Feb 2012-Mar 2012)	• New highway tunnel at Silvertown • A new vehicle ferry at Gallions Reach to replace the Woolwich Ferry
River Crossings (Oct 2012-Mar 2013)	• New Silvertown Tunnel • New ferry at Woolwich • New ferry at Gallions Reach • New bridge or tunnel at Gallions Reach • User charges for new crossings and the Blackwall Tunnel
East of Silvertown (July-Sept 2014)	• New ferry at Woolwich • New ferry at Gallions Reach • Bridge at Gallions Reach • Bridge at Belvedere
Silvertown Tunnel (Oct-Dec 2014)	• Silvertown Tunnel with a user charge at Blackwall and Silvertown tunnels
Silvertown Tunnel statutory consultation (Oct-Nov 2015)	• Silvertown Tunnel with a user charge at Blackwall and Silvertown tunnels • Included new information on proposed charge levels; changes to road layout; and complementary measures

5.1.4 Changes made to the Scheme as a result of consultation are summarised in section 5.9.

5.2 Starting point of the assessment

5.2.1 Following the support for a road tunnel at Silvertown in the London Plan, the various options for implementing such a scheme were assessed against engineering, environmental, land-use and cost criteria.

5.2.2 The development and assessment of the tunnel options was based on the alignment of a route being safeguarded in 1995 and 1997 under a direction from the Secretary of State/Government Office for London. The safeguarding direction was issued under the Town and Country Planning (General Development Procedure) Order 1995. In 2001 the safeguarding was transferred to the Mayor of London/TfL to bring it within the scope of the Mayor's planning functions under the Town and Country Planning (Mayor of London) Order 2000. This safeguarding presented a set of parameters to work within in developing the broad options for the Silvertown Tunnel. A summary of how the Scheme design has evolved as a result of the statutory consultation is presented in the Consultation Report (Document Reference 5.1).

5.3 River Crossings Programme – first non-statutory consultation

5.3.1 With the policy supporting the River Crossings Programme established in the MTS and the London Plan, TfL began to develop materials for the first non-statutory consultation on elements of the programme. This ran for four weeks in February and March 2012[75]. The consultation introduced the idea of a range of river crossings for east London and sought views on:

- The concept of a new highway tunnel at Silvertown to ease congestion and provide additional resilience at Blackwall; and
- A new vehicle ferry at Gallions Reach, to replace the Woolwich Ferry

5.3.2 This was an initial, high-level and non-statutory consultation. Therefore it did not present detailed information on potential scheme impacts, costs or timetable. However, it was founded upon the River Crossings Programme,

[75] https://consultations.tfl.gov.uk/river/crossings

policy support for which had been subject to a statutory consultation as part of the draft MTS and draft London Plan.

5.3.3 The consultation materials referred to the Emirates Air Line cable car, which was already under construction at this point, as the cycling and pedestrian element of the River Crossings Programme. The consultation leaflet stated that a range of options for paying for the Scheme was under consideration. This informal consultation also asked about respondents' general views on the ease of crossing the river.

5.3.4 The consultation ran for four weeks and attracted 3,900 responses. Support for the Silvertown Tunnel was strong, with over 80 per cent of respondents supporting or strongly supporting a new road crossing at this location. More detailed information on the responses can be found in the report to the Mayor on the consultation[76].

5.3.5 The consultation responses indicated a very strong level of agreement that it is important to improve highway river crossings in east and south-east London, with over 90 per cent of respondents agreeing or strongly agreeing that it is difficult to cross the river, and that there is a need for more crossings. Some stakeholders urged TfL to consider user charging as a means of managing demand and paying for the Scheme. Having considered the responses, TfL went to progress the River Crossings Programme in further detail.

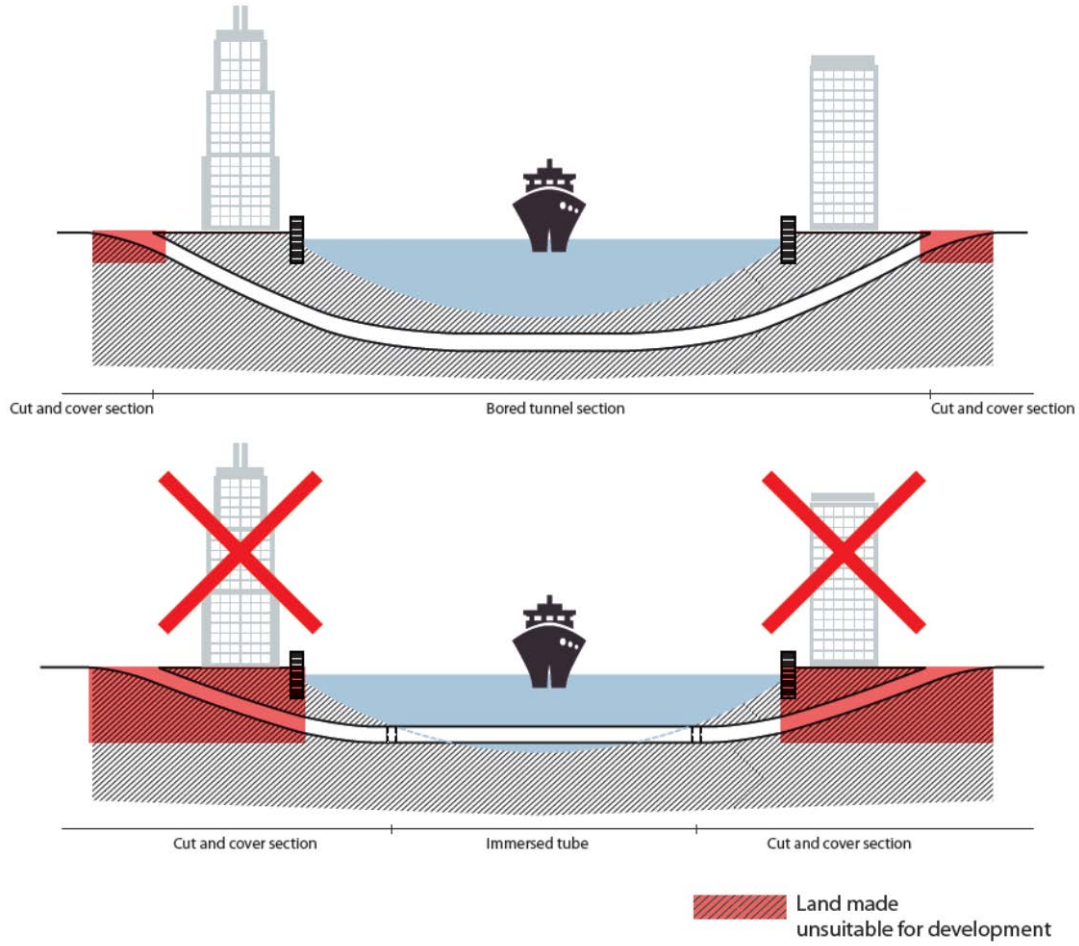
5.4 Early tunnel optioneering

5.4.1 With the principle of a crossing at Silvertown in the form of a tunnel now well established, a 2012 study[77] considered two feasible tunnel types for the crossing – using bored or immersed tube construction. The study focused on technical feasibility and potential impacts on the environment and navigational requirements. It concluded that while both were technically feasible, and an immersed tube tunnel could be cheaper and shorter, a bored tunnel would minimise adverse impacts on the environment and local land uses.

[76] *TfL River Crossings Package: Report to the Mayor on 2012 informal consultation,* Transport for London (July 2012)
[77] *Silvertown Crossing Study Tunnel Engineering,* Mott MacDonald (Jun 2012)

5.4.2 The study noted that an immersed tube tunnel would have greater impacts on the river bed, on navigation, and on the land above the tunnel, due to the larger cut and cover section (illustrated in Figure 5-1). This would create conflict with the Greenwich Peninsula masterplan. The masterplan was approved in 2004 and the 2006 Unitary Development Plan (UDP) of the Royal Borough of Greenwich sets out its support for a crossing between North Greenwich and Silvertown (policy M15), with the caveat that the crossing must be in the form of a tunnel.

Figure 5-1: Schematic comparison of bored and immersed tube tunnel



5.4.3 In addition to this engineering assessment, the fixed road-based options (including a wide range of options for comparison purposes) were appraised using TfL's Strategic Assessment Framework (SAF) which assesses projects

and programmes using a set of strategic planning criteria[78]. The use of the SAF enabled the options to be tested against all MTS outcomes and is consistent with the Department for Transport's WebTAG process.

5.4.4 This assessment recommended the following for further development:

- a bored tunnel at Silvertown; and
- user charging at the Blackwall Tunnel (in conjunction with the new infrastructure)

5.5 River Crossings Programme – second non-statutory consultation (Oct 2012-Feb 2013)

5.5.1 A further consultation was held at the end of 2012. This focused on a programme of river crossings options for east London including a new road tunnel between North Greenwich and Silvertown, a new vehicle ferry at Woolwich and a vehicle ferry or bridge or tunnel at Gallions Reach. There was a high level of support for the option of a new road tunnel between Silvertown and the North Greenwich, with 76 per cent supporting it (57 per cent strongly supported and 19 per cent supported).

5.5.2 The findings of the December 2012 SAF appraisal (which proposed that a bored tunnel would be the preferable solution) were presented to the public as part of this consultation.

5.5.3 In its response to feedback received in the consultation[79], TfL stated that from that point forward the Silvertown Tunnel would be progressed as a separate scheme, while work on the Woolwich Ferry replacement and other crossings would be continued as part of a separate programme of work as part of the overarching River Crossings Programme. In summer 2014 (July-September), TfL held a non-statutory consultation on what had become the 'East of Silvertown' river crossings programme.

[78] *East London River Crossings Assessment of Options,* Transport for London (Dec 2012)
[79] https://consultations.tfl.gov.uk/rivercrossings/consultation/user_uploads/responses-to-issues-raised.pdf

5.6 Detailed tunnel optioneering

5.6.1 In order to test the suitability of a bored tunnel, a comparison of eight tunnel options was undertaken in 2013 on the basis that these options were feasible in engineering terms but presented contrasting impacts when compared with one another[80]. The eight options were broken down into two groups – bored and immersed tube (four each) and included 'full length' and 'short' length variants.

5.6.2 The 'full length' tunnel options conformed to the agreed Greenwich Peninsula Masterplan layout, with the southern tunnel portal to the west of Millennium Way so as to provide physical separation between tunnel traffic and the areas of the Masterplan identified for residential and commercial development.

5.6.3 The 'short' tunnel options located the tunnel portal in areas of the Masterplan identified for residential and commercial development, in a position dictated by maximum desirable tunnel gradient and the proposed road layout of the development. The report noted that there was no opportunity to shorten the tunnel on the Silvertown side as the tunnel gradient is already at the maximum desirable gradient from the mid-river position to the northern portal.

5.6.4 An assessment using cost, risk, land-use and environmental criteria was carried out. The quantified comparison showed that the 'short' tunnel options posed significant planning risks which were likely to result in a significant delay to the programme and therefore add to the outturn costs. On this basis the 'short' tunnel options were de-selected leaving the 'full length' tunnel options for further consideration.

5.6.5 Of the lowest cost 'full length' options, the bored tunnel was seen to be the best option on the basis that it would minimise planning risks and cost associated with construction on the River Thames. This option was favoured by the Port of London Authority (PLA)[81]. The immersed tube option was confirmed as entailing more substantial environmental risk, additional land take, and potentially ongoing risk to shipping along this tidal section of river.

[80] *Silvertown Tunnel Options Study*, Hyder (Nov 2013)
Silvertown Tunnel Development Impacts Study, Atkins (Nov 2013)
Summary and Comparison of Tunnel Options, Transport for London (Dec 2013)
[81] *Summary and Comparison of Tunnel Options, Appendix A* Transport for London (Dec 2013)

5.6.6 In light of these conclusions it was confirmed that the 'full length' bored tunnel option was most suitable to be taken forward. A high-level summary of the assessment is shown in Table 5-2 and details were presented as part of the 2014 public consultation on the Silvertown Tunnel.

Table 5-2: Summary of tunnel options assessment

Option	Description	Environment risk	Land-use risk
Base	Full length immersed tube with on-site casting	High	Low
A	Full length immersed tube with off-site casting	High	Low
B	Shortened immersed tube with on-site casting	Highest	Medium - High
A+B	Shortened immersed tube with off-site casting	Highest	Medium - High
Base	Full length bored tunnel with cross-passages at up to 350m spacing	Lowest	Low
C	Shortened bored tunnel with cross-passages at up to 350m spacing	Medium	Medium - High
D	Shortened bored tunnel with cross-passages at 100m spacing	Medium	Medium - High
E	Full length bored tunnel with cross-passages at 100m spacing	Lowest	Low

5.7 First non-statutory consultation solely on the Silvertown Tunnel scheme (October to December 2014)

5.7.1 Details of the further refinement of the Silvertown Tunnel scheme were presented in the first non-statutory consultation solely on the Silvertown Tunnel in 2014.

5.7.2 This was the first consultation which focused exclusively on the Silvertown Tunnel scheme. TfL published suite of detailed technical reports, including:

i. Assessment of needs and options

ii. Outline Business case

iii. Introductory transport assessment

iv. Introductory environmental assessment (and environmental drawings related to air quality impacts, noise and assets)

v. Introductory equalities impact assessment

vi. Introductory health impact assessment

vii. Traffic forecasting report

viii. Outline user charging strategy

5.7.3 TfL also published extensive information on the background and development of the Scheme: a report on the recently completed River Crossings business survey; an Introductory Environmental Assessment Report which included a scope and outline methodology along with a high level assessment; studies on options assessment and tunnel development, and a report from an independent peer review group into the Scheme.

5.7.4 The questionnaire sought views on the principle of the Silvertown Tunnel as part of the river crossings programme, on a user charge and account system, and on the proposals for new cross-river bus provision. It also sought views on the proposed junction tie-ins at the north and south side and invited comments on the technical reports and any other issues of concern.

5.7.5 In response, 83 per cent of respondents agreed that a new river crossing was needed at this location. Just over half (55 per cent) opposed the user charge, with 37 per cent supporting it. In general there was support for the junction changes (48 per cent at north side and 54 per cent at south side), with a substantial proportion in each case responding ‘don’t know’. There were many suggestions about new bus connections and services.

5.7.6 Aside from these, respondents raised a number of issues, including: concerns about how the traffic impacts of the Scheme might be managed; suggestions for discounts on the user charge; suggestions for new public transport links in addition to or instead of the new Tunnel; and comments about the proposal not to incorporate provision for pedestrians and cyclists within the Tunnel. There was also a range of comments about the materials published to support the proposals.

5.7.7 TfL published a report responding to the issues raised in the consultation[82] which committed to addressing these issues in the statutory consultation on the Scheme. The materials made available for the statutory consultation in 2015 include a number of changes made as a result of a review of the layout and size of work sites and tunnel buildings. There was further information on potential new bus services and extensions[83] to existing services and intentions to strengthen the role of the EAL as the preferred crossing for pedestrians and cyclists in this location. The Preliminary Charging Report[84] outlined the proposed discounts and exemptions as well as indicative charges.

5.7.8 Also as a result of its appraisal of consultation responses, TfL re-examined the potential to allow pedestrians and cyclists to use the Tunnel (and so provide a further crossing at this location in addition to the EAL). Current design and safety standards indicate that only a segregated solution – either a separate tunnel bore or a deck underneath the road Tunnel – would be permissible.

5.7.9 Given the length of the crossing and the need to provide lifts and ramps, either option would suffer from poor ambience, and be unsuitable in terms of safety and security. Either approach would be very expensive (an increase in Scheme cost of some £70m for one bore and £150m for both bores plus additional annual operating costs). A more appropriate way to deliver improvements for pedestrians and cyclists is to improve access to the Emirates Air Line, the existing dedicated crossing in this location (see section 3.3.16 to 3.3.22 for further detail on pedestrian and cyclist options).

[82] *TfL River Crossings programme – Silvertown Tunnel, Responses to issues raised report, Consultation Oct-Dec 2014,* Transport for London (Jun 2015) https://consultations.tfl.gov.uk/roads/river-crossings/user_uploads/east-of-silvertown-responses-to-issues-raised.pdf
[83] *Silvertown Tunnel Preliminary Transport Assessment,* Transport for London (Oct 2015)
[84] *Silvertown Tunnel Preliminary Charging Report,* Transport for London (Oct 2015)

5.7.10 Details on how the tunnel design evolved as a result of the statutory consultation are presented in the Consultation Report (Document Reference 5.1) and the expected construction methods are presented in the Construction Method Statement which is appended to the ES (Document Reference 6.1). The Design and Access Statement (Document Reference 7.3) describes how the Scheme would fit within the public realm at Greenwich and Silvertown.

5.8 Silvertown Tunnel scheme – statutory consultation (October to November 2015)

5.8.1 From 5 October to 12 November 2015 TfL undertook a statutory consultation on the proposed Scheme in preparation for submitting the application for a DCO.

5.8.2 The consultation materials comprised a consultation booklet (the contents of which would be replicated online), a consultation questionnaire to guide respondents in their response, a series of supporting factsheets to assist respondents who might wish to understand more about the proposals, and a range of technical reports to outline specific aspects of the scheme in detail. The full range of consultation materials were:

- Consultation Booklet
- Preliminary Environmental Information Report (PEIR)
- Non-technical Summary of the PEIR
- Consultation Plans, Maps and Drawings
- Preliminary Case for the Scheme
- Preliminary Charging Report
- Preliminary Outline Business Case
- Preliminary Engineering Report
- Preliminary Transport Assessment
- Preliminary Design & Access Statement
- Preliminary Sustainability Statement
- Preliminary Equalities Impact Assessment

5.8.3 Details of the consultation and what the materials set out can be found in the Consultation Report.

5.9 Changes made to the Scheme following the statutory consultation

5.9.1 As noted in section 5.7 above, further work was undertaken and a number of changes to the scheme made as a result of the first non-statutory consultation on the Silvertown Tunnel. Following the statutory consultation in 2015, TfL has carefully considered the responses made by the public and stakeholders and undertaken further work, some of which has led to changes to the Scheme.

5.9.2 These are described in full in the Consultation Report (Document Reference 5.1), with some of the main changes summarised below. Further work on optioneering (for example on the location of the crossing and on model sensitivity tests) as a consequence of these comments has been described in Chapter 3.

- Further development of the approach to setting and varying the user charge, including the role of the Silvertown Tunnel Implementation Group.
- A commitment to transport at least 50% by weight of all materials associated with the Scheme by River, as further described in the Code of Construction practice (CoCP) (Document Reference 6.10).
- Ensuring continued ramped access to the Boord Street footbridge during its replacement works.
- Enhanced cycle provision has been provided on all new routes where cycling is permitted
- A number of changes to the land required for the Scheme.

5.10 The proposed Silvertown Tunnel scheme

5.10.1 In line with the clear policy position in support of the Silvertown Tunnel in the MTS and the London Plan, which is reflected in the local development plans for Greenwich and Newham, the Scheme has been developed intensively over a period of around five years, with extensive input from the local boroughs, stakeholders and the public.

5.10.2 It has been subject to continuous assessment against the transport requirements for east and south-east London, and has been back-checked

against other strategic options to ensure and to demonstrate that the right scheme is being taken forward.

5.10.3 The land for the crossing was safeguarded by Government, and development plans for the Greenwich Peninsula and the Royal Docks are being progressed. The Silvertown Tunnel has been developed with these long-term plans in mind and integrates with existing and future development.

5.10.4 The proposed Scheme now put forward involves the construction of a twin bore road tunnel providing a new connection between the A102 Blackwall Tunnel Approach on Greenwich Peninsula (Royal Borough of Greenwich) and the Tidal Basin roundabout junction on the A1020 Lower Lea Crossing/Silvertown Way (London Borough of Newham). The Silvertown Tunnel would be approximately 1.4km long and would be able to accommodate large vehicles including double-deck buses. It would include a dedicated bus, coach and goods vehicle lane, which would enable TfL to provide additional cross-river bus routes.

5.10.5 The Scheme also includes the introduction of free-flow user charging on both the Blackwall Tunnel (northern portal located in London Borough of Tower Hamlets) and at the new Silvertown Tunnel. This measure is intended to play a fundamental role in managing traffic demand and supporting the financing of the construction, maintenance and operation of the Silvertown Tunnel.

5.10.6 New portal buildings would be located close to each tunnel portal to house the plant and equipment necessary to operate the tunnel.

5.10.7 Main construction works could commence in late 2018 and would last approximately 4 years with the new tunnel opening in 2022/23.

5.10.8 The main construction compound would be located at Silvertown, utilising the existing barge facilities at Thames Wharf along with a new temporary jetty for the removal of spoil and delivery of materials by river. A secondary site compound would be located adjacent to the alignment of the proposed cut and cover tunnel on the Greenwich Peninsula.

5.10.9 See Figure 5-2 for an overview of the Scheme alignment.

Figure 5-2: Scheme alignment

6. SCHEME BENEFITS

6.1 Overview

6.1.1 The project objectives set for the Scheme are a way of optimising its benefits beyond solving the three transport problems – congestion, closures and incidents, and resilience – of the Blackwall Tunnel. These benefits may be as a direct result of the Scheme indirect benefits achieved in connection with the Scheme (sometimes known as 'legacy benefits'). This chapter summarises these benefits, organised by project objective.

6.1.2 The project objectives relate to policy objectives in the development plan (the London Plan together with the local development plans of the Royal Borough of Greenwich and London Boroughs of Newham and Tower Hamlets) and the MTS.

6.1.3 The Silvertown Tunnel scheme should be understood not only as the construction and operation of a new tunnel, but as part of a broad strategy which delivers improved cross-river connectivity for all users and enhances road network performance in east and south east London. The content of this Scheme has been developed in order to leave a positive and enduring infrastructural legacy for east and south east London.

6.1.4 The Silvertown Tunnel scheme is part of an ongoing programme of improvements to river crossings in east London which has already delivered the Emirates Air Line (for pedestrians and cyclists) and will soon provide a Crossrail connection (Custom House to Woolwich), in addition to the almost tenfold increase in capacity added to the cross-river rail network in east London since 1999. Connecting the Capital[85] sets out TfL's plans for more pedestrian, cycle and multi-modal crossings in east London. TfL has recently[86] completed a non-statutory consultation on two further crossings, one at Gallions Reach (connecting Thamesmead and Beckton) and the other at Belvedere (connecting Rainham and Belvedere).

6.1.5 This chapter sets out the benefits of the Silvertown Tunnel as they relate to the Scheme objectives.

[85] TfL, 2015, Connecting the Capital, Our plan for new river crossings for London http://content.tfl.gov.uk/connectingthecapital-newrivercrossingsforlondon-dec-2015.pdf
[86] 2 December 2015 – 12 February 2016

6.2 PO1: Improve resilience of river crossings in the highway network in east and south east London to cope with planned and unplanned events and incidents

6.2.1 The Scheme would directly address the severe and ongoing lack of resilience in the cross-river network in east London by adding an additional tunnel, which would both reduce the number of tunnel closures and greatly reduce the impact of closures when they do occur.

6.2.2 Being built to modern standards, the Silvertown Tunnel would be able to accommodate the tall vehicles currently unable to use the Blackwall Tunnel, but which wish to travel on the A2/A102/A12 corridor. TfL will also develop an operational strategy for both tunnels in order to reduce overheight vehicle incidents. As a consequence, the number of closures at the Blackwall Tunnel (most of which are caused by overheight vehicles) is expected to decrease by around 80 per cent. The modern design of the Silvertown Tunnel would also contribute to fewer incidents and closures.

6.2.3 The presence of the Silvertown Tunnel would also serve to greatly mitigate the impacts of any remaining closures of the Blackwall Tunnel, allowing traffic to re-route with minimal disruption to other roads. The impacts of any possible longer-term closure of the Blackwall Tunnel (for example, for refurbishment) would also be greatly mitigated by the existence of the alternative route.

6.3 PO2: Improve road network performance of Blackwall Tunnel and approach roads

6.3.1 In addition to the benefits relating to better management of disruptive traffic incidents, described above, the general performance of the road network in the vicinity of Silvertown is forecast to improve with the Scheme in place as a result of two factors:

- A reduction in general congestion as a result of increased cross-river road network capacity delivered by the Scheme, which would be carefully managed by the user charge.
- A substantial reduction in the frequency of closures (as a result of the Silvertown Tunnel being able to accommodate tall vehicles). Currently these closures are a cause of delays and congestion on the wider network for road users, including bus and coach passengers.

6.3.2 This improved road network performance would be seen in terms of reduced journey time, enhanced journey time reliability and reductions in delay and

congestion. The Scheme would effectively eliminate the severe congestion which currently routinely affects the Blackwall Tunnel and which is forecast to worsen in future.

6.3.3 All users of the Blackwall and Silvertown tunnels would experience shorter journey times to cross the River Thames as a result of the Scheme, with journey time savings on the immediate approaches to the tunnels of up to 20 minutes in peak periods (excluding any additional reliability benefits).

6.3.4 Through reducing congestion, the Scheme would significantly reduce day-to-day journey time variability. People would have much more certainty about how long a journey is likely to take. The morning peak currently spread across a much longer time than is typical of London, would contract: the Scheme would enable people to travel at the time they prefer to travel rather than leaving early to avoid excessive queues.

6.3.5 The biggest impact in the morning peak would be in the northbound direction, where the Scheme would effectively eliminate the severe queues on the A102 Blackwall Tunnel Approach. The Scheme would save drivers some 16 minutes on a morning peak journey from Lewisham to the Royal Docks. In the evening peak the savings for journeys heading in the southbound direction would be even more significant. The Scheme would deliver savings of around 19 minutes for journeys from Stratford to key destinations on the south side of the Scheme (e.g. Woolwich, Charlton, or Eltham). Journey time savings for additional routes are presented in the Transport Assessment (Document Reference 6.5).

6.3.6 Critical to achieving and maintaining these benefits is the flexible user charge. The DCO would give TfL a general power to set the user charges prior to Scheme opening and to make subsequent variations to them in the future, subject to the Charging Policy. By this means, TfL will keep the user charges under review; and in setting and varying the charges, TfL will have regard to the effects on traffic and the environment.

6.3.7 The Scheme, with the user charge in place, is not expected to lead to any significant increase in highway travel demand, but would greatly improve the efficiency of highway journeys across the river in this location. As a result, congestion that is today caused by both high levels of demand and disruptive traffic incidents would be substantially reduced, particularly at the busiest crossing times.

Public transport impacts

6.3.8 Congestion and delay on the road network have an adverse impact on public transport users by acting as a constraint on the extent and quality of bus and coach services that can be provided.

6.3.9 The Scheme would provide the infrastructure to enable a step-change in cross-river public transport in east London through new cross-river bus services, which would improve public transport links (including links between different modes of public transport) between south-east and east London. Additionally, the Scheme would lead to improvements to bus services on the surrounding network owing to reduced congestion and better journey time reliability.

6.3.10 Buses are a key element of the public transport network as they have the flexibility to fill gaps in rail public transport provision and to connect local communities. The Silvertown Tunnel is designed to accommodate double-deck buses, thus providing operational flexibility in the bus routes that could be extended across the Thames, as well as greater capacity. Where there is demand services can run 24 hours a day and buses provide a low cost transport option which promotes active travel. Over half (53 per cent) of local residents[87] said that they would benefit from new bus services that could be enabled by the Scheme.

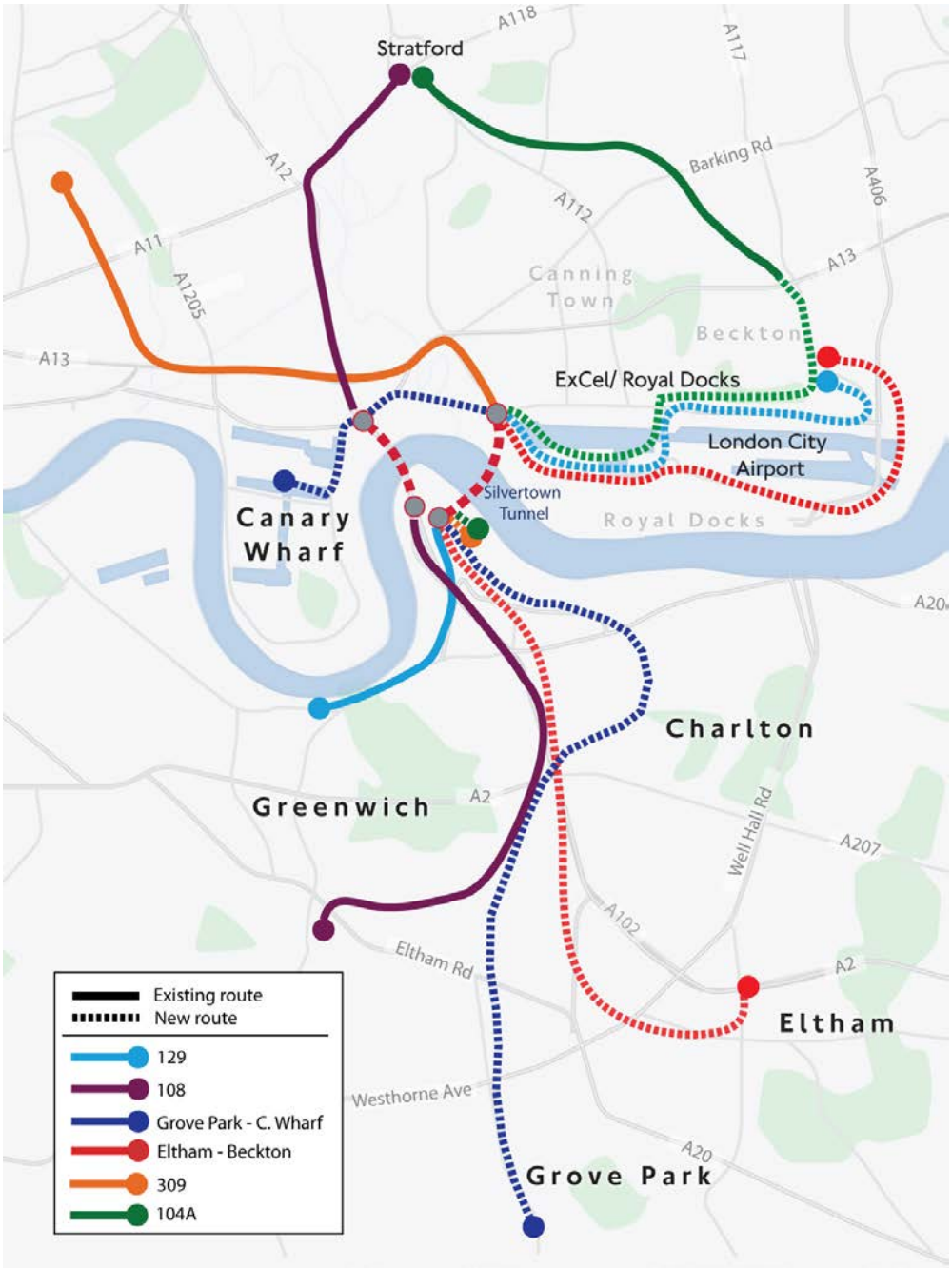
6.3.11 For users this would mean faster and more reliable journeys with shorter wait times for their services. In addition, new direct connections would be opened up for them. Based on the example network developed to assess the Scheme impact, the bus user benefits in travel time are estimated to be £590.5m[88].

6.3.12 TfL has taken account of comments made in the public consultations together with mapping of future growth areas to develop an example bus route network[89] (Figure 6-1) for the purpose of assessing the likely Scheme impacts. This shows four potential route extensions and two potential new services. This could provide around 37.5 buses per hour (bph) across the two crossings (7.5bph through Blackwall and 30bph through Silvertown),

[87] Accent for TfL, 2015, River Crossings Residents Survey.
[88] Both bus and coach figures are over a 60-year period and use 2010 prices.
[89] A detailed proposal will be worked up in advance of the Scheme opening, in accordance with TfL's Bus Service Planning Guidelines.

which would constitute a fivefold increase over the current cross-river service level at the Blackwall Tunnel.

Figure 6-1: Example route network developed for the purpose of assessing scheme impacts



6.3.13 While it is useful to show indicative routes now, east London is undergoing significant change and it is appropriate to confirm services nearer to the Scheme opening to ensure that they best serve the area. As for all TfL's bus route changes, these proposals would be subject to consultation. The

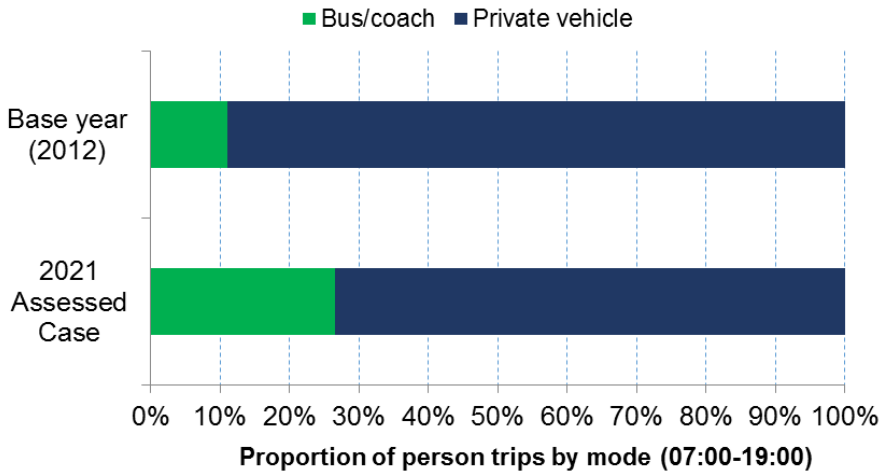
Silvertown Tunnel Implementation Group (STIG) would also have a role in reviewing proposals for cross-river bus services and making recommendations to TfL. TfL has committed to using Euro VI equivalent buses on routes using the Silvertown Tunnel.

6.3.14 Many commuters from Kent into Canary Wharf use coaches, which are currently subject to similar constraints as TfL buses as a result of poor resilience. Coach operators would be able to run more efficient and attractive services as a result of improved reliability and reduced congestion on the Tunnel approaches brought about by the Scheme. There would also be the opportunity to run additional services through the Silvertown Tunnel which could enable coaches to capitalise on improved interchange facilities as a result of North Greenwich bus station improvements (which are already in progress).

6.3.15 For coaches, user benefits in travel time are potentially worth £121.7m[90] by enabling them to increase patronage, use coaches more effectively in the inter-peak and potentially run additional routes and services.

6.3.16 The effect of this additional capacity is to significantly increase the share of trips made through the tunnels using buses or coaches, as shown in Figure 6-2.

Figure 6-2: Change in bus/coach mode share for trips through the Blackwall and Silvertown Tunnels



[90] TfL, 2016, Silvertown Tunnel Economic Assessment Report

6.4 PO3: Support economic and population growth in east and southeast London by providing improved cross-river road transport links

6.4.1 By directly addressing the severance caused by the River Thames in east London, the Silvertown Tunnel would support the significant population and employment growth which is transforming the sub-region. Businesses and commuters alike would benefit from reduced congestion and journey times and the better journey time reliability enabled by the Scheme.

6.4.2 For businesses, there would be reduced costs associated with congestion and the benefits of a bigger labour market within accessible reach. For employees and those seeking work, the Scheme enhances opportunities for travel to major employment centres including Canary Wharf and the Royal Docks.

6.4.3 Access to jobs by public transport is particularly important for regeneration, and as set out in the previous section, the Scheme would provide the infrastructure to enable TfL to run more and better bus services across the river. The charging policy at the tunnels would support public transport: buses and coaches would not be charged at any time and would also benefit from the dedicated lane for heavy vehicles.

6.4.4 The connectivity benefits brought by the Silvertown Tunnel directly support access to jobs and labour markets, for journeys made by both car and public transport as tested in the Assessed Case (shown in Figure 6-3 and Figure 6-4 respectively).

Figure 6-3: Change in job accessibility by car (2021 Reference Case v Assessed Case) based on journey time – AM peak hour

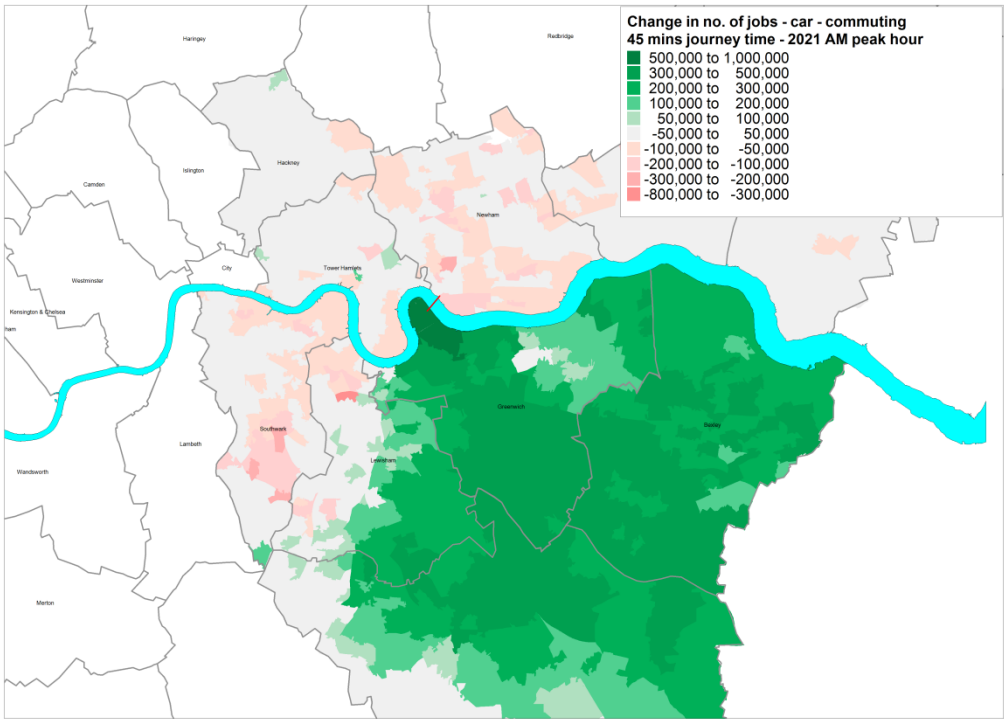
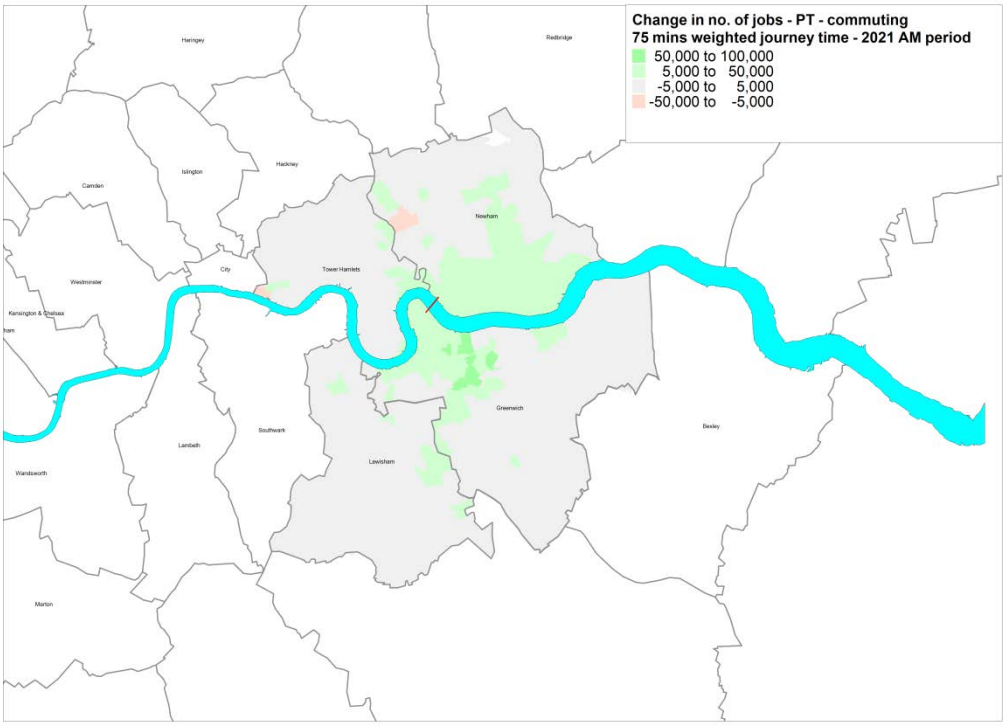


Figure 6-4: Change in job accessibility by PT (2021 Reference Case v Assessed Case) based on generalised time – AM peak period (07:00-10:00)



6.4.5 The benefits of the Scheme are of course tempered – for some users – by the user charge which must be offset against the gains made from time savings and reliability. Table 6-1 and Table 6-2 below show high net user benefits for all vehicle types apart from goods vehicles – the latter have user time and vehicle operating benefits, but these are outweighed by the relevant user charges. As noted in the Outline Business Case (Document Reference 7.8) the value which goods vehicle users place on reliability is likely to be underestimated, which would mean this potential disbenefit is overestimated.

Table 6-1: Summary economic results (initial) by users (£m, 2010 prices)

User Class	All modes	Cars	LGVs	HGVs	Coach	Bus
Commuting	£262.7	£12.6	£0	£0	£121.7	£128.3
Other	£477.4	£74.8	£0	£0	£0	£402.6
Business	£345.4	£451.3	-£36.7	-£128.8	£0	£59.6
Total	**£1,085.6**	**£538.8**	**-£36.7**	**-£128.8**	**£121.7**	**£590.5**

Table 6-2: Summary economic results (adjusted for reliability) by users (£m, 2010 prices)

User Class	All modes	Cars	LGVs	HGVs	Coach	Bus
Commuting	£291.1	£41.1	£0	£0	£121.7	£128.3
Other	£549.1	£146.5	£0	£0	£0	£402.6
Business	£503.1	£531.5	£20.8	-£108.7	-£0	£59.6
Total	**£1,343.4**	**£719.1**	**£20.8**	**-£108.7**	**£121.7**	**£590.5**

6.5 PO4: To integrate with local and strategic land use policies

6.5.1 The Planning Policy Compliance Statement (Document Reference 7.2) provides a full assessment of the Scheme against planning policy: this section highlights some features of the Scheme which enhance its local integration. The new Tunnel would be constructed on land which has been safeguarded since 1995; by using a bored tunnel (rather than a bridge or an immersed tunnel), the land available for development above the new structure is optimised. Building the Silvertown Tunnel would release land for development which has so far been unavailable or constrained owing to the safeguarding.

6.5.2 TfL's design for the Scheme seeks to integrate well with the existing surroundings while at the same time anticipating the future development of the area so that further changes to road layout or infrastructure can be undertaken by boroughs or developers as appropriate. In this way the Scheme is 'future-proofed' as the existing industrial uses on both sides of the river develop increasingly towards mixed-use and residential users. Where possible, opportunities to improve pedestrian and cycle facilities have been taken.

6.5.3 On the southern side the Greenwich Peninsula is undergoing major redevelopment through the implementation of property developer Knight Dragon's masterplan and in alignment with RB Greenwich's Peninsula West SPD. There is an opportunity for the Silvertown Tunnel scheme to help to overcome some of the severance caused by the tunnel approach roads, and to prepare the Peninsula West SPD area for future regeneration opportunities, by enhancing connectivity and wider linkages between the riverfront and the rest of the Peninsula.

6.5.4 There would be improvements to the public realm, walking and cycling as a result of the proposed highways layout of the Scheme. Enhanced cycle provision has been provided on all new routes where cycling is permitted. The detail of this provision is subject to detail design and further discussion with the host boroughs, however the illustrative design presented in the Design and Access Statement (DAS) (Document Reference 7.3) shows TfL's preferred approach. Improvements for pedestrians and cyclists through the Scheme would also include better links to the Emirates Air Line, which would help to make getting across the river easier at this location.

6.5.5 At Boord Street, the existing footbridge would be replaced with a wider and more accessible bridge. The footbridge would also be repositioned so that it is aligned with from Boord Street, improving legibility, visibility and providing

assurance to pedestrians and cyclists that they can safely cross the busy Blackwall Tunnel approach road. The result will be a more direct and coherent east-west route across the Greenwich Peninsula for pedestrians and cyclists. Step-free access to the footbridge would be maintained during the construction phase.

6.5.6 Improvements at the northern portal focus on Tidal Basin roundabout, which would be connected directly to the Silvertown Tunnel. The existing roundabout would be significantly reconfigured by the Scheme with improved public realm for pedestrians and better facilities for cyclists. Dock Road would be realigned with a new cycle way constructed along the route of National Cycle Route 13 (between Tidal Basin Roundabout and the pedestrian link under Silvertown Way). Outside the Scheme, TfL would contribute to borough improvements to cycle improvements and the public realm along North Woolwich Road[91] so that is better integrated with the improved Dock Road. The Scheme design allows for the future provision of a pedestrian and cycle link over the Silvertown Tunnel approach road that would connect directly to the forecourt of the proposed Thames Wharf DLR station.

6.6 PO5: To minimise any adverse impacts of any proposals on communities, health, safety and the environment

6.6.1 The Scheme would increase the throughput of vehicles through the tunnels at the busiest times without causing increases in traffic, by virtue of adding new capacity and at the same time managing demand with a user charge.

6.6.2 Because it can be varied over time, the user charge helps to ensure that the benefits of the Scheme are secured over the long-term and acts as 'embedded mitigation' for environmental impacts that the Scheme could otherwise have.

6.6.3 The Scheme would reduce traffic volumes along the existing Blackwall Tunnel approach roads which are currently included within Borough Air Quality Management Areas[92]. The Scheme would also provide the

[91] Between the edge of the Scheme's Limits of Deviation (LoD) at Dock Road and the existing off-road provision at West Silvertown DLR.
[92] An Air Quality Management Area is an area designated by the local authority, where UK air quality objectives are unlikely to be met.

infrastructure to facilitate more frequent cross-river bus services at this location, thereby promoting a greater use of sustainable transport.

Joining up communities

6.6.4 The Silvertown Tunnel would improve connectivity between communities across the river by reducing congestion and improving journey reliability for private and public transport users. The Scheme would facilitate significantly enhanced bus services which would provide a relatively low-cost alternative to the private car and reduce the severance effect of the River Thames.

6.6.5 For those who drive across the river, there would be opportunities to make cost savings on the user charge by registering for an account or by changing the times of travel from peak to off-peak or outside of the hours of charging or potentially via discounts and exemptions.

Safety

6.6.6 The Silvertown Tunnel would provide safer conditions than at Blackwall Tunnel due to the fact that it is a tunnel designed to modern standards, including on vehicle height. As traffic demand is forecast to reduce as a result of the Scheme, there would be a marginal positive impact on the number of accidents.

6.6.7 The junction tie-ins would be designed to relevant highway standards and TfL Streetscape Guidance, including measures to promote pedestrian and cyclist safety. Enhanced cycle provision has been provided on all new routes where cycling is permitted. The detail of this provision is subject to detail design and further discussion with the host boroughs, however the illustrative design presented in the DAS (Document Reference 7.3) shows TfL's proposed approach.

Environment

6.6.8 The air quality assessment concludes that the Scheme will not result in a significant effect on air quality.

6.6.9 From September 2020, all buses in central London must meet new emissions standards (Euro VI) owing to the introduction of the Ultra Low Emission Zone (ULEZ). From 2016 TfL will start to change its fleet so that all

double deck buses operating in central London are hybrid and all single deck buses are zero emission[93] (e.g. electric or hydrogen). TfL would use at least ULEZ-compliant buses on routes using the tunnels.

6.6.10 In developing the Scheme, TfL is seeking to be a leader in engineering sustainability and is working to achieve a CEEQUAL sustainability rating of Excellent.

6.7 PO6: To ensure where possible that any proposals are acceptable in principle to key stakeholders, including affected boroughs

6.7.1 TfL continues to engage with the local boroughs and other stakeholders in developing the Scheme and has consulted these bodies extensively. The Consultation Report (Document Reference 5.1) describes how TfL has engaged with the public and stakeholders and how their views have been taken into account in developing the Scheme.

6.7.2 As described in Chapter 4, a governance process would be put in place to oversee the setting of the user charge by TfL, which entails the involvement of the Silvertown Tunnel Implementation Group (STIG). This would comprise representatives from the local boroughs and constitutes a means of ensuring their ongoing involvement in the Scheme and its effects in operation.

6.7.3 STIG would have a role in reviewing the monitoring data collected by TfL (on traffic, environmental and socio-economic impacts) and in making recommendations with regard to localised mitigations and variations to the user charge. It would also be able to review and make recommendations with regard to the cross-river bus network.

6.7.4 In consultations support for a new crossing at Silvertown has been consistently high: over 80 per cent in the first river crossings consultation; 76 per cent in the second; and 83 per cent in the most recent non-statutory consultation[94]. In the 2015 statutory consultation, 58 per cent of respondents answered that they supported the Silvertown Tunnel scheme and 31 per cent stated that they were not in support[95].

[93] At tailpipe
[94] The following non-statutory consultations: River Crossings consultation Feb-Mar 2012; River Crossings consultation Oct 2012-Feb 2013; Silvertown tunnel Oct-Dec 2014
[95] Eleven per cent did not answer the question

Additional benefits – managing construction and operational impacts

6.7.5 TfL would seek to manage and mitigate the impacts of construction on the areas around the Tunnel portals, and seek opportunities for long-term mitigations and enhancements.

6.7.6 In the construction phase, TfL has committed to transport at least 50% by weight of all materials associated with the Scheme by River, as further described in the Code of Construction Practice (CoCP) (Document Reference 6.10). Visual and acoustic screening would also be possible around the Tunnel approaches.

6.8 PO7: To achieve value for money and, through road user charging, to manage congestion

6.8.1 Based on the Assessed Case user charges, the Scheme has a positive Net Present Value (NPV) of £783m[96] (without reliability benefits) and £1,041m (with reliability benefits) – it is therefore a scheme with a very positive economic outcome. Each user class (commuting, business and other trips) has positive net benefits (benefits less charges) over the 60 year appraisal. Including reliability, there are expected to be high net user benefits for all vehicle types apart from Heavy Goods Vehicles (HGVs). HGVs will have user time and vehicle operating benefits, but these are outweighed by the relevant user charges under the Assessed Case. Further detail on this can be found in the Economic Assessment Report (EAR) (Document Reference 7.8).

6.8.2 The Silvertown Tunnel itself is not expected to generate significant additional demand for cross-river trips. Rather, demand for the additional capacity provided would be managed through user charging to reduce existing congestion, suppress induced traffic and maintain optimal road network performance.

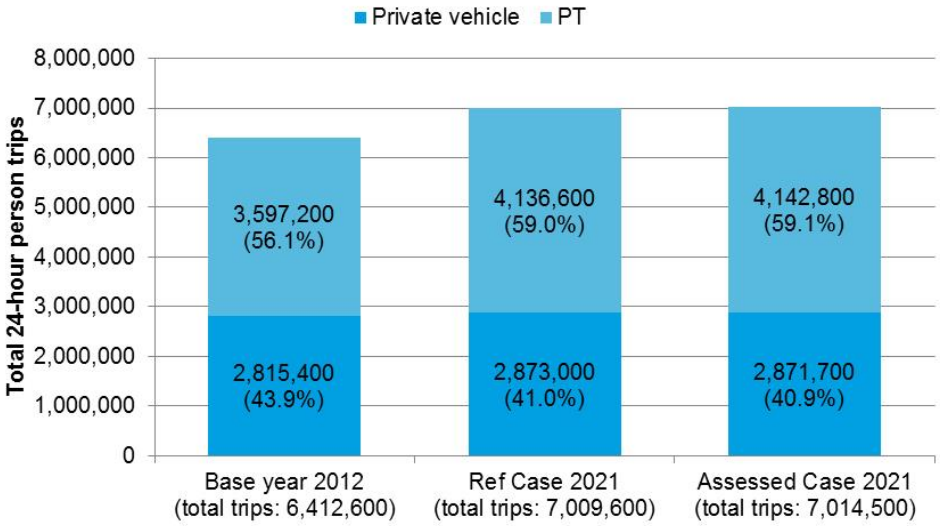
6.8.3 With the modelled charges assumed in the Assessed Case[97] in place, the Scheme would result in a very limited overall change in traffic demand for the two tunnels compared with the Reference Case (i.e. a future without the

[96] All present values shown are in 2010 prices, discounted over a 60 year appraisal period to 2010 and are quoted in the Market Price unit of account. TfL, 2016, Economic Assessment Report
[97] Appendix B of the Transport Assessment (Document Reference 6.5) provides more information on how TfL has considered the induced demand potential

Silvertown Tunnel). There is likely to be some change in the distribution of trips or changes to routes, but analysis of London travel data in the period 1993-2012 shows that trip rates generally remain relatively constant, despite changes to highway and public transport provision[98]. By retaining the flexibility to adjust the charge in the future, TfL can be responsive to events or trends which influence traffic levels and thereby ensure that the Scheme continues to meet its objectives.

6.8.4 TfL has modelled trip rates and mode share in the east sub-region in 2021 with and without the Scheme, and compared this to a baseline of 2012[99], shown in Figure 6-5. As would be expected given population and employment growth, there is an increase in trip-making: for public transport this increase is very significant and for private transport it is smaller but still significant. This is a reflection of the additional public transport provision (including cross-river bus services tested in the Assessed Case) planned for the coming years. The public transport mode share is expected to increase from its current level to around 59 per cent in 2021, regardless of whether the Scheme is in place. The Scheme would therefore not affect the continuing trend towards public transport. Indeed, there is even a very slight increase in public transport mode share with the Scheme in 2021.

Figure 6-5 Total trips by mode in east sub-region, 2012 base year and 2021 Reference Case and Assessed Case (24 hours)



[98] WebTAG also assumes constant trip rates within demographic sectors.
[99] See Transport Assessment (Document Reference: 6.5) for full details of modelling

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7. THE SCHEME IN CONTEXT

7.1 TfL's approach to managing London's growth

7.1.1 London's population is expected to rise from 8.6 million to 10 million by 2030. This means an extra 5 million trips a day by 2030 by both private and public transport, on top of the 30 million daily trips taking place currently. While the proportion of these trips made by public transport will rise to almost 60 per cent regardless of whether the Scheme is in place, there will inevitably be additional vehicle trips as a result of this population increase.

7.1.2 TfL's plan for accommodating this growth is wide-ranging and is guided by the objectives of the Mayor's Transport Strategy. It is critical that the consequent rise in demand for transport is accommodated in a timely and sustainable way, and that any adverse impacts of increased travel demand, especially on the environment, are appropriately managed. This means taking full advantage of opportunities to increase public transport, walking and cycling and maintain London's excellent track record in increasing the share of these modes. At the same time it is vital to recognise that some types of journey – the construction, servicing and delivery trips that keep the Capital alive – must be made by road, and that making our roads work well is therefore critical.

7.1.3 There is no single scheme or policy that will successfully accommodate this significant growth. This document necessarily focuses on the case for improving the road crossing facilities between North Greenwich on the south side and Blackwall and the Royal Docks on the north side of the River Thames.

7.1.4 Only a new road crossing at this location can address the ongoing and severe problems of congestion, closures and a lack of resilience at the Blackwall Tunnel: measures to improve the situation without adding capacity will not by themselves suffice. There is no doubt that the need for a reliable road crossing at this location has not been adequately met, and, with the level of growth forecast, and its concentration in east London, the consequences of this mismatch between provision and demand will have increasingly adverse effects. These extend beyond business and economic impacts to increased community severance and worsening noise and air quality locally.

7.1.5 Road-building is a fairly uncommon approach in London today and there has been no new investment in road capacity in the Capital since the 1960s. New road-building can nevertheless be an appropriate and sustainable highway intervention, as is recognised in the London Plan.

7.1.6 The introduction of a user charge to manage demand at both tunnels will ensure that the Scheme benefits are locked-in for the long-term, as well as providing a way of paying for the new infrastructure. Critically, a flexible user charge will ensure that the traffic and environmental effects of the Scheme which are contingent on traffic demand can be managed sustainably. The Charging Policy (Document Reference 7.11) and the strategic and local approaches to monitoring[100] which are integral to the DCO are the means of ensuring that, even with changing circumstances, the user charge remains an effective tool in this respect.

7.1.7 The Silvertown Tunnel would serve as a primarily local cross-river link, enabling the Blackwall Tunnel to perform better its strategic role in the east London highway network. It will significantly reduce current traffic congestion locally improving traffic flow and provide a much-needed alternative route for when the Blackwall Tunnel is unavailable. The importance of a sustainable, fully functioning road crossing at this location in east London for the UK economy is declaratory of the Scheme's national significance.

7.1.8 Overall the Scheme must be understood as only one of the many ways in which TfL is meeting the challenge of a rapidly-transforming London. Finding the right solution for the problems of the Blackwall Tunnel is an important part of this response but it is by no means the only solution required. Many consultation respondents noted the need to take forward public transport, walking and cycling schemes as well or instead of the Silvertown Tunnel. This concluding section will place the Scheme in the context of the many projects that TfL is undertaking to keep a growing London moving while managing the social, environmental and economic effects of transport.

7.2 River Crossings in east London

7.2.1 In Chapter 2 the development of London from Victorian times to the present day was described in terms of its influence on river crossings, noting the bias

[100] The Monitoring Strategy (Document Reference 7.6) and the Traffic Impacts Mitigation Strategy (TIMS) (Document Reference 7.7)

towards development in the west. More recently, there has been a sustained investment in public transport capacity in east London (notably the Jubilee Line extension and DLR to Woolwich) leading to a tenfold increase in capacity: this is reflected in the overwhelming preference for public transport as a way to cross the river. Just over two per cent of Greenwich and Newham residents make a cross-river trip by car each day, and fewer than one per cent in Newham[101].

7.2.2 Over the next twenty years, thirteen additional river crossings are planned in London,[102] six of which are for pedestrians and/or cyclists, including three bridges in east London (Rotherhithe to Canary Wharf, North Greenwich to the Isle of Dogs and Charlton to Royal Docks).

7.2.3 Non-fixed links can be delivered quickly: additional piers are currently proposed at Canary Wharf East (due to be delivered by Spring 2017),and at North Greenwich West (due to be delivered as part of the Greenwich Peninsula Masterplan). It is expected that that these piers will accommodate River Bus services, with an added potential to provide a dedicated cross-river ferry service for pedestrians and cyclists between the Greenwich Peninsula and Canary Wharf. Initial feasibility work on such a service is expected to commence in mid-2016. There are also plans for new ferry service between Rotherhithe and Canary Wharf in the short term ahead of a new bridge.

7.2.4 It is also important to maintain existing assets. For larger vehicles, and for pedestrians and cyclists, the Woolwich Ferry provides an important alternative to the Blackwall and Rotherhithe Tunnels. However, its infrastructure (including the ferry vessels) dates from 1963 and as such is recognised to be near the end of its operational life. Recently, work was completed to the jetties and loading bridges on both sides of the river. In addition to these life extension works, TfL is also investigating various potential improvement options to the vehicle waiting areas at both the northern and southern terminals, which would reduce the adverse effects of queuing on the local roads.

[101] Source: LTDS 2011/12-2013/14 (TfL analysis). RB Greenwich 2.4%, LB Newham 2.1%, LB Tower Hamlets 0.5%
[102] TfL, 2015, Connecting the Capital, Our plan for new river crossings for London http://content.tfl.gov.uk/connectingthecapital-newrivercrossingsforlondon-dec-2015.pdf

7.2.5 East and south east London will also benefit from major new rail links: Crossrail from Woolwich to Custom House and central London (opening 2018) and a London Overground extension from Barking Riverside to Thamesmead (which could start operation in 2021)[103].

7.2.6 Complementing these new east London links will be four road-based crossings: the Silvertown Tunnel, Gallions Reach, Belvedere and the Lower Thames Crossing (a Highways England scheme)[104]. It should be reiterated that road crossings are not for the exclusive use of private or commercial vehicles. The east London road crossings could significantly enhance public transport: the Silvertown Tunnel alone provides an opportunity to increase bus services across the river five-fold. TfL has recently completed a consultation on crossings at Gallions Reach and Belvedere, both of which could be multi-modal crossings carrying pedestrians and cyclists as well as vehicles and public transport in the form of buses or trams. Eighty-eight per cent of respondents supported one or both of these crossings, and seventy-seven per cent of respondents supported both crossings[105]. Subject to the planning process, these two crossings could be open in 2025.

7.2.7 A rapidly-growing east London needs some road crossings as part of its overall transport landscape, and the projects outlined here will begin to address this need. But it is incumbent on TfL to ensure that the environmental impacts of this new capacity are properly-managed and that the benefits are long-lasting: for this reason user-charging will be intrinsic to success.

7.3 Getting the most out of London's road network

7.3.1 As well as planning new crossings where these are needed, TfL is actively implementing approaches which optimise the use of existing road space.

7.3.2 Roads and streets account for 80 per cent of the public space in London, 80 per cent of all journeys and 90 per cent of all goods moved. Every day around 24 million journeys are made on London's roads[106]. With increasing

[103] Subject to powers being secured.
[104] A consultation on the routes for Option C of this crossing ran from 26 January-24 March 2016 www.highwaysengland.citizenspace.com/cip/lower-thames-crossing-consultation

[105] The Consultation Report, and other information, is available at www.tfl.gov.uk/east-london-crossings
[106] Response to Roads Task Force Report, TfL (July 2013)

development, there are greater and more diverse demands placed on these roads while at the same time it is increasingly important to balance our aspirations for better places and routes for pedestrians and cyclists.

7.3.3 With this challenge in mind, TfL is overseeing the largest ever investment in London's roads and streets through its £4bn Road Modernisation Plan. This plan comprises projects and programmes that will transform some of the busiest roads and junctions in London making them safer and more attractive for all road users including vulnerable road users. This includes 17 major schemes to unravel gyratory systems and improve key junctions, creating vibrant public spaces and safer facilities for cyclists and pedestrians. Flagship schemes include Elephant & Castle, Vauxhall gyratory, Waterloo Imax and Euston Road.

7.3.4 In east London, work has recently started at Bow Roundabout to put in place signalised pedestrian and cyclist crossings; this is the first step in an ambitious plan which TfL is developing with LBs Newham and Tower Hamlets to transform the roundabout and its vicinity. TfL will consult on proposals in summer 2016.

7.3.5 Buses are a critical part of London's public transport success. The Plan will invest £200million in road improvements to make sure our buses continue to be reliable and serve London's growing population, consisting of two major programmes. Bus Priority Pinch Points will target areas where buses are unreliable and suffer from delays. High quality Bus Priority Corridors will create and improve public transport links to London's Opportunity Areas.

7.3.6 For cyclists, there is a significant programme underway to put in place over 50km of fully segregated cycle ways and a further 16km of new cycle tracks, putting over 4 million Londoners within a 30 minute cycle journey of central London. This programme includes the East West Cycle Superhighway - a new cycle track through the heart of London, physically segregated from traffic and providing a safe and continuous connection between Tower Gateway and White City. Work has now begun on two new free cycle parking hubs at Hounslow West and North Greenwich stations as part of the Mayor's commitment to provide 80,000 new cycle parking spaces by the end of 2016.

7.3.7 For pedestrians, the Plan includes a commitment to more than double the number of Legible London wayfinding signs and to ensure that all TfL's pedestrian crossings meet accessibility standards by 2016. A £20million road safety technology fund is being established to develop new road safety

and autonomous vehicle technologies in London and help to meet the target of reducing the most serious road casualties by 50 per cent.

7.3.8 Locally, £148m has been identified in 2016/17 for boroughs' transport and public spaces schemes to improve transport and public spaces 2016/17, for example Bank Junction, Tottenham Court Road and Cambridge Circus.

7.4 The environmental impact of transport

7.4.1 A better-functioning road network will improve environmental impacts by making journeys smoother and by providing a more inviting place for cyclists and pedestrians. There are opportunities to optimise these benefits by incentivising the use of low or zero emission vehicles as well as encouraging people to use sustainable modes on the roads.

7.4.2 At the Silvertown Tunnel, passengers on low emission buses will benefit from the use of a dedicated heavy-vehicles lane. Buses and coaches – as the most sustainable ways to move people – will not be charged to use the tunnels. As we have seen, the Scheme will enable a significant enhancement to bus services. Drivers of cars and vans will be incentivised to use low emission vehicles in order to benefit from a 'green' discount.

7.4.3 Greater London was designated a Low Emission Zone (LEZ) in February 2008, requiring larger diesel vehicles to meet specified Euro emissions standards to drive in Greater London without paying a daily charge[107]. The scheme has been successful in removing the oldest, most-polluting vehicles from London's roads thereby reducing emissions of particulate matter[108], which is harmful to human health.

7.4.4 In May 2015 the Mayor confirmed the implementation of an Ultra Low Emission Zone (ULEZ). This will require all vehicles travelling in central London, including TfL's buses to meet emissions standards from September 2020. It has also changed the licensing requirements for all taxis and PHVs in London so that by 2030, all taxis and PHVs in London will be zero

[107] These are European Union standards that limit the levels of air pollutant emissions for new vehicles sold in Europe, with which all vehicles manufacturers must comply. The standards become more stringent over time.
[108] LEZ is currently achieving 99 per cent compliance with the Euro 3 for PM standard for vans and minibuses and 96 per cent compliance with the Euro IV for PM standard for HGVs, buses and coaches

emission capable. Over £60m has been identified to help this transition[109] and by the time the Silvertown Tunnel scheme opens, significant progress will have been made.

7.4.5 In central London, TfL intends to meet the ULEZ standards by operating only zero emission single-deck and hybrid buses. In turn this will have benefits outside the zone as routes extend beyond central London. In parallel, other improvements will reduce emissions from buses: by spring 2016 one third of TfL's bus fleet will be running on B20 green diesel and by the end of 2016 more than one in five of the fleet will be electric hybrids, with the world's first purpose-built fully electric double-deck bus beginning operation on Route 98 in the summer.

7.4.6 At the Silvertown Tunnel, TfL is committed to using Euro VI-equivalent buses, exceeding this standard and aligning with the ULEZ requirements. Developments in bus technology may mean that even 'cleaner' buses are in use by the time the Scheme opens.

7.4.7 In July 2015 TfL published 'An Ultra Low Emission Vehicle Delivery Plan for London' which sets out the plan to make ULEVs part of London's public transport offer. Among its commitments are the expansion of the Source London charging network[110], the introduction of a rapid-charging network in London and measures to increase commercial uptake of ULEVs.

7.4.8 In January 2016, TfL launched a new industry-led programme (LoCITY) to reduce the emissions of London's freight and fleet operators. The five-year programme will increase the availability of low emission commercial vehicles and improve electric charging infrastructure.

7.4.9 TfL has recently been awarded £13m from the Office for Low Emission Vehicles (OLEV) as part of Government funding to drive the uptake of low and ultra low emission vehicles (from the City Schemes fund). The money will be used to improve vehicle charging infrastructure and to bring forward borough schemes to increase the use of these vehicles. Separately, TfL has invited bids from London boroughs to become Low Emission

[109] £25m from Government for ZEC taxi purchase grant; £40m from TfL for a decommissioning scheme for older taxis.
[110] Since 2009, the Source London partners have delivered 1,400 publically accessible charge points in the Capital

Neighbourhoods (LENs) and is expecting to announce the schemes later in 2016.

7.5 Maintaining London's strong public transport mode share

7.5.1 In Section 2.12, it was described how the public transport mode share has continued to grow in London, in the context of increased population and demand for travel. Changes to modal share have not, however, been uniform: car travel has declined while demand for cycling and public transport modes has increased, outstripping even the population growth. Since 2000, public transport modes have all seen increases in passenger numbers to varying degrees, with the number of trips on London Underground up by 20 per cent, trips by National Rail in London up over 50 per cent, and bus trips increasing by 70 per cent[111].

7.5.2 It is important to maintain this pattern in future as London continues to grow. To achieve this, TfL will continue to invest and innovate in these sustainable modes.

7.5.3 On the Underground, significant improvements have already been made to keep up with increased demand as a result of London's growth. Despite now carrying a record number of passengers (1.3 billion journeys made in 2014/15), delays on the Underground have been reduced by more than a third since 2011. On the Victoria, Jubilee and Northern lines, reliability has improved by 74 per cent, 67 per cent and 40 per cent respectively. An increasing number of stations have step-free access[112] and the station accessibility fund will be doubled in 2016/17 to help achieve the target of half all rail and Tube stations being step-free by 2018[113].

7.5.4 The Tube Upgrade programme has already added more capacity on the Northern, Victoria and Jubilee lines. The next major phase of this work will bring faster, more frequent and more reliable journeys to millions of passengers who use the Circle, District, Metropolitan and Hammersmith & City lines. This will mean the frequency of trains running during peak periods will increase to 32 trains per hour in central London - a train every two minutes - with frequency increases at other times as well. Line upgrades will deliver more than 30 per cent increase in capacity.

[111] TfL, 2014, Drivers of Demand for Travel in London
[112] 66 stations as at January 2016
[113] TfL Budget and Business Plan, 2016/17

7.5.5 In 2017, tunnelling will begin for the Northern Line extension, the first major Tube extension since the late 1990s, extending the line from Kennington to Battersea Power Station via Nine Elms. On the Overground, a fifth carriage has been added to trains on most lines.

7.5.6 Crossrail, a new west to east link, will open as the Elizabeth line in 2018 and add ten per cent to London's rail capacity. Recently TfL completed a consultation on Crossrail 2, which would also add ten per cent to current rail capacity.

7.5.7 Public transport mode share in the east sub-region is forecast to increase from its current level (around 56 per cent) to around 59 per cent regardless of whether the Scheme in place. Indeed, as a result of the enhanced bus and coach opportunities afforded by the Scheme, there is forecast to be a small increase in public transport mode share compared to a future without the Scheme. The Scheme would not encourage people to drive, and should be understood as a sustainable road-based intervention in a landscape dominated by increased provision for and uptake of public transport, walking and cycling.

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Appendix A STRATEGIC OPTIONS BACK CHECK

A.1 Introduction

A.1.1 This matrix presents a back-check of the various river crossings options assessed by TfL since 2009. The purpose of this back-check is to present the options in a single overview showing the potential of each option to meet the project objectives. Furthermore, it is of course the case that external circumstances change over time and for this reason it was important to revisit options again in summer 2015 to check that the proposed scheme remained the best approach to the problems identified.

A.1.2 To address the problems of congestion, closures and incidents, and resilience at Blackwall, an option needs to score positively against PO1 and PO2. Options that do not meet these objectives have hence not always been developed to a level of detail which allows for scoring against the remaining objectives. Where options have been developed outside the context of this project, e.g. EAL, the assessment is included in this back-check.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
		To improve the resilience of the river crossings in the highway network in east and southeast London to cope with planned and unplanned events and incidents.	To improve the road network performance of the Blackwall Tunnel and its approach roads.	To support economic and population growth, in particular in east and southeast London by providing improved cross-river transport links.	To integrate with local and strategic land use policies.	To minimise any adverse impacts of any proposals on communities, health, safety and the environment.	To ensure where possible that any proposals are acceptable in principle to key stakeholders, including affected boroughs.	To achieve value for money and, through road user charging, to manage congestion.	
1	**Walking and cycling only options**								
1A	Pedestrian & cycle bridge between Rotherhithe and Canary Wharf (proposed by Sustrans)	No. Would not impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✘	No. Some mode shift from private transport to walking & cycling possible, however the number of trips that could switch modes is limited given journey type, purpose and origins and destinations. ✘	Partly. Improved connectivity will support growth, though limited to locations immediately adjacent to the river and the crossings rather than wider sub regions. --	The scheme is being progressed by Sustrans. It is assumed that the scheme would be designed to integrate with local land use policies.	The scheme is being progressed by Sustrans. It is assumed that the scheme would be designed to minimise adverse impacts.	The scheme is being progressed by Sustrans. It is assumed that the scheme would be designed and implemented to achieve stakeholder support.	Road user charging not applicable	TfL is now supporting Sustrans in the further development of this option as part of the wider East London River Crossings Programme. Plans exist for new ferry service between Rotherhithe and Canary Wharf in the short term and for a dedicated pedestrian and cycle bridge in the long term. We are in the process of planning to undertake market engagement to seek industry experts' advice and input to this project and test what can be delivered using the most cost effective solutions.
1B	Pedestrian & cycle bridge between North Greenwich &	No. Would not materially impact demand or incidents at the	No. Some mode shift from private transport to walking &	Partly. Improved connectivity will support growth, though	Partly. A range of options have been considered, one of which	Detailed assessments have not been carried out as this option	Such a scheme has been strongly supported by RB Greenwich and LB Tower Hamlets in	Road user charging not applicable	

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
	Canary Wharf	Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✗	cycling possible, however the number of trips that could switch modes is limited given journey type, purpose and origins and destinations. ✗	limited to locations immediately adjacent to the river and the crossings rather than wider sub regions. --	would require demolition of residential buildings. --	does not meet some of the key objectives and similar alternatives in form of the EAL and the pedestrian & cycle bridge between Rotherhithe & Canary Wharf have been/are being progressed.	the past.		
1C	Pedestrian & cycle bridge between North Greenwich & Silvertown	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✗	No. Some mode shift from private transport to walking & cycling possible, however the number of trips that could switch modes is limited given journey type, purpose and origins and destinations. ✗	Partly. Improved connectivity will support growth, though limited to locations immediately adjacent to the river and the crossings rather than wider sub regions. --	Yes. Land has been safeguarded for a river crossing at Silvertown but may conflict with an additional road crossing at this location. ✓	Detailed assessments have not been carried out as this option does not meet some of the key objectives and a similar alternative in form of the EAL has been progressed.	No report on stakeholder engagement included in this assessment.	Road user charging not applicable	
	Summary (walking and cycling only options)	Walking and cycling measures are unlikely to be able to achieve any significant reduction in demand which would be needed to address the problems at the Blackwall Tunnel. This is because, owing to the characteristics of the trips made through the Blackwall Tunnel, there is little potential for mode shift to active modes. Hence demand for vehicle crossings would not be reduced enough to make any difference in terms of congestion reduction (even when combined with demand management initiatives such as road user charging). Furthermore they do not offer a realistic alternative in case of incidents or closures and hence do not provide short- or long-term resilience. While not being taken forward to find a solution to the problems at the Blackwall Tunnel, some of the options listed above have merits in their own rights. As a result a number of options and have been progressed as part of a wider East London River Crossings Programme. Finally, the Emirates Air Line opened in 2012 which provides a connection for							

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
		pedestrians and cyclists between the Greenwich Peninsula and Silvertown.							
2	**Public transport options**								
	Rail options (including light rapid transit & heavy rail)								
2A	Multimodal road / DLR crossing at Silvertown	Yes. The road element (provided there is sufficient capacity) would provide increased resilience of the highway network in the sub regions. ✓	Yes. A road & DLR crossing would improve road network performance on the Blackwall corridor and ease congestion by providing additional capacity and generating mode shift, even if the latter is small. ✓	Yes. Improved connectivity in form of a road and DLR crossing would support local and sub regional growth. ✓	No. The scheme would limit full utilisation of all the existing capacity on the current lines serving the Royal Docks, the land-use plans for which assume full capacity use of the DLR. ✗	Detailed assessments have not been carried out at this stage as the scheme is limited in other aspects including engineering feasibility & transport operations (see below).	A DLR extension to Kidbrooke/Falconwood/Eltham is strongly supported by RB Greenwich.	No. Very high scheme cost due to engineering constraints. Very high user charges would be necessary to make the scheme more affordable. ✗	The option was ruled out on engineering feasibility & transport operation grounds (see comments following 2B). The same conclusion was reached in the back-check.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
2B	DLR from Canning Town to Falconwood	No. Potential for small reduction in demand at the Blackwall Tunnel, but minimal reduction in the number of unplanned incidents. No realistic alternative in case of incidents. ✘	No. Some mode shift from private transport to public transport possible, but the number of trips that could switch modes is limited. Not all trips can shift to public transport given journey purpose, vehicle type and origins and destinations. This is supported by experience from the Jubilee Line Extension at this location. ✘	Partly. Improved connectivity will support growth, although highway access to growth areas would remain constrained. --	No. The scheme would limit full utilisation of all the existing capacity on the current lines serving the Royal Docks, the land-use plans for which assume full capacity use of the DLR. ✘	Detailed assessments have not been carried out at this stage as the scheme is limited in other aspects including engineering feasibility & transport operations (see comments).	A DLR extension to Kidbrooke/Falconwood/Eltham is strongly supported by RB Greenwich.	High scheme cost due to engineering constraints. Road user charging not applicable though fare revenue would be collected.	The option was ruled out on engineering feasibility & transport operation grounds (see comments below). The same conclusion was reached in the back-check.
	Comments on Options 2A and 2B	Initial consideration has been given to the feasibility of extending the DLR network via the Silvertown Tunnel to serve the Kidbrooke, Eltham and Falconwood areas of south Greenwich. This would involve running new services to and from Stratford International, on the basis that spare capacity is available on this branch but not for additional services to Bank/Tower Gateway. Whilst such an extension could go some way towards improving public transport connectivity in the area around the Silvertown Tunnel, several major challenges exist which mean it is not deemed to be a viable option. No feasible options have been identified for connecting the extension to the existing network at Canning Town without eliminating land on Silvertown Way currently being progressed by the GLA for substantial amounts of housing, and enlarging the diameter of the Silvertown Tunnel to include sufficient space for DLR infrastructure would significantly increase costs. Furthermore, the alignment of the extension would be such that most passengers from the south Greenwich area would be likely to alight at North Greenwich to connect with Jubilee line services towards central London, thereby making the cross-river element of the extension poorer value for money. The envelope of the road tunnel would be at least 9 m by 4.7 m for a two lane road, and the minimum envelope for a single track DLR in tunnel would be 3.4 m by 4 m (not including emergency access, walkways, fans or other services). Consequently as a bored tunnel under the river is the preferred option for the Silvertown Tunnel, a separate tunnel would be needed for the DLR extension, thus minimising project synergies								

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
		Although a DLR extension through the Silvertown Tunnel is not being progressed, as set out above the possibility of extending the network from the Gallions Reach area to Thamesmead is being explored as part of the proposed Gallions crossing which forms part of the wider river crossings programme to the east of Silvertown. An opportunity also exists for constructing a new DLR station at Thames Wharf on the existing network between Canning Town and West Silvertown stations, close to the north portal of the Silvertown Tunnel, should this be justified by demand from new development in the area.							
2C	Light rapid transit bridge in the Gallions Reach area (e.g. DLR)	No. Potential for small reduction in demand at the Blackwall Tunnel, but minimal reduction in the number of unplanned incidents. No realistic alternative in case of incidents. ✘	No. Some mode shift from private transport to public transport possible, however the number of trips that could switch modes is limited. Not all trips can shift to public transport given journey purpose, vehicle type and origins and destinations. Location further east limits congestion relief at the Blackwall corridor. ✘	Partly. Improved connectivity will support growth, although highway access to growth areas would remain constrained. --	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No report on stakeholder engagement included in this assessment.	Road user charging not applicable though fare revenue would be collected.	
	Passenger ferry options								
2D	Passenger ferry between North Greenwich &	No. Would not materially impact demand or	No. Would not materially impact traffic flow in the	Partly. The impact on the connectivity of east London	Detailed assessments have not been carried out as	Detailed assessments have not been carried out as	No report on stakeholder engagement included in this	Road user charging not applicable though fare	In addition to the existing North Greenwich pier, additional piers are currently proposed at Canary Wharf East which is due to be delivered by spring 2017, and at North Greenwich West which is due to be

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
	Canary Wharf	incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✘	Blackwall corridor. ✘	will be minor through this incentive. Improvements to ferry services are important and required, however should not be considered as part of the larger solution to the problem of connectivity of east London. --	this option does not meet some of the key objectives.	this option does not meet some of the key objectives.	assessment.	revenue may be collected.	delivered as part of the Greenwich Peninsula Masterplan. It is expected that that these piers will accommodate River Bus services, with an added potential to provide a dedicated cross-river ferry service for pedestrians and cyclists between Greenwich Peninsula (west) and Canary Wharf (east). We expect initial feasibility work on such a service to commence in mid-2016.
2E	Passenger ferry from North Greenwich (O2) to East India (DLR)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. ✘	Partly. The impact on the connectivity of east London will be minor through this incentive. Improvements to ferry services are important and required, however should not be considered as part of the larger solution to the problem of connectivity of east London. --	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No report on stakeholder engagement included in this assessment.	Road user charging not applicable though fare revenue would be collected.	

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
2F	Additional river boat services around Blackwall	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. ✘	Partly. The impact on the connectivity of east London will be minor through this incentive. Improvements to ferry services are important and required, however should not be considered as part of the larger solution to the problem of connectivity of east London. --	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No report on stakeholder engagement included in this assessment.	Road user charging not applicable though fare revenue would be collected.	
2G	Passenger ferry at Gallions Reach	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. ✘	Partly. Improved connectivity will support growth, though limited to locations immediately adjacent to the river and the crossings rather than wider sub regions. It would further be limited by operating hours and conditions.	No. It is unlikely that significant demand for passenger ferry services would be achieved in lower density parts of the London Thames Gateway, where developments are not centred on the riverfront, and buses offer a	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No report on stakeholder engagement included in this assessment.	Road user charging not applicable though fare revenue may be collected.	

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
				--	high frequency connection to rail services. ✘				
	Cable car option								
2H	Cable car between North Greenwich & Canary Wharf	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short-long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. ✘	Partly. Improved connectivity will support growth, though limited to locations immediately adjacent to the river and the crossings rather than wider sub regions. It would further be limited by operating hours and conditions. --	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No report on stakeholder engagement included in this assessment.	Road user charging not applicable though fare revenue would be collected.	When assessed in 2009 there was difficulty in determining a suitable landing site at Canary Wharf as the area was significantly built up already. This option is now not taken forward as another location was progressed for the cable car in form of the Emirates Air Line, and a ferry could provide a similar function between North Greenwich and Canary Wharf. In addition to the existing North Greenwich pier, additional piers are currently proposed at Canary Wharf East which is due to be delivered by Spring 2017, and at North Greenwich West which is due to be delivered as part of the Greenwich Peninsula Masterplan. It is expected that that these piers will accommodate River Bus services, with an added potential to provide a dedicated cross-river ferry service for pedestrians and cyclists between Greenwich Peninsula (west) and Canary Wharf (east). We expect initial feasibility work on such a service to commence in mid-2016.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
2I	Cable car between North Greenwich & Royal Docks (Emirates Air Line)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. ✘	Partly. Improved connectivity will support growth, though limited to locations immediately adjacent to the river and the crossings rather than wider sub regions. It would further be limited by operating hours and conditions. --	Yes. Has been achieved with the implementation of the Emirates Air Line. ✓	Yes. Has been achieved with the implementation of the Emirates Air Line. ✓	Yes. Has been achieved with the implementation of the Emirates Air Line. ✓	Road user charging not applicable though fare revenue is collected and private sponsorship was sought.	This scheme was implemented in 2012 to kick-start improved connectivity in this location by providing a crossing for pedestrians and cyclists.
2J	Cable car at Gallions Reach	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. ✘	Partly. Improved connectivity will support growth, though limited to locations immediately adjacent to the river and the crossings rather than wider sub regions. It would further be limited by operating hours and conditions. --	No. It is unlikely that significant demand for a cable car would be achieved in lower density parts of the London Thames Gateway. ✘	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No report on stakeholder engagement included in this assessment.	Road user charging not applicable though fare revenue would be collected.	Work on cable car options showed that cable car tower height requirements were not feasible at Gallions Reach due to its proximity to London City Airport. The option is now not taken forward as another location was progressed for the cable car in form of the Emirates Air Line.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
	Other options								
2K	Pedestrian, cycle & bus bridge at Gallions Reach	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative due to location, low capacity and non-fixed nature of the link. ✘	No. Some mode shift from private to public transport possible, however the number of trips that could switch modes is limited given journey type, purpose and origins and destinations. ✘	Partly. Improved connectivity will support growth, although highway access to growth areas would remain constrained. --	Detailed assessments have not been carried out in the context of solving the problems in the Blackwall corridor as this options fails to meet a number of the key objectives. Public transport and walking and cycling options are being considered under the wider river crossings programme for east London.	Detailed assessments have not been carried out in the context of solving the problems in the Blackwall corridor as this options fails to meet a number of the key objectives. Public transport and walking and cycling options are being considered under the wider river crossings programme for east London.	No report on stakeholder engagement included in this assessment.	No. While a road-based bridge (which also allows for pedestrians, cyclists and buses) would be (part) funded through user charging, this revenue stream would be foregone if private traffic were to be excluded from a new crossing. ✘	

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
2L	Amfibus (location flexible) *Note: an amfibus is an amphibious bus which is capable of both driving on the road and sailing across the river*	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. ✘	No. Would be too low in capacity to support growth. ✘	Detailed assessments have not been carried out as this option does not meet the key objectives.	Detailed assessments have not been carried out as this option does not meet the key objectives.	No report on stakeholder engagement included in this assessment.	Road user charging not applicable though fare revenue would be collected.	Amfibuses have been subject to technical difficulties and failures in the recent past.
	Summary (public transport options)	Public transport options are characterised by the same in-principle limitations as walking and cycling options when it comes to solving the three transport problems identified at the Blackwall Tunnel. This means that although any of these schemes may have some merits, they are not sufficient in themselves to fully address these problems. Data collected from road side interviews in 2012 shows that the origins and destinations of trips through the Blackwall Tunnel are widely dispersed. This means that a fixed public transport crossing e.g. in form of a DLR or rail connection would only serve small proportion of trips. The potential of public transport options to generate sufficient mode shift to alleviate the problem of congestion at the Blackwall Tunnel is hence limited. Furthermore, public transport does not provide a viable alternative diversion route in case of incidents or closures and does hence not provide short- or long term resilience. However it should also be noted that a road-based crossing does not preclude enhanced public transport. Options for a Gallions Reach crossing are being progressed in the East London River Crossings Programme, and include public transport options. The Silvertown Tunnel scheme being proposed comprises public transport elements: a dedicated lane for heavy vehicles including buses, no charge for buses and coaches, and more scope to run better services.							

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
3	**Road-based options**								
	Vehicle ferry options								
3A	Vehicle ferry at Silvertown (incl. user charging)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures (demand would significantly exceed capacity) and does hence not offer short- or long term resilience. ✘	Partly. Capacity would be low and the service would be limited by operating conditions and hours. --	Partly. Improved connectivity will support growth in this region. It would be limited due to operating hours and conditions. --	No. It would conflict with the development plans for the areas on either side of the river, particularly on the Greenwich Peninsula. It would entail large vehicles crossing the peninsula and queuing for the ferry through an area designated as residential-led mixed use, and for which development has begun. Ferry approach roads are therefore unlikely to fit with the Greenwich Peninsula Masterplan. ✘	No. It would conflict with the development plans for the areas on either side of the river, particularly on the Greenwich Peninsula. It would entail large vehicles crossing the peninsula and queuing for the ferry through an area designated as residential-led mixed use, and for which development has begun. Ferry approach roads are therefore unlikely to fit with the Greenwich Peninsula Masterplan. ✘	No. It is assumed that RB Greenwich may not be supportive (see PO4 & PO5). ✘	No. Given the lack of journey time benefits for a ferry crossing so close to Blackwall, it is expected that the business case would be negative. ✘	

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
3B	Woolwich Ferry refurbishment / upgrade / renewal	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents or closures (demand would significantly exceed capacity) and does hence not offer short- or long term resilience. ✗	No. Would not materially impact traffic flow in the Blackwall corridor. ✗	No. While an existing connection is enhanced, no new connection is provided & this is unlikely to be sufficient to support expected in these sub regions. ✗	Yes. Achievable as demonstrated by current ferry. ✓	Yes. Achievable as demonstrated by current ferry. ✓	Yes. Achievable as demonstrated by current ferry. ✓	Road user charging not applicable as TfL is currently under obligation to operate the ferry free of charge	Independently of the Silvertown Tunnel Scheme, TfL completed works in December 2015 including the refurbishment of the in-river piers and fully overhauling the moveable platforms which allow vehicles to board and alight the vessels. In addition TfL are undertaking further phases of work, including an evaluation of options for replacing the existing ferry vessels which, subject to funding approval, could be in place by 2018. These are considered essential works to ensure the continued operation of the service. In addition to these life extension works, TfL are also investigating various potential improvement options to the vehicle waiting areas at both the northern and southern terminals.
3C	Vehicle ferry at Gallions Reach (incl. user charging)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative due to location, low capacity and non-fixed nature of the link. ✗	No. Would not materially impact traffic flow in the Blackwall corridor. It does not provide a realistic alternative due to location, low capacity and non-fixed nature of the link. ✗	Partly. Improved connectivity will support growth but capacity is comparatively low and it does not provide a fixed link and is thus limited by operating hours and conditions. --	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No. Opposed by RB Greenwich and LB Newham in the 2014 East of Silvertown consultation. ✗	Yes. It is assumed that a user charge would be required to pay for (part of) the ferry services. ✓	Not being taken further forward following the 2014 consultation on options east of Silvertown which showed low public and stakeholder support for a ferry at this location.
	Bridge options								

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
3D	Bridge at Silvertown *Note: the option refers to the concept of a bridge at Silvertown rather than more detailed design and could include user charging*	Partly. A road bridge would provide increased resilience of the highway network in the sub regions. Though it would be limited in the case of a lifting bridge due to closures to allow for shipping movements. --	Yes. A road bridge would improve road network performance on the Blackwall corridor and ease congestion. Though it would be limited in the case of a lifting bridge due to closures to allow for shipping movements. ✓	Yes. Improved connectivity in form of a bridge would support local and sub regional growth. Though it would be limited in the case of a lifting bridge due to closures to allow for shipping movements. ✓	Partly. Land has been safeguarded for a river crossing at Silvertown and while overall a bridge integrates with land use policies, a major road bridge would not fit well with the urban neighbourhoods emerging on both river banks, and it is likely that any bridge option would need to be scaled to suit the urban riverfronts. --	Partly. While overall the crossings would seek to minimise impacts, a major road bridge would not fit well with the urban neighbourhoods emerging on both river banks, and it is likely that any bridge option would need to be scaled to suit the urban riverfronts. --	No. Stakeholders responsible for delivering the planned regeneration of the peninsula are strongly opposed to the construction of an elevated highway through the area, or at grade junctions which allow crossing traffic to use roads built for the distribution of residential access traffic. ✗	Yes. User charging could be implemented to manage traffic and fund the scheme. ✓	A bridge option at Silvertown is technically feasible though brings several disadvantages to a tunnel option. These are outlined in detail under the specific bridge options listed in this matrix.
3E	Lifting bridge at Silvertown (low- or mid-level) (incl. user charging)	No. Frequent closures of up to 5 times per day for up to 30 minutes means that little additional resilience is provided. ✗	Partly. Frequent closures to allow for shipping movements mean that road network performance improvements are limited. --	Yes. Improved connectivity in form of a lifting bridge would support local and sub regional growth. Though it would be limited in the case of a lifting bridge due to closures for shipping	No. The large viaduct required and elevated highway will have a negative impact on local land-use. ✗	Partly. While it is assumed that the scheme would be implemented so as to minimise impacts, bridge closures for shipping movements will cause a certain level of congestion on	No. Stakeholders responsible for delivering the planned regeneration of the peninsula are strongly opposed to the construction of an elevated highway through the area, or at	Partly. User charging would be required to make the scheme affordable and to manage traffic but it is problematic where some users would incur charge without gaining journey time benefit when	The conclusions of the original work remain relevant. Lifting operations would have significant impacts on the efficiency of the highway network in which the bridge is connected. Due to frequent shipping movements on this stretch of the Thames, the bridge would need to be lifted up to 5 times per day for up to 30 minutes at a time. Cross-river accessibility is therefore limited and this option does not fully address the objectives of improving resilience, reducing congestion and supporting growth.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
				movements. ✓		approach roads. --	grade junctions which allow crossing traffic to use roads built for the distribution of residential access traffic. ✗	bridge is lifted for shipping movements. --	
3F	High level fixed bridge at Silvertown (incl. user charging)	Yes. A fixed bridge would provide increased resilience of the highway network in the sub regions. ✓	Yes. A fixed bridge would improve road network performance on the Blackwall corridor and ease congestion. ✓	Yes. Improved connectivity in form of a fixed bridge would support local and sub regional growth. ✓	No. The large viaduct required and elevated highway will have a negative impact on local land-use. ✗	No. The impact on the local area would be significant. A large and impacting 3.5km elevated viaduct highway through an inner-urban area may be deemed by most as unattractive reducing the sense of place and public realm a key 'Challenge' set out in the MTS. ✗	No. Stakeholders responsible for delivering the planned regeneration of the peninsula are strongly opposed to the construction of an elevated highway through the area, or at grade junctions which allow crossing traffic to use roads built for the distribution of residential access traffic. ✗	Yes. User charging could be implemented to manage traffic and fund the scheme. ✓	The conclusions of the original work remain relevant. TfL's studies indicated concern about the feasibility of integrating a high bridge due to the long approach ramps creating physical severance. This is now even more of a problem in the context of intensified residential development locally. A further consideration is the decision – following the confirmation of MTS in May 2010 – to take forward the cable car (later known as Emirates Air Line) which also conflicts with a high bridge at this location.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
3G	Low level bridge at Woolwich (incl. user charging)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative when the bridge is closed to allow for shipping movements and does hence not offer short- or long term resilience. ✘	Partly. Would only marginally impact traffic flow in the Blackwall corridor, especially when the bridge is closed to allow for shipping movements. --	Yes. Improved connectivity in form of a lifting bridge would support local and sub regional growth. Though it would be limited in the case of a lifting bridge due to closures for shipping movements. ✓	No. Due to the nature of the land use in this area, the opportunities to develop a bridge to replace the Woolwich Ferry would be extremely limited. ✘	No. The lifting operation would hold traffic up for up to 30 minutes at a time, holding traffic and causing congestion and associated impacts on local roads, especially at Woolwich Town Centre. ✘	No report on stakeholder engagement included in this assessment.	Partly. User charging would be required to make the scheme affordable and to manage traffic but it is problematic where some users would incur a charge without gaining journey time benefit when bridge is lifted for shipping movements. --	
3H	Bridge at Gallions Reach (incl. user charging) *Note: the option refers to the concept of a bridge at Gallions Reach rather than more detailed design and could include user charging*	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative due to its location and does hence not offer short- or long term resilience. ✘	No. Would not sufficiently impact traffic flow in the Blackwall corridor. It does not provide a realistic alternative due to its location. ✘	Yes. Improved connectivity in form of a bridge would support local and sub regional growth. Though it would be limited in the case of a lifting bridge due to closures to allow for shipping. ✓	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Partly. RB Greenwich & LB Newham are in favour of a bridge at this location (though not in place of Silvertown), LB Bexley is strongly opposed if built in isolation, neutral if built in parallel with another crossing at Belvedere. --	Yes. User charging at the new bridge would almost certainly be needed to provide a source of revenue to contribute towards the costs of construction. ✓	Bridge options are now being assessed (including potential public transport and walking & cycling elements) as part of the wider East London River Crossings Programme.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
3I	Local low level lifting bridge at Gallions Reach (incl. user charging)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative due to its location and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. It does not provide a realistic alternative due to its location. ✘	Yes. Improved connectivity in form of a lifting bridge would support local and sub regional growth. Though limited due to closures to allow for shipping movements. ✓	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Partly. RB Greenwich & LB Newham are in favour of a bridge at this location (though not in place of but in addition to Silvertown), LB Bexley is strongly opposed if built in isolation, neutral if built in parallel with another crossing at Belvedere. --	Yes. User charging at the new bridge would almost certainly be needed to provide a source of revenue to contribute towards the costs of construction. ✓	This option is not being taken further forward due to the impact of shipping on traffic/bridge availability and major engineering feasibility concerns.
3J	High level fixed bridge at Gallions Reach (incl. user charging)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative due to its location and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. It does not provide a realistic alternative due to its location. ✘	Yes. Improved connectivity in form of a fixed bridge would support local and sub regional growth. ✓	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Partly. RB Greenwich & LB Newham are in favour of a bridge at this location (though not in place of but in addition to Silvertown), LB Bexley is strongly opposed if built in isolation, neutral if built in parallel with another crossing at Belvedere. --	Yes. User charging at the new bridge would almost certainly be needed to provide a source of revenue to contribute towards the costs of construction. ✓	This option is now being assessed (including potential public transport and walking & cycling elements) as part of the wider river crossings programme for east London.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
3K	Thames Gateway Bridge (incl. user charging)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative due to its location and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. It does not provide a realistic alternative due to its location. ✘	Yes. Improved connectivity would support local and sub regional growth. ✓	Yes. Land for TGB is safeguarded and the improved connectivity would support development in the local Opportunity Areas. ✓	Yes. The safeguarded corridor for TGB means that local impacts can be managed fairly well, although wider impacts in terms of traffic from the A2 using the crossing is a concern. ✓	No. TGB is strongly supported by the host boroughs of Greenwich and Newham but strongly opposed by Bexley ✘	Yes. User charging was planned for the scheme to manage traffic and fund the scheme. ✓	The option was assessed at this stage for comparison purposes to other schemes. However a bridge option at Gallions reach is being assessed as part of the wider river crossings programme for east London.
3L	Pontoon bridge at Gallions Reach (incl. user charging)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative due to its location, capacity and requirement for closures to allow for shipping movements and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. It does not provide a realistic alternative due to its location. ✘	No. Analysis of shipping movements on this part of the Thames shows that the bridge would need to open around 70 times per day, or 3 times per hour. With this in mind and a 30 minute approximate time of being open, the bridge would be rarely available to road users or pedestrians. ✘	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	This option has not been discussed in detail with stakeholders. It is assumed their support would be highly unlikely given the constraints of this option.	Partly. User charging would be required to make the scheme affordable and to manage traffic but it is problematic where some users would incur charge without gaining journey time benefit when bridge is opened for shipping movements. --	The conclusions of the original work remain relevant. Pontoon bridges have been subject to failures, with examples of destructed or sinking bridges due to poor weather which rules out this option.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
	Tunnel options								
3M	Road tunnel at Silvertown *Note: This refers to the concept of a road tunnel at Silvertown with potential provision of pedestrian and cyclist facilities through the tunnel and includes user charging*	Yes. A tunnel would provide increased resilience of the highway network in the sub regions. ✓	Yes. A tunnel would improve road network performance of the Blackwall corridor and ease congestion. ✓	Yes. Improved connectivity in form of a tunnel would support local and sub regional growth. ✓	Partly. A larger cut and cover section required for an immersed tube tunnel would impact negatively on the circulation of people and vehicles. --	Partly. Significant riverworks required for an immersed tube tunnel option would have negative environmental impacts. --	Yes. The tunnel concept is well supported by stakeholders generally and features in the relevant boroughs' local plans. However the large cut and cover section required for the immersed tube tunnel is likely to conflict with masterplans for the Greenwich Peninsula. ✓	Partly. User charging would be implemented to manage traffic demand and contribute towards the funding of the scheme. Provision of pedestrian & cycle facilities would increase scheme costs & increase affordability gap. --	Current design and safety standards indicate that only a segregated solution – either a separate tunnel bore or a deck underneath the road tunnel – would be acceptable for pedestrians & cyclists. Both of these are very expensive and given the length of the crossing and the need to provide lifts and ramps, would suffer from poor ambience, and be unattractive in terms of safety and security. The scheme cost increase of around £70 million (as a minimum) could bring greater benefits for cyclists if invested in infrastructure elsewhere along the eastern Thames, where schemes have in some cases already been identified and are being given serious consideration. Provision of pedestrian & cyclist facilities through the tunnel is hence excluded from further assessment.
3N	**Bored tunnel at Silvertown (includes user charging)**	**Yes. A tunnel would provide increased resilience of the highway network in the sub regions.** ✓	**Yes. A tunnel would improve road network performance of the Blackwall corridor and ease congestion.** ✓	**Yes. Improved connectivity in form of a tunnel would support local and sub regional growth.** ✓	**Yes. Land has been safeguarded for a river crossing at Silvertown and a bored tunnel option minimises impacts on land-use and the masterplan for the Greenwich**	**Yes. Environmental impacts can be minimised leading to an overall environmental benefit.** ✓	**Yes. The tunnel concept is well supported by stakeholders generally and features in the relevant boroughs' local plans.** ✓	**Yes. User charging would be implemented to manage traffic demand and contribute towards the funding of the scheme.** ✓	**This is the option taken forward to DCO application.**

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
					Peninsula. ✓				
3O	Immersed tube tunnel at Silvertown (includes user charging)	Yes. A tunnel would provide increased resilience of the highway network in the sub regions. ✓	Yes. A tunnel would improve road network performance of the Blackwall corridor and ease congestion. ✓	Yes. Improved connectivity in form of a tunnel would support local and sub regional growth. ✓	Partly. The cut and cover section would impact negatively on the circulation of people and vehicles. --	Partly. Compares less favourably to bored tunnel as the temporary loss of habitat on the foreshores is a major concern. The effect on the river dynamics due to the foreshore cofferdams will impact on current river flows potentially leading to erosion and deposition within the river. --	Partly. The tunnel concept is well supported by stakeholders generally and features in the relevant boroughs' local plans. However the large cut and cover section required for the immersed tube tunnel is likely to conflict with masterplans for the Greenwich Peninsula. --	Yes. User charging would be implemented to manage traffic demand and contribute towards the funding of the scheme. ✓	
3P	Road tunnel between Charlton & Royal Docks (includes user charging)	Partly. A road tunnel at this location would support resilience in the sub regions but at some distance from the Blackwall Tunnel it only provides an alternative for some trips. --	No. Due to its location, the road network performance of the Blackwall corridor is unlikely to improve sufficiently. ✗	Yes. Improved connectivity in form of a road tunnel at this location would support local and sub regional growth. ✓	No. While a tunnel at this location would offer good local connections it would have a substantial impact on property. ✗	No. The proximity of the tunnel to the Thames Barrier would present a major risk. ✗	No report on stakeholder engagement included in this assessment.	Yes. User charging at the tunnel would almost certainly be needed to provide a source of revenue to contribute towards the costs of construction. ✓	Ferry options are also being considered as alternatives as part of the wider East London River Crossings Programme.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
3Q	Road tunnel at Woolwich (integrated with Crossrail)	Partly. A road tunnel at this location would support resilience in the sub regions but at some distance from the Blackwall Tunnel it only provides an alternative for some trips. --	No. Due to its location, the road network performance of the Blackwall corridor is unlikely to improve sufficiently. ✗	Yes. Improved connectivity in form of a road tunnel at this location would support local and sub regional growth. ✓	No. Traffic diversion/increases would negatively affect (plan for) the local town centre of Woolwich. ✗	No. Traffic diversion/increases would negatively affect (plan for) the local town centre of Woolwich. The rail alignment requirements do not allow a road element to be provided alongside Crossrail without considerable impact around the portals, particularly in Woolwich Town Centre, where a portal could undermine the planned regeneration of the town centre. ✗	No report on stakeholder engagement included in this assessment but unlikely to be supported due to lack of connectivity for Opportunity Areas and impact on A2.	No reference to user charging made in this assessment.	The addition of a highway element to a Crossrail tunnel would have added considerable cost, time and risk to Crossrail. If pursued at all, it should be taken forward separately from the rail element of the scheme so as to not to delay its progress. Geography would require southern portal to be at Eltham Common leading to a 6km bored tunnel.
3R	Blackwall Tunnel 3rd bore (includes user charging)	Partly. Replacing the small diameter northbound tunnel with a full gauge tunnel has the potential to address reliability issues. Some	Partly. Congestion relief is limited by tidal operations. --	Partly. While additional capacity is provided for an existing connection this is unlikely to be sufficient to support expected in these sub	Yes. It is expected that a 3rd bore Blackwall Tunnel would fit within the land-use policies of the areas. ✓	Yes. Though benefits would be marginal. ✓	Detailed engagement with stakeholders not carried out as option not feasible in engineering terms.	Yes. User charging would be implemented to manage traffic demand and contribute towards the funding of the scheme. ✓	The conclusions of the original work remain relevant. While overall the option addresses some of the project objectives, it has significant technical construction challenges. The option is not regarded as feasible by the tunnelling engineers consulted, as there is insufficient space to allow tie-in to the road network while meeting current standards for tunnel gradient and visibility.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
		incidents would remain and in these circumstances there would be no means of diversion. In addition, tidal operations would result in different vehicle restrictions at different times of day. There is a high potential for overheight drivers to arrive and cause difficulties when the new tunnel is running southbound and they are unable to use the Blackwall tunnel. --		regions. --					

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
3S	Blackwall Tunnel Refurbishment (could include user charging)	No. Would not materially impact demand at the Blackwall Tunnel. While the tunnel will be improved to add resilience against failure, some incidents will still occur (including overheight vehicle incidents) which means no diversion alternative would be in place. It does not provide a realistic alternative due to its location and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. ✘	No. While an existing connection is enhanced, no new connection is provided & this is unlikely to be sufficient to support expected in these sub regions. ✘	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No report on stakeholder engagement included in this assessment.	Partly. It may be possible to implement user charging to manage future demand and to pay towards refurbishment costs but it is likely to be met with greater opposition as no new infrastructure would be provided. --	While overall the option does not meet the project objectives, it should be considered as part of a wider package of a refurbishment and new river crossings. The work to refurbish the tunnel has been committed and is ongoing.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Additional back-check comments
3T	Local tunnel at Gallions Reach (includes user charging)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative due to its location and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. It does not provide a realistic alternative due to its location. ✘	Yes. Improved connectivity in form of a tunnel would support local and sub regional growth. ✓	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Partly. RB Greenwich & LB Newham are in favour of a bridge at this location (though not in place of but in addition to Silvertown), LB Bexley is strongly opposed if built in isolation, neutral if built in conjunction with a crossing at Belvedere. --	Yes. User charging at the new tunnel would almost certainly be needed to provide a source of revenue to contribute towards the costs of construction. ✓	This option is being assessed (including potential public transport elements) as part of the wider East London River Crossings Programme.
	Other options								
3U	New Lower Thames Crossing (bridge or tunnel)	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative due to its location and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. It does not provide a realistic alternative due to its location. ✘	No. Due to its location would not directly support growth in London / the Opportunity Areas in this region. ✘	Detailed assessments have not been carried out as this option does not meet some of the key objectives. It is outside the remit of TfL & being taken forward independently of the Silvertown Tunnel by Highways England.	Detailed assessments have not been carried out as this option does not meet some of the key objectives. It is outside the remit of TfL & being taken forward independently of the Silvertown Tunnel by Highways England.	Detailed assessments have not been carried out as this option does not meet some of the key objectives. It is outside the remit of TfL & being taken forward independently of the Silvertown Tunnel by Highways England.	Detailed assessments have not been carried out as this option does not meet some of the key objectives. It is outside the remit of TfL & being taken forward independently of the Silvertown Tunnel by Highways England.	This option falls outside the remit of TfL and is being progressed by Highways England. Due to its location it could not solve the problems in the Blackwall corridor.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Comments
	Summary (road-based options)	Some of the road-based options assessed have the potential to address the problems of congestion, closures and lack of resilience at the Blackwall Tunnel. In order to meet these objectives, options need to be located sufficiently close to the Blackwall Tunnel and need to be of sufficient capacity to cope with the demand in the event of a closure of the Blackwall Tunnel. Some options have greater adverse impacts on land use, the environment etc. than others; the latter hence generally being more acceptable to stakeholders. A range of options outlined above as well as road-based crossing options at Belvedere are being considered as part of the wider East London River Crossings Programme.							
4	**Demand management and other options**								
4A	Do nothing	No. The costs of unreliability are very significant; of those cross-river trips directly affected by closures, a cost of around £16 million per annum is incurred. In addition, as this traffic seeks to use alternatives it impacts routes which are already busy or congested. ✘	No. Congestion in the Blackwall Corridor is significant. Drivers experience an around 15-20 minute delay in crossing the river at peak times. ✘	No. The current situation at the Blackwall Tunnel does not support growth in east and south east London. ✘	No. Poor reliability of the crossings and long journey times will worsen over time with background growth. This would have a negative effect on the regeneration potential of the area, and in particular those Opportunity Areas along both sides of the Thames. ✘	No. Negative impacts arising from congestion and poor reliability would remain. ✘	No. Local boroughs and local businesses support action to address the current problems associated with the river crossings. Doing nothing is therefore likely to be opposed. ✘	Road user charging not applicable	

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Comments
4B	Demand management & encouraging mode shift	No. Would not materially impact demand or incidents at the Blackwall Tunnel. It does not provide a realistic alternative in case of incidents and does hence not offer short- or long term resilience. ✗	No. While some mode shift to public transport would be achieved, it would not materially impact demand at the Blackwall Tunnel. ✗	No. No new connections are being provided and problems at existing crossings aren't being relieved substantially. ✗	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Road user charging not applicable	
4C	Charging Blackwall Tunnel	No. Would not materially impact incidents at the Blackwall Tunnel. It does not provide an alternative in case of incidents and does hence not offer short- or long term resilience. ✗	Partly. User charging would go some way in alleviating but not eliminating congestion at the Blackwall Tunnel. --	Partly. User charging would support economic development and population growth to a certain extend but have limited impact on connectivity. --	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No report on stakeholder engagement included in this assessment.	Yes. The primary objective of the charge would be traffic management. ✓	The conclusions of the original work remain relevant. Assumes peak direction charging at the Blackwall Tunnel only. Not recommended that user charging is pursued as a means of reducing congestion in isolation; however, it could prove effective in conjunction with new infrastructure which delivers improved road network resilience.

	Project objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Comments
4D	Charging existing crossings e.g. Blackwall, Rotherhithe, Woolwich	No. Would not materially impact incidents at the Blackwall Tunnel. It does not provide an alternative in case of incidents and does hence not offer short- or long term resilience. ✘	Partly. User charging would go some way in alleviating but not eliminating congestion at the Blackwall Tunnel. --	Partly. User charging would support economic development and population growth to a certain extend but have limited impact on connectivity. --	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	No report on stakeholder engagement included in this assessment.	Yes. The primary objective of the charge would be traffic management though TfL is currently under obligation to operate the Woolwich Ferry free of charge. ✓	
4E	Dartford crossing toll plaza improvements	No. Would not materially impact incidents at the Blackwall Tunnel. It does not provide an alternative in case of incidents and does hence not offer short- or long term resilience. ✘	No. Would not materially impact traffic flow in the Blackwall corridor. It does not provide a realistic alternative due to its location. ✘	No. Due to its location would not directly support growth in London / the Opportunity Areas in this region. ✘	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Detailed assessments have not been carried out as this option does not meet some of the key objectives.	Not applicable as road user charging already in place	The implementation of this option falls outside the remit of TfL. However MTS Proposal 39 F states that TfL will provide *'support for Government proposals to reduce congestion at the Dartford Crossing'.* Free flow tolling was implemented in autumn 2014 by Highways England.
	Summary (demand management & other options)	Demand management including user charging can achieve behaviour change whereby people drive less, change their journey or switch to (non-charged) sustainable modes, or not make the journey. Demand management could therefore be effective in significantly reducing congestion, which is one of the main problems at the Blackwall Tunnel. TfL assessed the option of congestion charging at the Blackwall Tunnel (with no additional infrastructure). But this approach on its own it would not generate sufficient mode shift to significantly reduce congestion; nor does it provide an alternative diversion route which could address the prevailing issues of closures and lack of resilience which affect private and public transport.							

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