Appendix B

Third Lower Thames Crossing – Department for Transport Consultation
Kent County Council – Option Consideration

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2. The need for a new crossing

The current Dartford to Thurrock crossing is one of Europe's most heavily used crossings and provides a key link on the M25, the UK's most important orbital motorway. It performs a vital function as the only crossing point east of London for strategic and international traffic between the main Channel crossings and areas north of the Thames including to the Midlands and on to Scotland. It is also the point of connection between the strategic growth areas of North Kent and South Essex making up the Thames Gateway. In effect, it is one of the country's most important strategic connections. It is also one of Britain's worst bottlenecks which is currently stifling much needed national and regional economic growth.

The Government has confirmed that short term to medium term measures will be implemented to make best use of existing capacity. These measures are the introduction of charge suspension during severe congestion as well as the technology to enable free flow tolling. An increase in toll prices to help manage demand as well as fund infrastructure is also part of this package. The evidence is clear however, that these measures will provide minimal short term relief and that the case for a new crossing is still absolutely urgent. This case is outlined below with the majority of the evidence presented below being sourced from the Department for Transport's current consultation reports[1].

2.1 Traffic volumes and congestion

The existing Dartford crossing has a design capacity of 135,000 vehicles per day but currently experiences travel volumes in excess of 160,000 vehicles per day a least once a week[2] and regular flows of 140,000 vehicles per day[3]. This situation is confirmed by the Dartford free-flow charging project which found that the crossing operated above its design capacity on 257 days during 2010[4]. The daily average flow for 2011/12 was 138,760 vehicles with over 50 million vehicles carried annually. DfT analysis has concluded that the section of network that includes the Dartford Crossing, experiences the third highest levels of delays nationwide[1] and this is despite total flows over the crossing having reduced slightly in recent years[5]. Separate studies[1, 2] have concluded that the current road based infrastructure lacks resilience and is not able to cope with current traffic volumes for the majority of the day.

Peak flows are around 5,500PCUs in each direction occurring at around 1700 – 1800 however there are significantly reduced levels of service on the crossing (characterised as vehicles using the crossing which experience more than 9 minutes of additional delays) once flow exceeds 3,000 vehicles per

[1] Review of lower Thames Crossing Options: Final Report, Department of Transport/Aecom, April 2013

[2] The Dartford River Crossing study into capacity requirements. Parsons Brinckerhoff on behalf of the Department for Transport (2009)

[3] http://www.highways.gov.uk/our-roads/area-teams/area-5/the-dartford-thurrock-river-crossing/traffic-flow/

[4] Highways Agency HATRIS data

[5] Kent Travel Report (2012)

hour. This level of service and associated delay is experienced by almost half of users in either direction throughout the day with flows above 4,000 vehicles per hour from 0600 to 1900 each weekday.[2] This demonstrates that even for the inter-peak period (0900 to 1500) congestion is a continual problem.

2.2 Incidents, resilience and journey time reliability

The traffic volumes, proximity of junctions on the approach to the crossing and the lack of an alternative route all lead to a higher level of incidents and extremely low levels of network resilience. The existing crossing, toll plazas and approaches to the crossing have twice the national average injury accident rate for a route of this type[2]. When an accident or incident occurs this lack of network resilience results in even greater levels of delay and its associated cost.

This lack of capacity and resilience results in delays, longer journey times and reduced journey time reliability. The Highways Agency data on journey time reliability shows that between October 2011 and September 2012, the Dartford Crossing was the least reliable section of the strategic road network[6]. These factor increase costs for individuals and business, reducing productivity and ultimately weakens UK economic performance. These capacity and resilience issues will worsen as a result of forecast traffic growth, detailed below.

2.3 Forecast traffic growth and freight growth

Data over recent years has shown the there have been declines in traffic volumes on the Dartford Crossing since a peak figure of just over 148,000 vehicles in 2005. While this decline has been marginal, traffic volumes are still such that the crossing is operating over capacity.

Using DfT National Road Traffic Survey data, the table below shows how the average daily flow across the motorway and major road 'A' class network has changed over a number of years.

Table 1[7]

Year	Traffic volumes on UK motorway network	% change from 1993	Traffic volumes on all 'A' class road network	% change from 1993
1993	58.2		11.3	
1994	59.8	2.7%	11.6	2.7%
1995	61.9	6.4%	11.8	4.4%
1996	64.8	11.3%	12.1	7.1%
1997	66.6	14.4%	12.3	8.8%
1998	68.7	18.0%	12.4	9.7%
1999	69.7	19.8%	12.5	10.6%
2000	69.6	19.6%	12.4	9.7%
2001	71.6	23.0%	12.6	11.5%
2002	73.0	25.4%	12.8	13.3%
2003	73.3	25.9%	13.0	15.0%
2004	74.9	28.7%	13.1	15.9%
2005	75.6	30.0%	13.1	15.9%

[6] http://data.gov.uk/dataset/journey-reliability-highways-agency-network
[7] DfT National Road Traffic Survey

2006	76.6	31.6%	13.3	17.7%
2007	77.4	33.0%	13.2	16.8%
2008	76.9	32.1%	13.0	15.0%
2009	76.5	31.4%	13.0	15.0%
2010	75.6	30.0%	12.9	14.2%
2011	76.3	31.1%	12.9	14.2%
Average annual growth		1.72%		0.79%

From this it can be seen traffic volumes on the motorway network have increased by 31% over the 18 year period and by 14% for the major 'A' class road network. Taking the average across both these road types gives an annual growth figure of 1.26%. The DfT's Lower Thames Crossing traffic model forecasts that overall traffic flows will increase from 2009 to 2041 by around 30% across the policy area[1]. The 2009 DfT study estimated that there would be a 38% increase in traffic volume by 2031 using the Dartford Crossing.[2] For LGV traffic the 2009 DfT study forecast this will rise by 88% between 2010 and 2035 with the equivalent figure for HGVs being 43%.[8]

These figures for the Dartford Crossing and LGV/HGV traffic represent a higher annual growth figure than the general motorway and major 'A' class road network statistics. In recognition however, that growth has slowed in the last few years during the recession, applying a growth figure of 1% per annum into the future would seem reasonable and indeed is likely to represent a conservative estimate.

On this basis, the daily average flow on the Dartford Crossing is likely to be just over 153,000 vehicles in ten years time and just under 170,000 vehicles per day in 20 years. Given the design capacity of the crossing (135,000 vehicles), it is absolutely clear that the existing crossing has outlived its design life and has no capacity to cope with even the smallest levels of traffic growth. This also crystallises the point that free-flow tolling and the improved flow that this will facilitate, can only ever be a short term "sticking plaster".

In 2010, UK ports handled 95% of all goods in and out of the UK. This means freight to and from our main ports will make up a key component of traffic on the strategic network serving those ports and that a high quality, congestion free strategic network to the major ports is vital to the effective functioning of the UK economy. The 2009 DfT study established that over 30% of HGV journeys using the crossing are travelling particularly long distances to and from the Port of Dover[2].

Dover is the UK's busiest port for roll-on, roll-off (ro-ro) freight with 87% of UK ro-ro traffic entering and leaving the country via Dover, and Felixstowe is the UK's top container port handling 2 million containers per annum.[9] The Dartford Crossing is currently a significant bottleneck on the main route to

[8] Road Transport Forecast 2011 DfThttp://assets.dft.gov.uk/publications/road-transport-forecasts-2011/road-transport-forecasts-2011-results.pdf
[9] Department for Transport, UK Port Freight Statistics, Statistical Release September 2012

Dover from anywhere north of London and, similarly for freight movements between the South East and Felixstowe.

This situation will be compounded by the conclusions of work carried out by MDS Modal on behalf of the DfT which was updated in 2007[10]. This forecast that there would be the following increase in demand by 2030 over a 2005 base of:

- 182% in containers (from 7m to 200m teu[11])
- 101% in ro-ro traffic (from 85m to 175m tonnes)

While these figures were derived during pre-recession years and there has been a subsequent downturn in demand, the Government has expressed the view that the long term effect will be to delay by a number of years but not ultimately reduce the eventual levels of demand for port capacity. In reality what this will mean, is increasing levels of freight needing to use the Dartford Crossing. Without a new crossing, congestion levels and resulting delays will increasingly escalate costs for business and so reducing productivity and ultimately economic performance.

2.4 Cost of congestion and impact on business

A very broad assumption of the cost of current congestion on the Dartford Crossing has been calculated using Webtag values for time and vehicle occupancy. Based on the fact that between 6am and 7pm flow rates on the crossing are in excess of 4,000 vehicles per hour and at that level, average delays are 9 minutes per vehicle. Applying Webtag values this gives an annual cost of £39.4 million. This broad calculation reinforces the figure of £40 million estimated in the Dartford River Crossing Study report.[12]

A recent survey[13] of the freight industry on their experiences and views of the impacts the existing Crossing has on their operations was carried out by the South East Local Enterprise Partnership on behalf of the local transport authorities. This survey was conducted via the Road Haulage Association, Freight Transport Association and Chambers of Commerce. Key results are summarised below.

- 30% of respondents used the crossing 50 or more times per week
- 91.5% experienced congestion with just under half experiencing it more than 3 times a week
- 95.3% said they lose time due to congestion.
- 81% said they incur additional costs from congestion.
- 26% estimated they lost 3 or more hours per vehicle per week due to congestion at the Crossing.

[10] Department for Transport, National Policy Statement for Ports, January 2012
[11] Teu = twenty foot equivalent container unit
[12] Dartford River Crossing Study Report, Department for Transport April 2009
[13] Freight Sector Survey – Consultation Findings Technical Note, Atkins, 3 May 2013

- 77.5% build in additional time to account for delays, but then 62.7% state that it is then wasted time if delays do not occur, hence unproductive time for the business.
- 15% stated they do not do business with companies on different sides of the river because of congestion at the Crossing.
- If congestion was to reduce, 27.9% perceived that they would have operational efficiencies and more reliable deliveries, 21.3% would have reduced costs in terms of fuel and staff costs with 23% reducing costs in general.
- 31.3% said they route deliveries to avoid the Dartford Crossing (the majority, 68.8%, do not avoid the crossing resulting in further freight traffic adding to congestion at the Crossing).
- 88.5% thought that a new Lower Thames Crossing would help provide a solution.
- 94% perceived that there would be reduced congestion as a result of a new Lower Thames Crossing and 87% viewed that there would be improved journey time reliability.
- In terms of the perceived operational business improvements as a result of a new Lower Thames Crossing, 89% stated journey time reliability, 85% time savings, 76% reduced operating costs and 73% improved productivity.
- The majority (53.2%) said they would be prepared to pay the same toll as the existing Dartford Crossing for a new Lower Thames Crossing. With a further 20.8% saying that the price they would be prepared to pay depends on the location of the new crossing.

From this survey, it is evident that there is a clear view from the freight sector that the existing Dartford Crossing costs their business in terms of lost time due to congestion and unreliable journey times, ultimately impacting on their overall productivity. Similarly, there is a clear view from the majority of respondents that a new crossing would reduce congestion and improve journey time reliability. Over half said they would be willing to pay toll levels equivalent to the existing crossing tolls to see these benefits.

This survey confirmed from the business perspective, the fact that the current crossing contributes to poor connectivity between the Kent and Essex parts of the Thames Gateway. 15% of survey respondents stated they will not do business with companies on the opposite side of the Thames because of congestion on the Dartford Crossing: clear evidence of stifled growth potential. This issue will similarly affect private individual in such choices as where to work, shop and socialise limiting options and ultimately impacting quality of life and wellbeing.

2.4 The growth agenda

The Thames Gateway is one of the largest growth areas in the country with 160,000 houses and 225,000 jobs planned for delivery by 2026 reflecting the fact that it was designated by the previous Government as a national priority for urban regeneration. The economic strategy for the Thames Gateway development priorities aimed to deliver £12 billion of GVA to the UK economy

by 2012[14] which clear demonstrates the scale of growth this area is capable of delivering. There is a considerable challenge in ensuring this growth can be accommodated in a sustainable way and that congestion and poor accessibility do not operate to stifle the massive potential the area can deliver for economic growth.

Key developments to note are the London Gateway facility currently under construction by Dubai Ports representing a £2 billion investment. This will compound the South East's position as the gateway for a significant proportion of UK trade when it opens in the 4th quarter of 2013. This facility will be the UK's biggest deep-sea container port capable of handling 3.5 million teu and will house Europe's largest planned logistics park offering 860,000sqm of accommodation, primarily for the distribution sector. It will create 12,000 direct jobs. While a significant proportion (30%) of the containerised units is planned to be transferred to rail, London Gateway will still generate substantial amounts of road traffic for which high quality, congestion free road connections will be essential if the facility is to fulfil its potential role in boosting the UK economy.

The Swanscombe Peninsula on the south side of the Thames is the location for the proposed Paramount Park development. If consented, this theme park will include a water park, event space, cinemas, theatres, hotels and ancilliary housing and is claimed will be the third largest theme park in the world. It will potentially create 27,000 jobs and London Resort Company Holdings, the scheme promoters anticipate opening in 2019. Efficient and easy access by both road and public transport will be vital if such a development is to be successful.

In September 2012 KCC organised an "Action for Growth" Infrastructure Summit involving representatives of the construction and development sectors, central and local government including senior representatives of UKTI, the Local Enterprise Partnership and the investment sector.

A number of key requirements were identified across several topic areas for implementation if the UK is to make real progress in delivering growth over the short to medium term on a scale that will be sufficient to boost the country's economy. The requirements were:

- *cutting costs and reducing the burden of compliance*
- *streamlining procurement*
- *cutting planning delays*
- *kick-starting growth locally by identifying new growth*
- *Utility companies should no longer be able to hold developments to ransom*
- *enabling greater private infrastructure investment*

[14] Thames Gateway Economic Development Investment Plan (East of England Development Agency, London Development Agency and South East of England Development Agency)

Within the remit to kick start local growth, there was clear recognition that early commitment from the Government to deliver a new lower Thames Crossing was vital. The immediate action arising from this was for a corridor that enabled a new strategic route to be developed along the North American design/build/finance/operate model. It is evident from the outcomes of this summit that it is not just the business sector who recognises the urgent need for a new crossing, but the wider economic benefits such a project could deliver are well recognised by the construction, development, financial and investment sectors as well.

The huge levels of planned and anticipated growth in the Thames Gateway, even during times of economic recession, demonstrate that development pressure is spreading eastwards from the capital. To make this work and ensure it comes to fruition good connections north and south of the river are essential. The existing crossing simply does not have the capacity to deliver on this even after the introduction of short and medium term measures.

2.6 Air quality and health impacts

The sustained high levels of traffic flow on a daily basis through the year and the consequential delays at both the existing crossing and its approaches, have an adverse impact particularly in terms of vehicle emissions. Air Quality Management Areas have been declared for Dartford which includes the M25 J1a-1b and the A282 and at locations adjacent to the A282 and M25 in Thurrock. It is likely the existing crossing will be a significant contributory factor in the designation of these AQMAs as the principle issue in both cases is the emissions from traffic on the approach to the crossing rather than on the crossing itself.

These high levels of emissions and exceedences of specific pollutants as denoted by the AQMAs, will have an impact on health. This will be particularly so for Dartford and Thurrock residents who live in close proximity to the approaches to the existing crossing. To some extent this is borne out by the fact that Darford, along with Gravesham, Medway, Swale, Thanet, Dover and Shepway has higher lung cancer rates than other districts in Kent and the South East[15].

Transport related air pollution increases the risk of mortality, particularly from cardio-pulmonary causes. It also affects health in a number of other ways, including: non-allergic respiratory disease; allergic illness and symptoms (such as asthma); cardiovascular morbidity; cancer; pregnancy; birth outcomes; and male fertility. The Figure 1 and 2 below both demonstrate how Dartford has higher instances of respiratory diseases and asthma, both of which can be acerbated by poor air quality.

[15] Cancer Inequalities in the South East Region: the Burden of Cancer, NHS, Sept 2006

Figure 1 Hospital Emergency Admission rates for Asthma - Dartford[16]

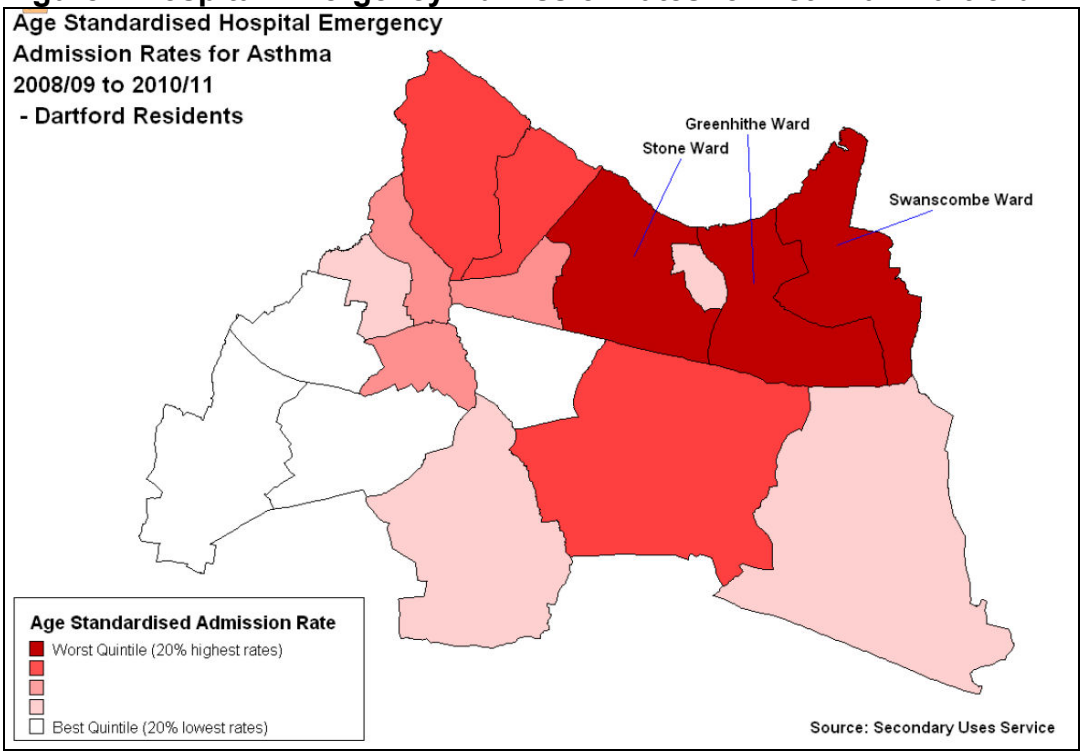
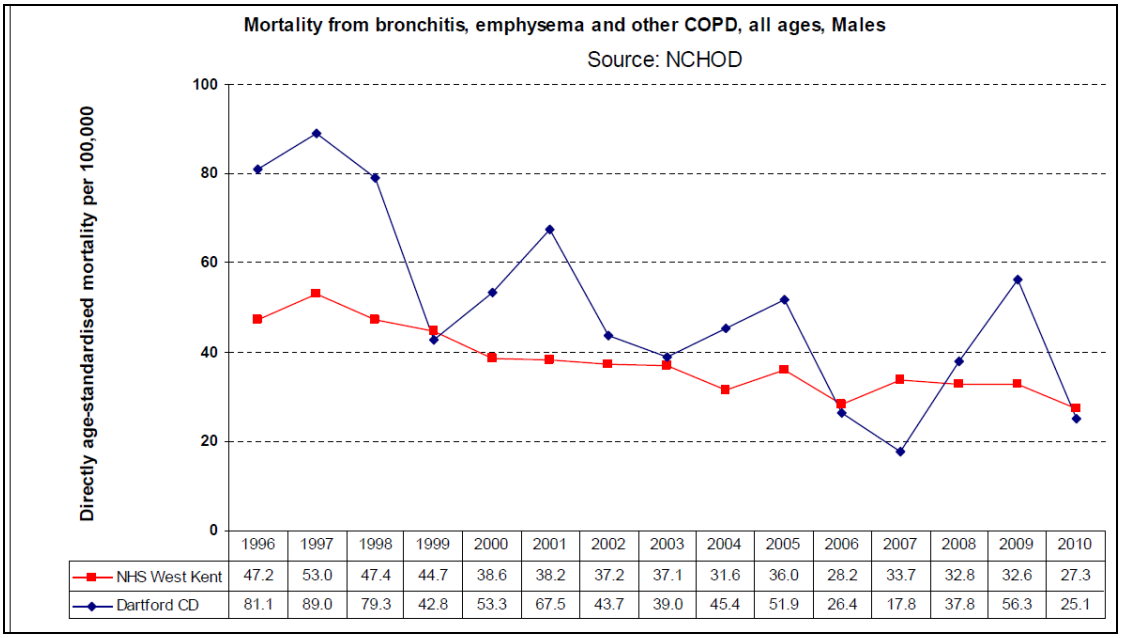


Figure 2 Male mortality from respiratory diseases Dartford and West Kent[16]



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
NHS West Kent	47.2	53.0	47.4	44.7	38.6	38.2	37.2	37.1	31.6	36.0	28.2	33.7	32.8	32.6	27.3
Dartford CD	81.1	89.0	79.3	42.8	53.3	67.5	43.7	39.0	45.4	51.9	26.4	17.8	37.8	56.3	25.1

[16] Health and Social Care Mapping Kent and Medway Public Health Observatory

Summary of case for new crossing
The evidence presented above makes it abundantly clear that the need to significantly enhance Thames crossing provision in the Lower Thames area, both as a catalyst for and facilitator of growth in the Thames Gateway and the wider South East is urgent. Government has been clear, that even with free-flow charging in place, the existing crossing will be over capacity and continue to experience severe delays with extremely poor network resilience[17].

3. Assessment of corridor options

3.1 The corridor options

The corridor options being assessed as potential location for a Third Lower Thames Crossing are shown in Appendix A and described below.

- Option A:This option would provide additional long-term capacity at Dartford through the delivery of a new crossing while retaining all existing infrastructure (bridge and tunnels). This offers the shortest crossing route among the options and links the M25 J31 and M25 J1, and therefore directly ties in with the strategic road network.

- Option B: This option would provide a new crossing in the vicinity of the Swanscombe peninsula. It would connect the A2 to the south in the vicinity of Dartford, to the A1089 to the north in the vicinity of Tilbury Docks.

- Option C: This option comprises the provision of a new crossing to the east of Gravesend and Thurrock. It would need to link the M25 with the M2 and thus form a major new piece of infrastructure in the strategic road network. It would potentially provide a direct route for longer distance movements using the north-east section of the M25 and the M2 as well as providing some relief to the existing crossing.

- Option $C_{variant}$: Option C with an additional link to the M20 for long distance traffic, which has been assumed would take the form of widening the A229 linking the M2 and M20.

For each option three types of structure are considered namely, a bridge, an immersed tunnel and a bored tunnel. An immersed tunnel is a shallow depth tunnel submerged in a trench in the riverbed, while a bored tunnel requires the construction of a circular tunnel at depth, without removing the ground above. Each option will provide 2 lanes in each direction and it is anticipated construction could take place in the 2020-25 period with a year of opening of 2025.

[17] Stephen Hammond at his launch of the Lower Thames Crossing Consultation, Westminster, 20 May 2013.

3.2 Evidence Base

In order to allow informed decision making on which option should be progressed, the Department for Transport has issued detailed evidence evaluating the benefits and impacts of each option. The following assessment draws largely from that DfT evidence[1]. Government has been clear that each option will result in the following, albeit to varying extents:

- Benefits that exceed the costs;
- Increased traffic levels crossing the lower Thames;
- Reduced congestion on existing crossing;
- Large benefits to business users
- Improved journey times using the existing crossing
- Increase population experiencing noise: and,
- Some relocation of jobs eastwards from London into Thames Gateway.

In order to inform it's own decision making, KCC jointly commissioned with Essex County Council and Thurrock Council two studies during 2012 to provide an evidence base in relation to the three crossing options. The first of these studies, the KCC Regeneration Study 2012, assessed the likely regeneration impact a new Lower Thames Crossing would have[18]. This study considered how each of the three crossing options could:

- unlock or bring forward the development of key sites to provide employment opportunities and delivery of homes.
- Impact on the scale, timing and type of development
- Impact on the net additional economic impact of each option.

The second study, the KCC Environmental Study 2012, assessed the environmental impact of the crossing options following the implementation of mitigation[19]. The main aspect of this work identified the potential environmental impacts that would affect the ecology and biodiversity (impact on European designated sites, SSSI, LNR, LWS, RSPB reserve, UKBAP Habitats and notable/protected fauna), cultural heritage, landscape, flooding, noise and air quality factors identified as relevant to each crossing option. The process involved identifying the environmental impacts and the feasibility of potential mitigation and then assessing the residual impacts after the implementation of this mitigation. As with the regeneration study, account is taken of the Option B routing towards the east of the Eastern Quarry site.

3.3 Contribution to national economy

3.3.1 Regeneration

The KCC regeneration study shows that Option A offers the least potential in terms of delivery of new homes and jobs therefore representing a significant

[18] Third Thames Crossing Regeneration Impact Assessment, URS, May 2012 and Addendum Report December 2012

[19] Review of Environmental Impacts of Lower Thames Crossing Options, Mouchel, November 2012

missed opportunity for Thames Gateway, as well as national economic growth. Option B offers significantly more potential for the delivery of new homes and jobs than Option A and marginally more than for Option C and represents the biggest opportunity to boost economic growth. These figures are given in Table 2 below.

Table 2 KCC Regeneration Study Assessment of each Option[18]

Impact	Option A		Option B		Option C	
	2012-2021	2012-2031	2012-2021	2012-2031	2012-2021	2012-2031
Additional Jobs	21,700	22,931	33,150	35,807	30,083	32,334
Additional Homes	10,613	15,580	16,641	32,813	14,892	28,320

This finding that Option C offers the greatest potential for economic growth is confirmed by an earlier study KCC commissioned in 2010. This earlier study by KPMG carried out a high level assessment of the wider economic and regeneration impacts of a new Lower Thames crossing and concluded that a crossing from Chadwell in Essex to east of Gravesend would provide major economic benefits for the local area contributing £12.7 billion to local GVA (£334 million a year)[20].

3.3.2 User Benefits

Benefits to users can be captured through traffic modelling work and reflects the time savings for users as well as other costs incurred or saved and equates this to financial savings. As can be seen from Table 3 below, savings are substantially higher for business users which reflects the fact that financial costs and hence operational costs for HGVs are significant compared to cars. This evidence demonstrates that Option C variant and Option C offer considerably more user benefits than options A or B, with Option C variant offering over 3 times the benefit of Option A.

Table 3 Comparison of Options broken down by user types[1] (present value over 60 years, £m 2010 prices)

Impact Assessed	Option A	Option B	Option C	Option C variant
Business users	700	1,200	2,200	2,900
Consumer users	200	-300	-100	200

A practical example of this is the potential cost savings route choice could realise for strategic traffic. An analysis of the cost savings for trips between the south of Kent (Dover) to the J7 on the M11 which are likely to form the basis of a significant proportion of traffic from north of the Thames to Europe. Table 4 below shows that for this particular trip savings of just over £158,000 can be made per day in terms of car and OGV2 vehicle running costs based on current traffic volumes if they used option C. This would equate to just under a £40 million saving annually. Additional costs of just under £57,000

[20] The lower Thames Crossing – KPMG Regeneration and Funding Report, August 2010

would be accrued if this traffic switched to option B giving an annual cost of just over £14 million.

Table 4 Vehicle operating cost comparison of switching route to Option B and C

	Option A	Option B	Option C
Trip distance (miles)	87.3	88.6	83.7
Costs/Savings for Cars of switching routes			
Cost per car journey[21]	£42.91	£43.66	£40.60
Change from Option A for car		+£0.75	-£2.31
Cost assuming 50% of car traffic switches from existing crossing		+£52,031.63 per day	- £144,241.02 per day
Cost/Savings for OGV2 of switching routes			
Cost per OGV2 journey [22]	£47.69	£48.40	£45.72
Change from Option A for OGV2		+£0.71	-£1.97
Assuming 10% HGVs on existing crossing and half switches from existing crossing		+£4,925.98per day	- £13,667.86 per day

3.3.3 Wider Economic Benefits

Connectivity of the strategic road network will also be a significant potential contributor to economic growth. This confirms the evidence that Option C variant and Option C will generate substantially greater wider economic benefits than either A or B. The majority of these benefits accrue from agglomeration benefit from connecting businesses on either side of the Thames. Agglomeration effects arise where businesses become better connected and benefit from that proximity through improved labour market matching and sharing of best practice. Option A produces relatively little wider economic benefit with Option B marginally more.

Summary of Contribution to National Economy

Overall from the facts above it can be seen that Option B offers the greatest potential for delivering new jobs and houses and Option C only marginally less. Option A performs poorly on this front. For both user benefits in terms of cost savings, and wider economic benefits generated Option C and C variant offer the greatest return.

[21] Applying average value across car prices up to £32,000 with annual mileage up to 15,000. RAC data 2011 http://www.theaa.com/motoring_advice/running_costs/petrol2011.pdf

[22] Assuming a rate of 54.63 pence per kilometre for a OGV2 (3 to 5 axle articulated vehicles)

3.4 Congestion, resilience and impacts on strategic road network

Modelling work carried out for the DfT is the basis on which the performance of each of the new crossings is assessed[1].

3.4.1 Congestion on existing crossing

This modelling work forecasts that option A will provide most congestion relief to the existing crossing, but it could add delay to the A13. Option C provides next greatest relief with Option B providing least congestion relief to the existing crossing.

3.4.2 Congestion on surrounding road network

On the surrounding road network, congestion around Dartford is significantly reduced by all options, however while Option C variant is forecast to significantly improve congestion near Tonbridge and Malling, it would also see increased congestion in Medway, particularly on the section of M2 feeding into the A229. Options A and B will increase congestion notably in Thurrock, Basildon, Brentwood and Rochford and in Kent, all crossing options will increase average congestion delays for journeys in Sevenoaks and Swale. With Option A it is likely the impact of incidents at or on the approach to the new and existing crossings will have considerable and concentrated impact on the local road networks north and south of the river as traffic looks for alternative routes to bypass queuing and access the crossing as near to the bridge/tunnel itself.

3.4.3 Congestion on new crossings

For Option A it is forecast that there would be some congestion and hence delay on the northbound section, and similarly Option C would see some delay on the northbound side. Option B is forecast to operate at close to free-flow conditions.

3.4.4 Network resilience and journey times

Assessment of journey times and working on the assumption that route users will choose the shortest journey time, modelling shows that Option B will be expected to attract only relatively local trips while Option C would be expected to attract longer and strategic movements. Movements to and from destinations to the east of the M25 (Maidstone – Harlow, Dover - Birmingham, Dover to Cambridge) are likely to re-route via Option C as in effect they would travel a shorter distance. Movements with neither end east of the M25 (Brighton to Cambridge, Sevenoaks to Harlow) would be likely to use the existing crossing. They would, however benefit from congestion relief at the existing crossing.

In terms of network resilience therefore, Option A will not perform well. By connecting into the existing road network in close proximity to the existing crossing means the “bottleneck” phenomenon will prevail and increasing volumes of traffic will concentrate on the same congested parts of the

network. This means pressure will continue to grow on the A2, M25 north and south of the river, and other routes such as the A13, and perhaps more significantly, the junctions on these roads.

At present this vital economic corridor is subject to the catastrophic disruption to movement caused by single incidents on or near the existing Dartford Crossing as well as persistent congestion. A new crossing in close proximity to the existing one, will singularly fail to address this issue with the daily misery will continue for thousands of motorists, costs to business continually racking up and a missed opportunity to deliver truly significant growth in the Thames Gateway and across the wider UK economy.

Similarly, given that Option B is likely to only attract local based trips meaning more strategic trips will still route to the existing crossing, this option will offer fewer benefits than Option C and represent a missed opportunity to create a new north-south strategic route to the east of London.

Option C would also therefore, in part, help deliver on KCC's objective of achieving bifurcation of strategic traffic through the county. This would take pressure off the M20 increasing network resilience and would provide a vital first stage of an improved A2/M2 corridor across the county.

It is work noting that Option A or B proposals do not include for improvements at J30/31 on the M25. J30 is where the A13 meets the M25 and it is likely that if either of these options were taken forward, this junction and J2 of the M25 would need to be substantially upgraded. It is likely the cost for these improvements could reasonably be in the vicinity of £0.5-£1 billion. Option C would avoid the need for this additional work.

3.4.5 Accidents

The traffic modelling carried out on behalf of the DfT[1] shows that options B, C and C variant lead to much larger increases in traffic within the modelled areas, and therefore the forecast number of accidents increases by more than twice the amount for option A.

Summary of congestion, resilience and impacts on strategic road network

Option A will provide most congestion relief to the existing crossing, but it could add delay to the A13. While Dartford will experience significant congestion relief from all options, Swale and Sevenoaks are likely to experience more congestion from all options. Option B is likely to only attract local based trips while Option A focuses all traffic on the same approaches to the crossing meaning Option C and C variant are the only options that offer an opportunity to create a new strategic north-south route as well as increased network resilience. In terms of accidents, options B, C and C variant are all forecast to see large increases in accidents due to the large increase in traffic each option will bring about.

3.5 Contribution to reducing greenhouse gas emissions

Option A is forecast to produce a small benefit in terms of reduction in greenhouse gas which is due to the reduction in emission from decreased congestion. Options C and C variant however are forecast to produce considerable reductions in greenhouse gas emission as a result of a decrease in the distance travelled of 4.9% (Option C) and 8.0% (Option C variant) in 2025[1]. This reduced distance is accrued by the proportion of trips between East Kent, for instance Dover, and areas to the north of the Thames. In effect, strategic traffic making medium to longer distance trips. Option B is forecast to produce an increase in greenhouse gas emissions due to a marginal increase in distance travelled with this option in place.

Summary of contribution to reducing greenhouse gas emissions

Options C and C variant produce large benefits through significantly shortened journeys as well as a reduction in delay. Options A and B have relatively little forecast greenhouse gas impact with option A being slightly positive and option B slightly negative.

3.6 Impacts on environmentally sensitive areas and quality of life

3.6.1 Noise and air quality

In relation to noise Option A will have least impact with relatively few additional people affected by noise than are currently affected by the existing crossing. A greater impact is forecast for each of the remaining options as more people will be exposed to noise from a new transport corridor but with no real distinction between the three options in terms of the level of that impact.

In relation to air quality the results paint a similar picture as for noise. For Option A in the future year (2025) a greater number of areas will see an improvement in air quality than a deterioration. For the remaining three options, in the future year, they will each experience more areas seeing a deterioration in air quality than an improvement, with no significant difference in performance for these three options. Table 5 below summarises this position and identifies where air quality will be affected in existing Air Quality Management Areas (AQMAs).

Table 5 Forecast impacts of the options on air quality in 2025[1]

Option	Percentage of zones where air quality would:			Areas where air Quality at AQMAs may deteriorate
	Deteriorate	No Change	Improve	
Option A	29%	13%	58%	Those adjacent to existing crossing in Dartford and Thurrock

Option B	49%	13%	38%	Those adjacent to A226 and Bean Interchange
Option C	50%	6%	44%	Those adjacent to A2
Option C variant	65%	7%	28%	Those adjacent to A2

3.6.2 Landscape and Townscape

In terms of landscape and townscape, for Option A it is considered that there would be a neutral to slight adverse impact. A bridge structure at this location would fit well with the existing linear structure including its scale and there are fewer sensitive receptors with regard to landscape compared to other proposed routes due to the 'commercial' nature of the developed area. Option B is anticipated to have a moderate adverse impact on landscape and townscape. A crossing at this location would introduce an entirely new transport corridor with either a bridge and elevated road infrastructure or the approach to major tunnel infrastructure which would be out of scale with the local townscape character and impacting on locally valued townscape features.

Option C and C variant would be judged to have a moderate to large adverse impact on landscape. The introduction of a new transport corridor with its associated infrastructure will introduce significant change to the landscape and have a considerable impact for the length of this corridor. In addition, this option will impact on locally and nationally valued landscape features including the Kent Downs AONB, Cobham Hall Registered Historic Park and Garden, listed buildings, conservation areas, cultural heritage, ancient woodlands, Shorne Country Park and surviving Thames marshland. This level of impact could be reduced if the structure was one of the tunnel options rather than a bridge, in which case the level of impact would be considered to be moderate adverse.

The Kent Downs AONB unit believe option A would have the least impact from the perspective of the AONB. Option C will not only have a have a direct major impact on the landscape, heritage and air quality assets of the AONB but also on its cultural cohesion, essentially through the C variant improvements to the A229. Additional traffic pressure on the A229 as a result of Option B even without C variant in place, would similarly have a negative impact on the AONB.

The work commissioned by KCC[19], concluded that option A would be likely to have very little landscape impact, however for Options B and C, this was likely to be significant with the risk that it was unlikely mitigation would be feasible.

3.6.3 Heritage

In relation to heritage, option A is assessed as having a moderate adverse impact. While this option will not impact on the setting of designated sites, it is likely that the setting of some undesignated sites could be affected. There may also be an impact on a limited number of known cultural heritage sites.

The assessment for Option B carried out by KCC[19] concluded that there are a number of environmental issues both north and south of the Thames. The greatest impacts however relate to the Swanscombe Peninsula and while the routing of this option to the eastern side of the Peninsula lessens the impact on landscape, noise, air quality and designations associated with the Swanscombe Heritage Park, it increases the impact on heritage factors within the Ebbsfleet Valley.

These factors include the presence of buried archaeological remains, particularly Scheduled Palaeolithic, Neolithic and Romano-British sites, including the Scheduled Roman settlement and religious focus of Vagniacis. It also affects undesignated but nationally important (which the National Planning Policy Framework (NPPF) advises should be treated as if they were scheduled) Palaeolithic remains within the valley.

The assessment overall considered worse case scenarios, and in this instance, if mitigation included tunnelling under important sites in the Ebbsfleet Valley, it is likely the identified impacts would be reduced. Overall, it is considered by the DfT that this option will have a large adverse impact in terms of heritage; KCC Heritage Conservation considers that the impact has been underestimated by not considering nationally important but undesignated sites (contrary to NPPF policy), and if the impact on the Palaeolithic and Roman sites could not be mitigated through tunnelling the impact would probably be very large adverse.

KCC Heritage Conservation also consider that earth heritage has not been properly assessed for Option B - the SSSI for Pleistocene geology and Palaeolithic archaeology in the Ebbsfleet Valley has not been included in the assessment.

For option C and C variant, the likely impact on heritage is considered to be large adverse. Option C variant could affect two Scheduled Monuments of Neolithic date (the internationally important megalithic sites of Kits Coty House and Little Kits Coty). It should be possible to avoid this impact by staying within or to the east of the existing corridor of the A229; there would however still be an adverse impact on the setting of the Scheduled sites.

Option C itself does not directly affect any Scheduled sites in Kent but does affect undesignated sites in Shorne Country Park and the important Shornemead Rifle Range. There could also be a significant impact on the setting of the Grade II Registered Cobham Park. Shorne Country Park is KCC's flagship country park with over 400,000 visitors per annum. It had a new visitor centre built in 2006 and impact on this location along with those of Randall Wood or Brewers Wood will require liaison with the Heritage Lottery Fund with whom KCC currently have up to 80 year agreements in place to maintain land.

3.6.6 Biodiversity and water environment

A large adverse impact is anticipated for options A and B in relation to biodiversity primarily due to impact on the recommended Marine Conservation Zone[23]. The construction of a bored tunnel as opposed to a bridge or immersed tunnel however would reduce this level of impact to slight adverse for option A and moderate adverse for option B. For option C and C variant the same principle applies in that a bored tunnel will reduce likely impact on biodiversity however, overall the assessment for option C and C variant is one of very large adverse impact.

This is due not only to impact on the recommended Marine Conservation Zone, but also to impacts on the Thames Estuary Special Protection Area and Special Area of Conservation/Ramsar, which are designated at an EU level. In order to derogate from the requirements of legislation, the development would not only have to demonstrate over-riding public interest but also that no other alternative was available and compensatory habitat could be provided for. In addition, option C also impacts on various Sites of Special Scientific Interests and ancient woodland - the NPPF suggested that development should not take place where it adversely impacts or destroys these.

In terms of water environment, for all options the main significant impact would be due to changes to the form and processes of the River Thames as a result of a new river crossing. In each case an immersed tunnel option would be likely to have the greatest adverse impacts. Overall, for each option the impact is assessed as moderate to large adverse.

Summary of impacts on environmentally sensitive areas and quality of life

a) Noise and Air Quality
For both noise and air quality Option A will see slight benefits with the remaining 3 options all experiencing a similar level of disbenefits

b) landscape and townscape impacts
For landscape and townscape impacts, the principle is the further east, then the greater the adverse impact. Option A is judged to have a neutral to slight adverse impact, option B a moderate adverse impact and option C and C variant a moderate to large adverse impact, although a tunnel structure for C and C variant could potentially reduce this impact to moderate.

c) heritage impacts
For heritage, Option A offers least impact being assessed as having a moderate adverse impact. All other crossing options have been assessed as having a large adverse impact, however KCC Heritage team consider that Option B has been underestimated and would probably be very large adverse.

d) biodiversity and water environment impacts

[23] The Thames Estuary was one of 127 sites recommended to Government as possible Marine Conservation Zones. The Government has proposed to designate 31 sites. The Thames Estuary is not included in this list, however further designations are anticipated in tranche 2.

For biodiversity the greatest impact will be from option C and C variant and while a bored tunnel option will lessen these impacts, they will still be considerable. Options A and B will have a lesser scale impact although still considered large, however a bored tunnel option could also reduce this.

For impact on water environment, the assessment is the same for each option, with the avoidance of using an immersed tunnel potentially reducing the level of impact.

The KCC environmental impact study[19] concluded that Option A would be likely to have considerably less environmental impact than the other options, with options B and C having environmental factors that would require extensive mitigation at considerable cost and include some factors for which direct mitigation would not be possible and that would require route-realignment as a result. Some mitigation may be possible for Option B with a tunnel type structure, however more detailed work would be required to establish if this would be sufficient to mitigate the likely impacts. Of all three options, C is likely to have the greatest environmental impact with 14 out of the 18 environmental impacts considered being assessed as being significant or above.

3.7 Costs and value for money

An estimated capital cost has been produced for each of the corridor options. As would be expected, Option A is the least cost option ranging from £1.1bn - £1.9bn depending on the type of structure. For Option B this range is from £1.6bn - £2.5bn and for Option C, £2.8bn - £3.8bn. Again, as would be expected Option C variant is the most expensive ranging from £4.4bn -£5.9bn. The costs in Table 6 below represent the 'most likely' cost for each option.

Table 6 Estimated Capital Cost for Each Option[1]

Option	Capital Cost (£m)*
A – Bridge	1,245
A – Immersed Tunnel	1,601
A – Bored Tunnel	1,571
B – Bridge	1,780
B – Immersed Tunnel	2,016
B – Bored Tunnel	2,174
C – Bridge	3,239
C – Immersed Tunnel	3,092
C – Bored Tunnel	3,155
$C_{variant}$ – Bridge	5,007
$C_{variant}$ – Immersed Tunnel	4,860
$C_{variant}$ – Bored Tunnel	4,922

* A lower and upper cost for each option has been produced. This cost represents the 'most likely' cost

In terms of value for money, government is clear that this will form a key consideration in its decision about whether a proposal should go ahead and is generally assessed by the benefit to cost ratio (BCR) for a scheme. This figure shows the amount of return expected for each £1 of investment, for example a BCR of 1:1.5 would mean that for ever £1 invested we would expect to see a return of £1.50. Table 7 provides the BCR for each option. The range of figures reflects the BCR depending on whether a bridge or tunnel option.

Table 7 Benefit to Cost Assessment for each option[1]

	Option A	Option B	Option C	Option C variant
Indicative BCR without wider impacts	1.0 - 1.8	0.5 – 0.8	1.2 – 1.3	1.2
Indicative BCR with wider impacts	1.4 – 2.4	1.1 – 1.7	1.9 – 2.0	1.7

It can be seen that the bridge structure for Option A (BCR of 2.4) and each structure possibility for Option C potentially offer the greatest value for money. However, as the DfT consultation acknowledges, if Option A is pursued, it is highly likely that significant improvements would be needed at J30 and J2 of the M25. In this case, the cost of option A could reasonably be increased by £0.5-1 billion meaning its cost benefit assessment figure will be reduced.

4. Funding

KCC has carried out its own investigations on how a third Lower Thames crossing could be funded. A key part of this work involved direct discussions with the North American investment sector. From these discussions it is clear that there is considerable interest from blue chip investors to be involved in projects of this nature. Projects such as this which involve tolling, offer the right mix of long term cash flow and contract security to make them an attractive investment, even in times of global economic recession.

Our discussions revealed that subject to a number of key criteria, it is highly likely that private sector investors in a third Lower Thames Crossing would be forthcoming. These criteria included:

- The creation of a Special Purpose Vehicle (SPV) to deliver the project
- A longer term concession, such as up to 50 years;
- The tolling regime for the existing crossing must be included in the concession to ensure the tolls cover the full financing of the scheme;
- A minimum revenue guarantee for Government would be preferred, and;
- A clear commitment from UK Government to backing the project with a senior Minister acting as project champion.

With clear commitment from Government to some key criteria, it is KCC's view that a third Lower Thames Crossing can be delivered without recourse to the public purse, even if the most expensive corridor option was chosen.

5. Summary and conclusions

Table 8 below provides a summary of the case for each of the crossing options. This summary is from the DfT's assessment of the options and is extracted from their consultation document. From this table it can be seen that options A and B tend to perform better on congestion relief, environmental factors and cost while options C and C variant perform better in terms of regeneration, wider economic impacts, network resilience, strategic routes, greenhouse gas reduction and value for money. Option C and C variant would also have the potentially considerable challenge under EU regulations of overcoming the test of demonstrating there are no reasonable alternatives given the potential environmental impacts of this corridor.

Key to Table 8	
□	Very positive impact
□□	Positive impact
-	No discernible impact
□	Negative impact
□	Very negative impact

Table 8 Summary of relative merits of option corridors

Table8 Summary guide to the relative merits of the location options				
(Based on assessment of forecast impacts over 60 years, except where year is otherwise indicated)				
	Option A	**Option B**	**Options C and $C_{variant}$**	**Location of information**
	Impact	**Impact**	**Impact**	
Contribution to the national economy				
Time saved to business users	£700m □	£1,100m □	£1,900m–£2,600m □□	Tables 4.4–4.7, Final Review Report
Wider economic benefits	£250m □	£600m □	£1,200m–£1,500m □□	
Improved connectivity (by 2025)	500 jobs relocated to the Thames Gateway area □	2,100 jobs relocated to the Thames Gateway area □□	3,000–3,200 jobs relocated to the Thames Gateway area □□	
Journey times using new crossing	New crossing would be located next to existing crossing, so see commentary below	Shortened between some towns in Essex and Kent if new crossing used □	Many journeys shortened when new crossing is used, both within the south east and nationally □□	Table 4.2, Final Review Report
Congestion and resilience of the crossing and the strategic road network				
Conditions at existing crossing (2041)	Operates at 75% capacity or less than capacity, which should result in uncongested conditions □□	Operates at around 90% capacity, occasional queues □	Operates at around 90% capacity, occasional queues □	Table 4.4, Final Review Report

Journey times using existing crossing (2041)	7 minutes shorter in evening peak □□	5 minutes shorter in evening peak □□	5 minutes shorter in evening peak □□	Section 4.4, Central Forecasts and Sensitivity Tests Report
Queues at existing crossing (2041)	Shorter queues in northbound direction in the evening peak □	Shorter queues in northbound direction in the evening peak □	Shorter queues in northbound direction in the evening peak □	

Table 8 Summary guide to the relative merits of the location options				
(Based on assessment of forecast impacts over 60 years, except where year is otherwise indicated)				
	Option A	**Option B**	**Options C and $C_{variant}$**	**Location of information**
	Impact	**Impact**	**Impact**	
Resilience on other parts of the strategic road network	Delays on A13 eastbound are worsened □□ Delays on A229 northbound are slightly worsened □ Potential for additional congestion around M25 junctions 30 and 2 □	Delays on A13 eastbound are worsened east of Basildon □ Delays on A229 northbound are slightly worsened □ Adds pressure to A2 □	Delays on A13 eastbound are slightly improved □ Delays on A229 are worsened in both directions by Option C □□ Delays on A229 are improved in both directions by Option $C_{variant}$ □□	Figures 4.7–4.8, Final Review Report and section 8.5, Final Review Report
Number of accidents	Accidents are forecast to increase across the area due to the increase in total traffic predicted due to the provision of a new crossing			
	Increases by 26,000 over 60 years □	Increases by 58,000 over 60 years □●□	Increases by 60,000–62,000 over 60 years □●□	Tables 4.4–4.7, Final Review Report
Contribute to reducing greenhouse gas emissions				
Greenhouse gas emissions over 60 year period	Reductions of 693,000 tonnes □	Increased emissions of 1,300,000 tonnes □	Reduction of 6–8 million tonnes due to many journeys being shortened □□	Tables 4.4–4.7, Final Review Report
Avoid unacceptable impacts on environmentally sensitive areas and improve quality of life				
Impact on landscape/ townscape and heritage	Least adverse impacts of the location options □	Moderate to large adverse impacts, including proximity to housing south of Grays □□	Largest adverse impact of the location options, including significant impacts on land designated as Green Belt north and south of the Thames □□	Table 4.8, Final Review Report

Table8 Summary guide to the relative merits of the location options				
(Based on assessment of forecast impacts over 60 years, except where year is otherwise indicated)				
	Option A	**Option B**	**Options C and $C_{variant}$**	**Location of information**
	Impact	**Impact**	**Impact**	

Habitats and biodiversity	Slight to large adverse impacts □	Moderate to large adverse impacts □	Very large adverse impacts □□	Table 4.8, Final Review Report
Numbers of people affected by noise (by 2015)	Smallest net increase of the location options of 245 people □	Middling net increase of the location options of 1,857 people □□	Largest net increase of the location options of 1,769-1,932 people □□	Tables 4.4–4.7, Final Review Report
Impacts on air quality (2025)	Improvements in local air quality for a greater proportion of zones (road links) than deterioration. Air quality may deteriorate at Dartford and Thurrock AQMAs.	Improvements in local air quality for a greater proportion of zones (road links) than deterioration. Air quality may deteriorate at AQMAs adjacent to A226 and Bean Interchange.	Improvements in local air quality for a slightly greater proportion of zones (road links) than deterioration. Air quality may deteriorate at AQMAs adjacent to the A2.	Table 4.12, Final Review Report
Avoid unacceptable impacts on committed development				
Impacts on committed development	Possible impacts on a number of planned developments within Dartford and Thurrock □	Impacts on development sites within Ebbsfleet Valley development area □□	As most of the area is designated as Green Belt, there is limited development in the area —	Chapters 5–8, Design and Costing Report

Table 8 Summary guide to the relative merits of the location options

(Based on assessment of forecast impacts over 60 years, except where year is otherwise indicated)

	Option A	**Option B**	**Options C and $C_{variant}$**	**Location of information**
	Impact	**Impact**	**Impact**	
Distributional impacts on different income groups				
Time saving benefits/ disbenefits	Benefits associated with longer journeys favour people in higher income groups	Disbenefits associated with short trips more adversely affect middle & higher income groups	Disbenefits associated with short trips more adversely affect middle and higher income groups	Tables 4.4–4.7, Final Review Report, column headed 'Social and distributional impact', row 'Social, Commuting and other users'
Noise	Large adverse impact on lowest income group □	No particular bias in adverse impacts towards higher or lower income groups —	Option C has a large adverse impact on lower income groups, and a beneficial impact on higher income groups. Option $C_{variant}$ also adversely impacts higher income groups. □□	
Air quality	Positive impacts on all income groups, but highest income groups benefit the most □□	Positive impact on lowest income group but adverse impact on other income groups □□	Positive impact on lowest income group but adverse impact on other income groups □□	Tables A1.20-A1.23, Appendices to the Final Review