highways england

Lower Thames Crossing

Summary Business Case

Lower Thames Crossing
Route Consultation 2016

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1 INTRODUCTION

1.1.1 Highways England is consulting on proposals for a new road crossing of the River Thames connecting Kent and Essex. The proposal for a new crossing is supported by a strong case for change and is in line with broader Government objectives for improved transport links and economic growth. A new crossing is needed to reduce congestion at the existing Dartford Crossing and provide free-flowing north-south capacity. Unlocking economic growth and supporting the development of new homes and jobs in the region is also a priority and would be facilitated by this scheme.

1.1.2 This document is the Summary Business Case for the scheme, presenting the need for a new crossing and how it would be delivered.

1.1.3 This Summary Business Case has been prepared with reference to the government's general approach to decision making on transport infrastructure investment as set out in the DfT's Transport Business Case Guidance[1]. This has five elements which demonstrate that:

- There is a compelling case for change - the "**Strategic case**".
- The proposed scheme offers good value to the public purse - the "**Economic case**".
- The proposed scheme is commercially viable, attractive to the market place and can be procured - the "**Commercial case**".
- The proposed scheme is financially viable - the "**Financial case**".
- The proposed scheme can be delivered successfully - the "**Management case**".

[1] The Transport Business Cases, January 2013 (Department for Transport) Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/85930/dft-transport-business-case.pdf

2 THE STRATEGIC CASE

2.1 Introduction

2.1.1 The strategic case sets out the need for the scheme. It considers the problems that exist with traffic congestion and the consequences for road users, air quality and the economy. It looks at the crossing locations that have been considered and presents the proposed location. It also explains why a bored tunnel has been selected for the proposed crossing.

2.1.2 This strategic case should be read in conjunction with the Consultation Booklet and the pre-consultation Scheme Assessment Report.

2.2 The need

2.2.1 For over 50 years, the Dartford Crossing has provided the only road crossing of the Thames Estuary east of London. The crossing is a critical part of the country's road network. It connects communities and businesses and provides a vital link between the Channel Ports, London and the rest of the UK. Figure 2.1 shows the location of the Dartford Crossing in relation to the Strategic Road Network.

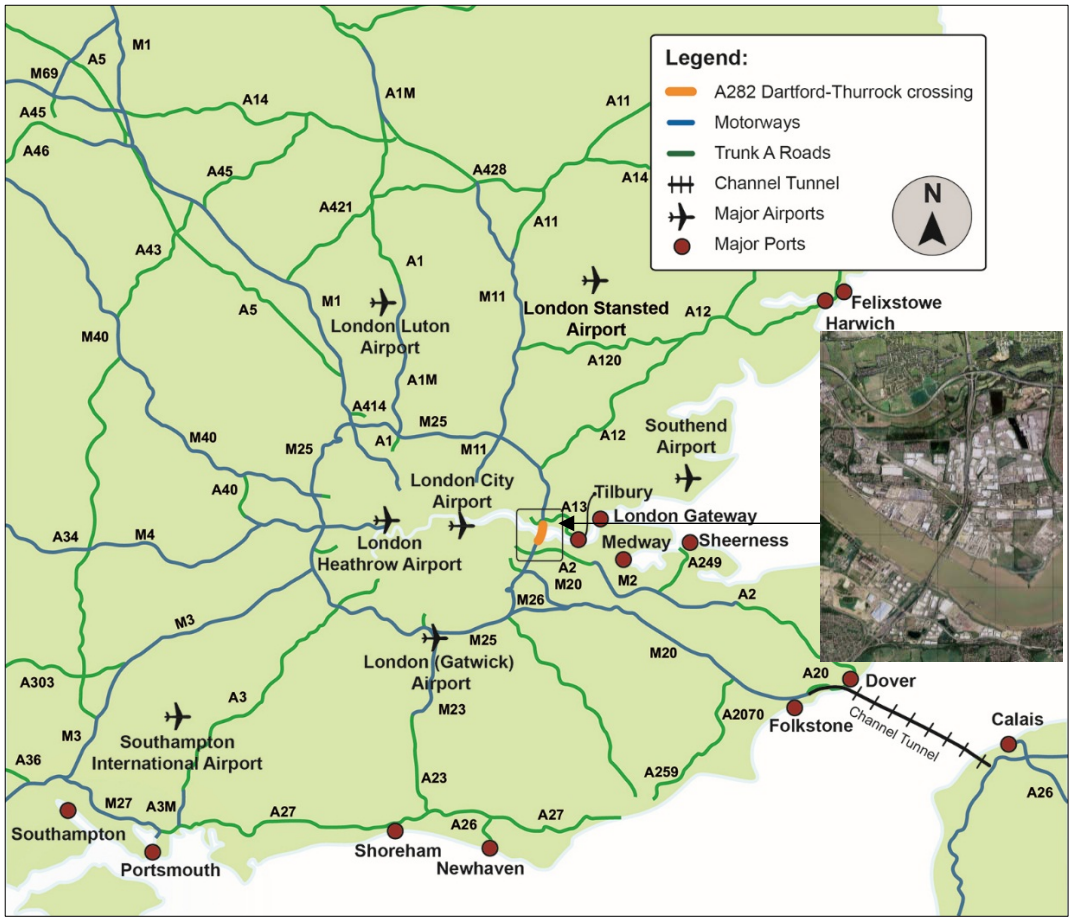

FIGURE 2.1 - LOCATION OF THE DARTFORD CROSSING IN RELATION TO THE STRATEGIC ROAD NETWORK

2.2.2 The Dartford Crossing (which is also known as the A282) is one of the busiest roads in the country, used 50 million times a year by commuters,

business travellers, haulage companies, emergency services and holidaymakers. Its reliable operation is essential for the provision of services and goods, enabling local businesses to operate effectively and for local residents to access housing, jobs, leisure and retail facilities north and south of the river.

2.2.3 The first tunnel opened in 1963 and the QEII Bridge opened in 1991. With the exception of the removal of the toll booths and the introduction of electronic payments (Dart Charge), there has been no significant improvement in the capacity of the existing crossing for nearly 25 years, during which time there have been significant developments in the area.

2.2.4 The existing crossing is one of the least reliable sections of the UK's Strategic Road Network of motorways and major roads. In 2015 only 50% of journeys southbound are on time and 53% northbound. Travelling in the evening peak 1 in 5 journeys average less than 20 mph.

2.2.5 Heavy and light goods vehicles currently represent 25% of journeys and this is predicted to rise to 34% by 2041, indicating the importance of the crossing to businesses and freight.

2.2.6 At present the crossing handles an average daily traffic flow of about 141,000 vehicles (2014) which is greater than the design capacity of 135,000 vehicles. This can be seen in Figure 2.2 which also shows the growth in traffic since the crossing first opened in 1963.

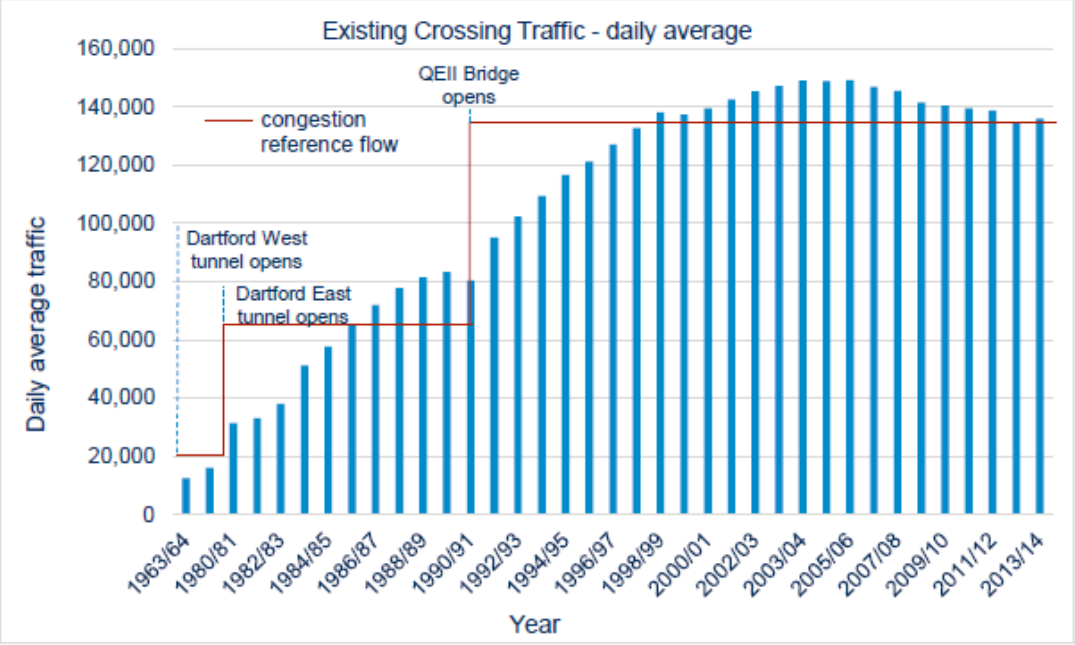

FIGURE 2.2 - AVERAGE ANNUAL DAILY TRAFFIC FLOW ACROSS THE DARTFORD CROSSING SINCE OPENING IN 1963 (2-WAY ANNUAL AVERAGE DAILY TRAFFIC)

2.2.7 Road users regularly experience delays and unreliable journeys, and when there are incidents, the congestion at the crossing quickly causes congestion on local roads and arterial roads in and out of London. Typically it takes between 3 to 5 hours for traffic flows to return to normal after an incident has been cleared. On average, there are over 300 full or partial unplanned closures each year which last approximately 27 minutes. Refer to Figure 2.3.

When the crossing closes, local roads are badly affected and users have no alternative but to:

- 'Wait it out'
- Use the Blackwall tunnel – 30 extra miles
- Take the long way round the M25 – 100 extra miles

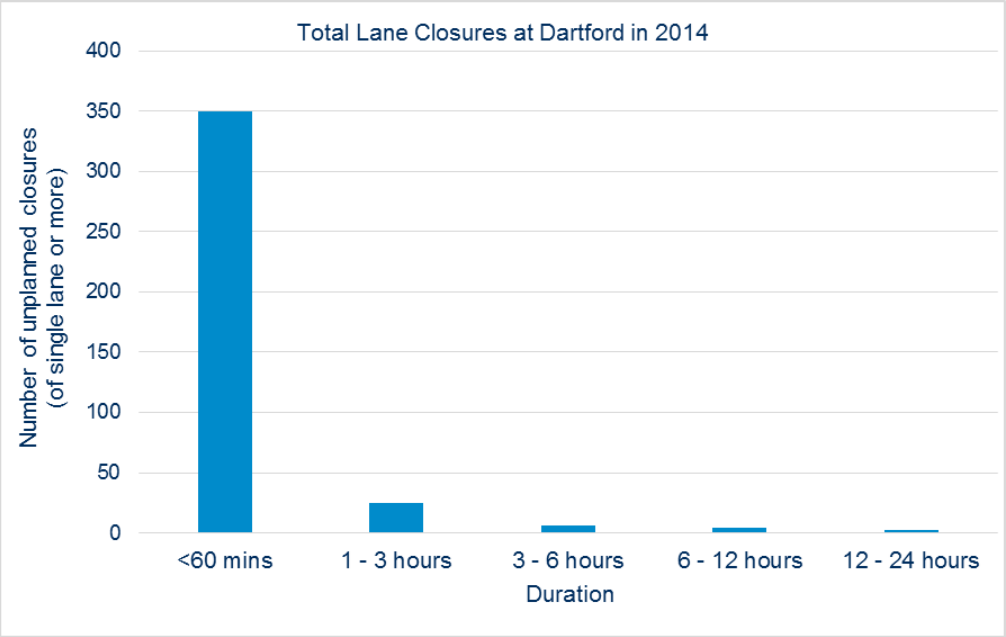

FIGURE 2.3 - TOTAL NUMBER OF LANE CLOSURES AT DARTFORD IN 2014

2.2.8 Incidents at the crossing have a ripple effect on the surrounding road network as demonstrated by reference to an incident in July 2014, when the northbound tunnels were shut at about 12.30pm due to an accident:

> *By 1pm the queues were already spreading back from Junction 2 on the M25. At 5pm, the queues had reached their largest extent and had reached back to Junction 5 of the M25, down the A2 and along the M20 in Kent. An area of some 425 square kilometres was affected by the resultant congestion. It was almost midnight that night before traffic returned to normal*.

2.2.9 Even when the crossing is operating normally the experience for drivers and other users is poor, with closely spaced junctions, 50mph speed limits and the need to negotiate the Traffic Management Cell when entering the western tunnel which has significant restrictions on lorry movements.

2.2.10 More broadly, congestion at the crossing is viewed as a major restriction on development and growth in the region, adversely affecting productivity and constraining business opportunities. Areas close to the crossing and to the east show low levels of gross value added (GVA), a measure of the value of goods and services produced in an area, compared to other areas west of London. Refer to Figure 2.4.

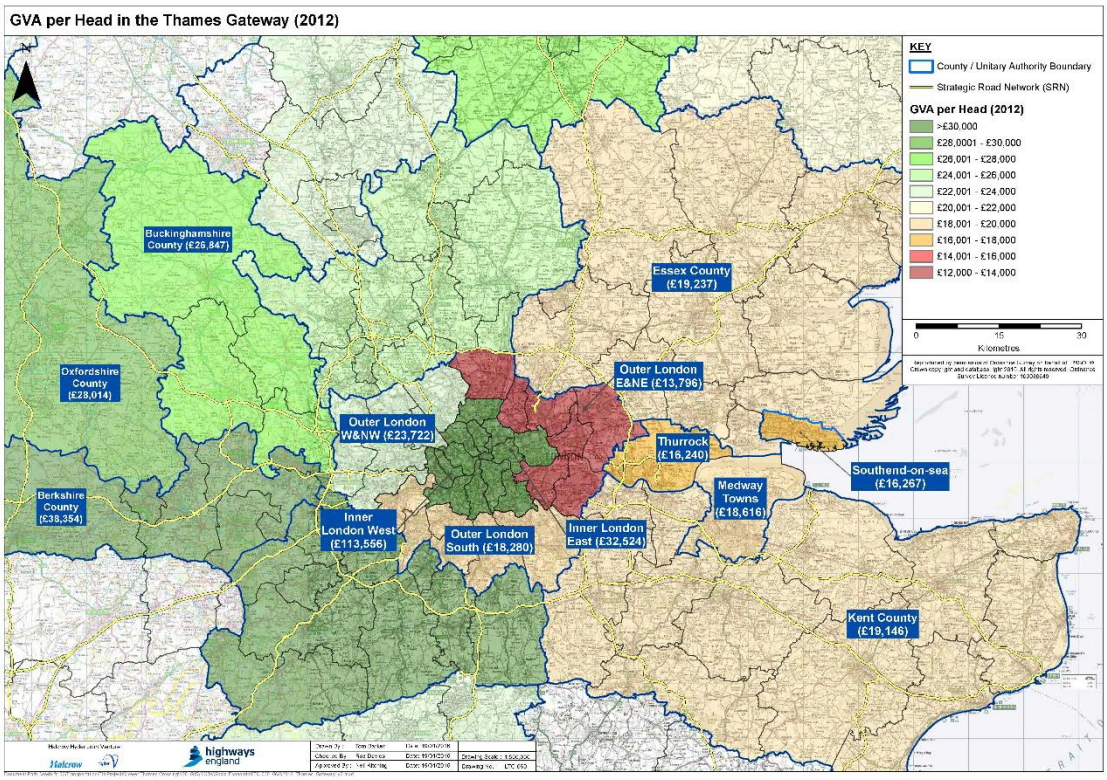

FIGURE 2.4 - GROSS VALUE ADDED (PER HEAD) IN 2013 FOR LOCAL AUTHORITIES AROUND THE LOWER THAMES CROSSING

2.2.11 A recent business survey indicated a strong relationship between the crossing and the investment plans of developers and businesses. 73% of respondents said that traffic congestion at Dartford affects their business. Approximately 60% thought their business would grow and almost 50% said that they could employ more people if the problem of congestion at the crossing were to be addressed.

2.2.12 Congestion and poor local transport provision limits access to jobs for those who live north and south of the river. Survey data shows that only a small number of residents from Dartford and Thurrock commute to work across the river.

2.2.13 In addition to traffic congestion, people living close to the crossing and its approach roads are exposed to high levels of noise and vehicle emissions. These are expected to get worse as congestion increases, despite improvements to vehicle emission standards. There are a number of Air Quality Management Areas close to the crossing where nitrogen dioxide levels are high and air quality is poor.

2.2.14 The introduction of Dart Charge to replace toll barriers has improved journey times over the last twelve months but as traffic volumes continue to grow, the improvements brought about by Dart Charge will be eroded. Delays at the crossing are forecast to be at pre-Dart Charge levels within the next ten years.

2.2.15 Government recognises the importance of efficient infrastructure in supporting and enabling economic growth and acknowledged this in 2011. A new Lower Thames Crossing was included in the National Infrastructure Plan as one of the government's top 40 priority projects. In addition, the National Policy Statement for National Networks (NPSNN) recognises the critical need to improve the national networks to address road congestion to enable safe and reliable journeys and to provide a transport network that is capable of stimulating and supporting economic growth.

2.2.16 It is clear that something further needs to be done to alleviate problems in the long term and to prepare for the future. A new crossing would provide better journeys for millions of people and would unlock economic growth, supporting the creation of new homes and jobs.

2.3 Previous studies

2.3.1 In 2009 the Department for Transport (DfT) examined five locations where an additional crossing might be feasible (referred to as Locations A, B, C, D and E). The most easterly of these (D and E) were found to be too far from the existing crossing to ease the problems at Dartford and were eliminated from further consideration.

2.3.2 In 2013 further analysis of the three remaining locations (A, B and C) together with an addition referred to as $C_{Variant}$ (which would involve widening of the A229 between the M2 and M20) was carried out.

2.3.3 In 2013 the DfT ran a public consultation on the need for a new crossing and invited views on:

- Location A (at the existing crossing)
- Location B (connecting the A2 and the Swanscombe Peninsula with the A1089)
- Location C (east of Gravesend and Tilbury)
- C Variant (widening of the A229 between the M2 and M20)

2.3.4 Later that year the Government announced its decision not to proceed any further with Location B due to limited public support, the potential impact on local development plans and its limited transport benefits.

2.3.5 In 2014, the Government published its response to the consultation, confirming the need for an additional crossing between Kent and Essex but acknowledging that there was no consensus at that stage on where it should be located.

2.4 Scheme objectives

2.4.1 In 2014 the government commissioned Highways England to identify and assess options for a new road crossing at Location A and Location C with the aim of identifying a proposed solution. It was also asked that consideration be given to the need to upgrade the A229 as part of a new crossing scheme (C Variant). The assessment is to include consultation with the public before a final selection is made. Refer to Figure 2.5.

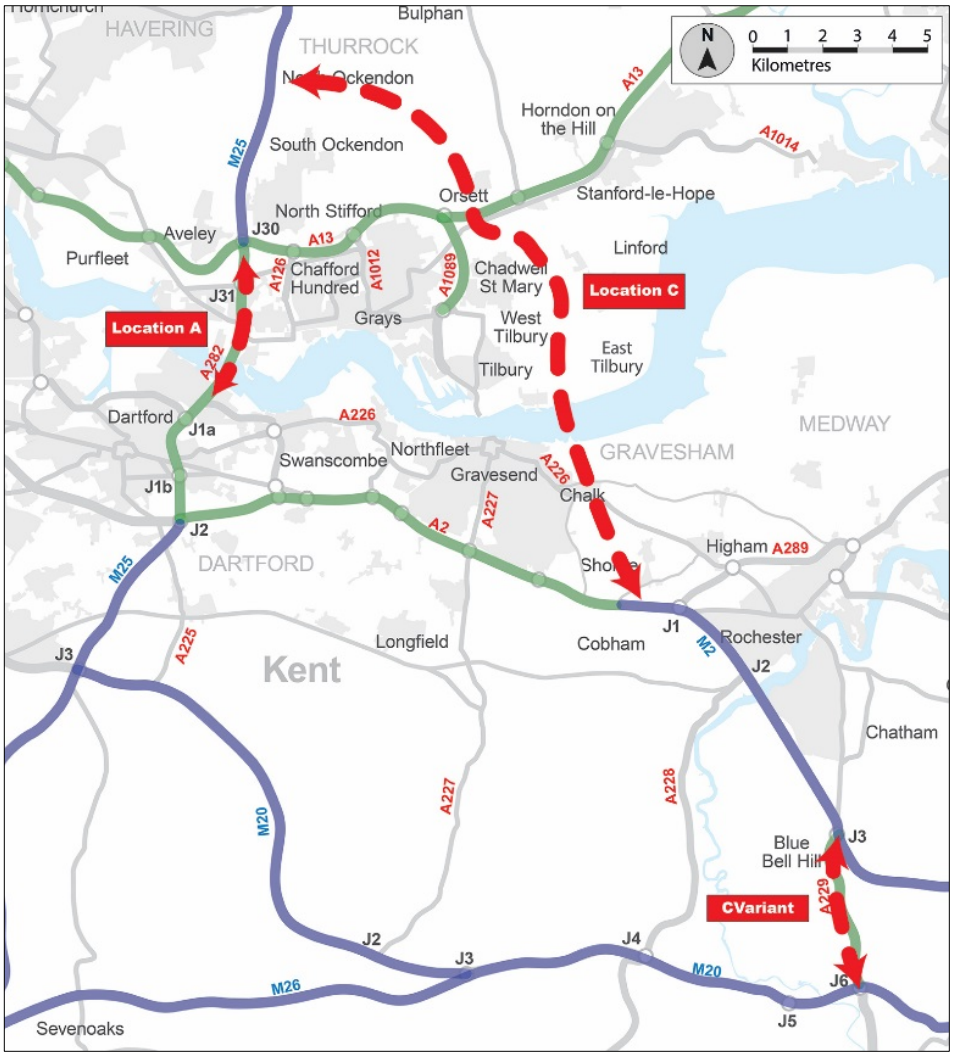

FIGURE 2.5 - LOCATION A, LOCATION C AND C VARIANT

2.4.2 DfT and Highways England agreed requirements for this work and developed the following scheme objectives:

TABLE 2.1 - SCHEME OBJECTIVES

Scheme Objectives	
Economic	• To support sustainable local development and regional economic growth in the medium to long term • To be affordable to government and users • To achieve value for money
Transport	• To relieve the congested Dartford Crossing and approach roads and improve their performance by providing free flowing north-south capacity • To improve resilience of the Thames crossings and the major road network • To improve safety
Community and Environment	• To minimise adverse impacts on health and environment

2.5 Development of the options

2.5.1 Since 2014 Highways England has developed feasible alternative routes and assessed these against the project objectives. A range of route options at both Location A and Location C were tested against the scheme objectives and evaluated against technical, economic, environmental and traffic criteria as well as cost and value for money. The options were sifted to produce a shortlist of the four principal routes shown in Figure 2.6 and described in Table 2.2. Further information on the sifting of the longlist can be found in the consultation booklet and the pre-consultation Scheme Assessment Report.

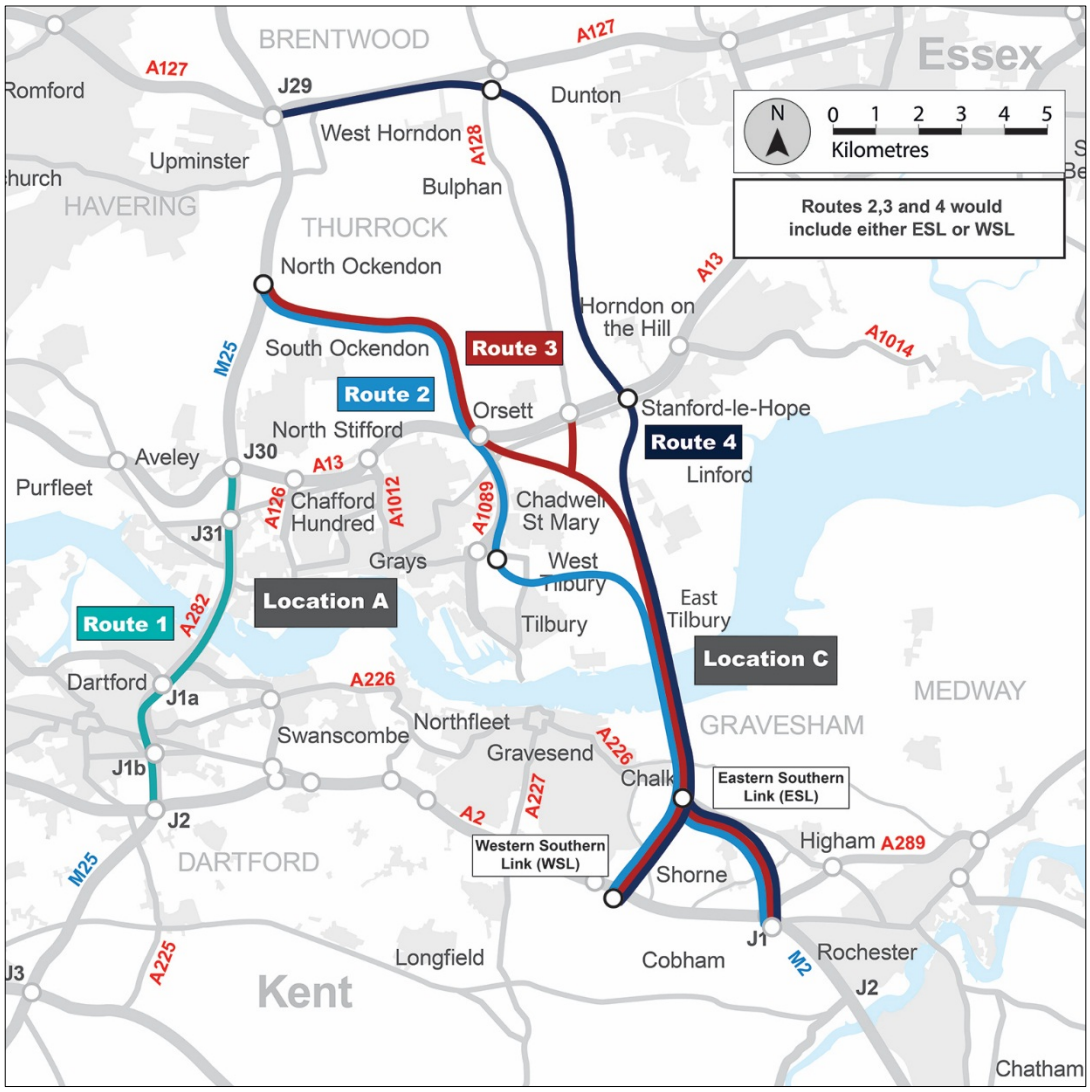

FIGURE 2.6 - SHORTLIST OF ROUTE OPTIONS

TABLE 2.2 - SHORTLIST OF ROUTE OPTIONS

Route 1	**Location A**: A bridge or bored tunnel adjacent to the existing Dartford Crossing	
Route 2	**Location C**: A bridge, bored tunnel or an immersed tunnel	South of the river - using either a **Western Southern Link** from the A2 or an **Eastern Southern Link** from the M2. North of the river - from the crossing following a westerly line via the existing A1089 to the M25 between J30 and J29.
Route 3		South of the river - using either a **Western Southern Link** from the A2 or an **Eastern Southern Link** from the M2. North of the river - from the crossing following a middle-line to the M25 between J30 and J29.
Route 4		South of the river - using either a **Western Southern Link** from the A2 or an **Eastern Southern Link** from the M2. North of the river - from the crossing following an easterly line via the existing A127 to the M25 at J29.

2.5.2 These shortlisted options were then developed and assessed in greater detail. As part of the detailed analysis, the widening of the A229 between the M2 and the M20 ($C_{Variant}$) was considered. The assessment concluded that this upgrade would have limited economic benefits, high environmental impact, a high cost and would have little benefit in transferring traffic from Dartford onto Location C routes. It was not considered to be essential to the new crossing scheme. Further consideration will be given to this link as part of our regional route planning, separately to the Lower Thames Crossing project.

2.6 Appraisal of the shortlist

2.6.1 In assessing the shortlist there have been three main considerations:

- Location – where a new crossing should be built (Location A or C)
- The Crossing – the type of crossing structure (bridge or tunnel)
- Routes and junctions – alignment of link roads and connections to strike a balance of environmental factors, local access and highway design standards

2.7 Location

Location A

2.7.1 A new crossing at Location A could be considered a widening scheme within the existing Dartford crossing corridor and as such would have benefits broadly similar to such a scheme. It would offer limited wider economic value as it does not connect new communities to the road network nor increase the resilience of the network through the provision of an alternative route. The

Adjusted Benefit Cost Ratio (BCR) for Location A is estimated to be approximately 2.3 based on the most likely costs. Benefit Cost Ratios are discussed further in Section 3 – Economic Case.

2.7.2 A new crossing at Location A could increase crossing capacity by 60% in the opening year and would deliver journey time benefits of up to 5 mins between Junction 3 and Junction 28 on the M25. However, with the absence of an alternative route, additional traffic would be funnelled through the existing corridor from Junction 2 to Junction 29 and incidents at Dartford would still cause long delays and severe congestion on local roads. By attracting additional traffic to the existing corridor, congestion on the adjacent A2 and A13 would also increase. Additionally, due to the existing configuration of approach roads there would be limited improvement for drivers. The 50mph speed limit and the closely spaced junctions with associated lane changing would remain.

2.7.3 From an ecological perspective, a crossing at Location A would likely have a lower impact on protected habitats and species than a crossing at Location C, as it is further from the environmentally sensitive sites. From an environmental perspective, attracting more traffic to the existing crossing corridor would make existing noise and air quality problems worse.

2.7.4 From an implementation perspective, Location A would result in at least 6 years of additional traffic disruption during construction which would also affect the M25 and connecting roads. These delays would effectively negate any benefits of Dart Charge during the construction period and are estimated to cost the economy approximately £390m.

Location C

2.7.5 In comparison, a new crossing at Location C would create a new road connection linking key areas of Ebbsfleet, Swanscombe and Gravesend in the south with Tilbury and wider areas of Thurrock in the north. Significant growth and regeneration would be enabled, improving access to jobs and services and providing opportunities for businesses. Estimates of wider economic benefits indicate that a crossing at Location C could increase GDP by over £7 billion and create over 5,000 new jobs. The adjusted BCRs for options at Location C range from 2.9 to 3.4 based on the most likely costs and the route selected. Refer to Figure 2.7.

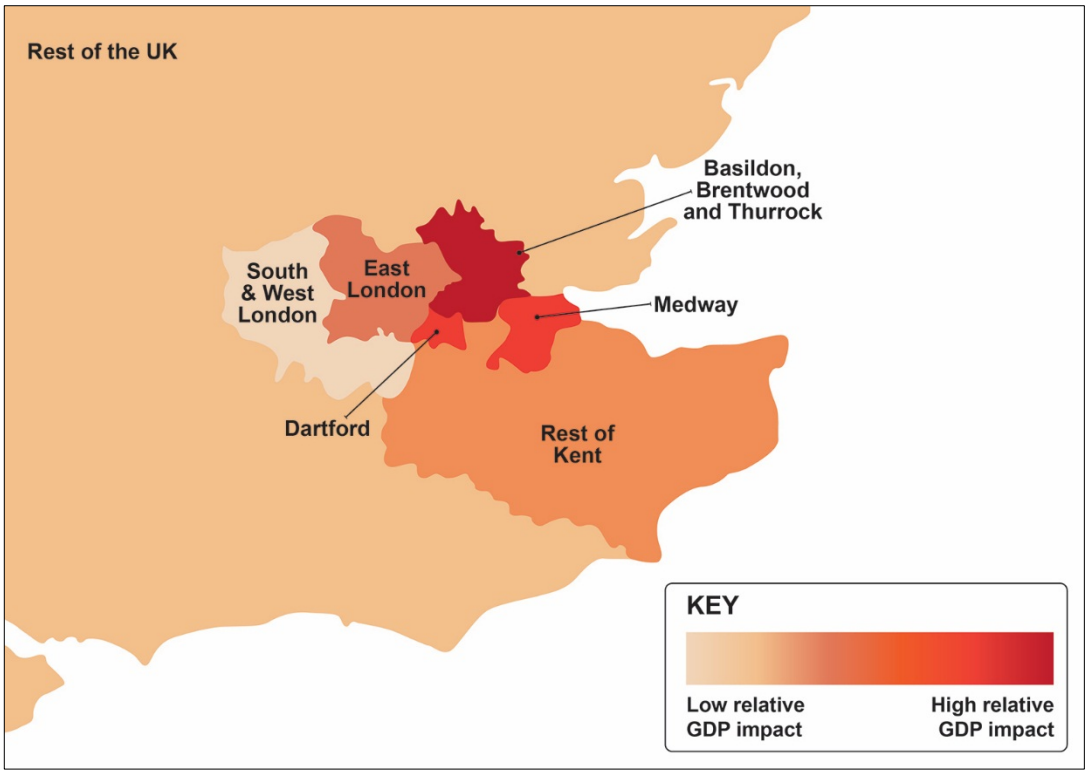

FIGURE 2.7 - THE RELATIVE GROSS DOMESTIC PRODUCT IMPACT FROM A NEW CROSSING AT LOCATION C

2.7.6 A new route at Location C would provide a high quality modern route with safer journeys on a 70mph road. North south crossing capacity of the River Thames, east of London, would increase by 70% in the opening year and, as a new route constructed offline from the existing road network, it would minimise impacts to the existing Dartford corridor which would remain open and unrestricted throughout the construction period.

2.7.7 On opening, route options at Location C would draw approximately 13-14% of existing traffic away from Dartford, improving journey times on the existing crossing by up to 5 minutes in peak time and improving journey times from Kent to the M25 by up to 12 minutes using the new crossing. As a new route it would also provide increased network resilience and improve flows on the A2 and A13.

2.7.8 A new crossing at Location C would be closer to sensitive ecological areas and as such would require appropriate mitigation measures (see Section 2.8).

Conclusion

2.7.9 A crossing at Location C is proposed because it offers greater economic and transport benefits than Location A. It would unlock significant wider regional economic growth and offers higher transport performance in terms of safety, capacity and resilience. In contrast a new crossing at Location A would not meet the transport and economic objectives of the scheme, nor would it provide good value for money when compared with Location C.

2.7.10 As Location C is proposed for the crossing, the remainder of this document presents consideration of the type of crossing structure and the options for link roads and junctions only for Location C.

2.8 The crossing

2.8.1 Possible sites for a new river crossing structure are limited, due to a number of constraints, to a narrow corridor bounded by Gravesend to the west and environmentally sensitive sites to the east (refer to Figure 2.8). A crossing west of this point would increase the impact on residents and property whilst moving further east would increase the impact on these environmentally sensitive sites.

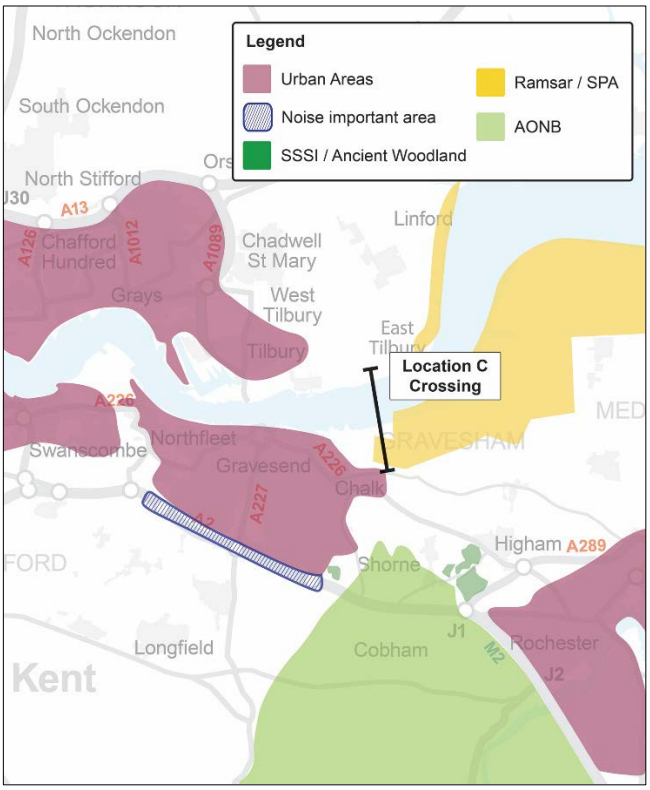

FIGURE 2.8 - CROSSING LOCATION SHOWING URBAN AND ENVIRONMENTAL CONSTRAINTS

2.8.2 The environmentally sensitive sites south of the river are important wetland habitats. They include the Thames Estuary and Marshes Ramsar site and the Thames Estuary and Marshes Special Protection Area (SPA). These are recognised internationally and are protected by law in the UK. They are protected because they contain a number of sensitive habitats and species, including a complex of brackish floodplain grazing marsh ditches, saline lagoons and intertidal saltmarsh and mudflats. These habitats together support internationally important numbers of wintering waterfowl, diverse wetland plants and invertebrates.

2.8.3 Three types of crossing structure have been considered: a bridge, a bored tunnel and an immersed tunnel. All of these are considered to be technically feasible at this location.

2.8.4 A bridge or immersed tunnel have a high potential to affect the integrity of the protected sites described above through physical damage, disturbance and through changes in physical processes e.g. sedimentation.

2.8.5 A bored tunnel solution would generate the least noise and visual impact during both construction and operation and, based on the assessments undertaken at this stage, would have the least impact on protected habitats and species by minimising disturbance over much of its length. Of the available options it is therefore considered to be the least environmentally-damaging alternative.

2.8.6 Compared to a bridge, a bored tunnel is more complicated and expensive to operate and maintain. There are a number of successful modern 'motorway standard' tunnels operating in other countries and Highways England already operates a number of road tunnels in the UK.

2.8.7 Of the three crossing types, bored tunnels generally have the highest construction risk profile but there is a good understanding of the risks associated with constructing tunnels in this location as a result of previous projects in the area, such as High Speed 1.

2.8.8 Highways England's proposed crossing is a bored tunnel at Location C with separate northbound and southbound tunnels, as this would provide a modern 70mph road which would have the least impact on local communities and the protected habitats and species. A tunnel with two lanes in each direction with additional space to provide future capacity is proposed.

2.9 Route options north of the river

2.9.1 Three route options north of the river at Location C have been shortlisted (Routes 2, 3 and 4). These have been developed through engagement with local authorities and other stakeholders to take account of physical constraints including existing urban areas, housing proposals and commercial plans. All three options would perform similarly in terms of solving the transport challenges and unlocking economic potential however, they would all have some impact on communities, biodiversity, greenbelt, areas of ancient woodland and cultural heritage. A summary of these is shown in Table 2.3.

2.9.2 Route 2 is closest to existing urban areas and would therefore have greater noise impacts than either Route 3 or Route 4. It would also have more impact on ecological and heritage sites and affect the nearby Environment Agency flood storage area.

2.9.3 Route 2 would require the A1089 to be upgraded and would feature closely spaced junctions. Existing local traffic would need to share this route with long-distance traffic. The alignment of Route 2 would include some design compromises and it could not provide a modern high quality new route throughout its length. There would also be disruption to the A1089 during construction which would affect commercial traffic to the Port of Tilbury.

2.9.4 Route 3 would be the shortest route and would be a new road designed to modern highway standards over its entire length. It would have some impact on local ecological and heritage sites but this would be less than for Routes 2 and 4

2.9.5 Route 4 would require construction of a new section of road together with an upgrade of the existing A127 and the existing junction with the M25. It would impact directly on ancient woodland, a conservation area and a registered park and garden. The route would be longer and more expensive than either Routes 2 or 3 but it would provide improved connections to the road network for planned housing developments.

Conclusion

2.9.6 All three routes would have broadly the same congestion relief impact at the existing crossing and could generate similar levels of economic benefits. Route 2 would require compromises in its design, would add through traffic to an existing road and would have greater noise and air quality impacts in existing urban areas. Route 3 could generate the highest direct benefits of £3.9bn compared to £3.8bn for Route 4 and £3.7bn for Route 2 (in 2010 prices). Route 4 would be the most expensive and would be longer but it could provide improved connectivity to areas of planned housing developments.

2.9.7 Overall, Route 3 would provide the shortest route, the greatest improvement to journey time and, being an entirely new road, would deliver a modern high quality 70mph road. It would also have the lowest environmental impact of the three options and could be constructed with the least disruption to existing traffic routes.

2.10 Route options south of the river

2.10.1 There are two alternative feasible options for the link roads south of the river at Location C. These are referred to as the Western Southern Link and the Eastern Southern Link. They would affect existing communities and protected environmental sites differently. These community and environmental impacts are presented in Table 2.4.

2.10.2 The Western Southern Link would connect the crossing to a new junction on the A2, approximately 2 miles west of junction 1 of the M2. The location and design of this junction would be constrained by the High Speed 1 rail line and existing urban areas. The junction would need to be of compact design which would compromise the design as speed on some of the connecting roads would be limited to 30mph-50mph. This route would impact the Kent Downs Area of Outstanding Natural Beauty but to a lesser extent than the Eastern Southern Link.

2.10.3 The Eastern Southern Link could provide a direct connection from the M2 to the new crossing so that there could be a motorway-to-motorway connection between the M2 and the M25 with a high quality 70mph road throughout its entire length. As a faster route for the majority of traffic from Kent, the Eastern Southern Link provides greater travel time saving benefits than the Western Southern Link. These are estimated to be £560m although the capital cost is estimated to be £200m higher. An Eastern Southern Link would, however, have a greater impact on ancient woodland, the Kent Downs Area of Outstanding Natural Beauty and would also affect a Site of Special Scientific Interest (Great Crabbles Wood).

Conclusion

2.10.4 The Eastern Southern Link would provide the most direct route and the greatest improvement to journey times. The economic benefits would outweigh the additional costs of construction and operation. In conjunction with Route 3 north of the river, this is the only overall route which would create a modern, high quality 70mph road throughout its entire length and provide a motorway-to-motorway link between the M2 and the M25. It would however, have a higher environmental and community impact which would have to be appropriately mitigated.

TABLE 2.3 - COMPARISON OF COMMUNITY AND ENVIRONMENTAL FACTORS NORTH OF THE RIVER

Feature	Route 2	Route 3	Route 4
Air Quality	Limited impact on air quality immediately adjacent to the routes but improved air quality at Dartford		
Noise	All routes reduce noise disturbance for properties close to the existing Dartford Crossing		
	Has the greatest impact in terms of noise disturbance as the route is closer to more densely populated areas.	Noise disturbance is less than Route 2 but greater than Route 4.	Has the least impact in terms of noise disturbance as the route is further away from urban areas.
Biodiversity	Routes 2 and 3 have lower impacts on ecological sites than Route 4.		Greatest Impact on ecological sites.
Landscape	Routes 2 and 3 run through greenbelt in Thurrock.		Route 4 runs through greenbelt in Thurrock and Brentwood.
Cultural Heritage	Requires land within West Tilbury conservation area and scheduled monuments. Potential impact on listed buildings.	Requires land within a scheduled monument. Potential impact on listed buildings. Avoids conservation areas. Has the least impact of Routes 2, 3 and 4.	Runs through Thorndon Park, a Registered Park and Garden and conservation area. Potential impact on listed buildings.
Impacts on Property[2]	9 residential 3 agricultural	14 residential 22 traveler plots 3 agricultural	14 residential 9 commercial 3 agricultural

[2] Properties which may require demolition, based on preliminary illustrative route design.

TABLE 2.4 - COMPARISON OF COMMUNITY AND ENVIRONMENTAL FACTORS SOUTH OF THE RIVER

Feature	Eastern Southern Link (ESL)	Western Southern Link (WSL)
Air Quality	Limited impact on air quality immediately adjacent to the routes but improved air quality at Dartford	
Noise	Reduced noise disturbance for properties close to the existing Dartford Crossing. There is little to differentiate between the Eastern Southern Link and Western Southern Link in terms of noise.	
Biodiversity	Affects areas of ancient woodland and local wildlife sites east of Shorne and Great Crabbles Wood Site of Special Scientific Interest.	Affects Claylane Wood ancient woodland and Shorne and Ashenbank Woods Site of Special Scientific Interest. Less overall effect of the two options.
Landscape	Greatest area required within the Kent Downs Area of Outstanding National Beauty.	Lesser area required within the Kent Downs Area of Outstanding National Beauty.
Cultural Heritage	Potentially impacts the setting of listed buildings. Route is close to but not in the conservation area of Shorne.	Potentially impacts the setting of listed buildings. Route is close to but not in the conservation area of Thong.
Impacts on Property[3]	10 residential 2 commercial	4 residential 3 commercial

[3] Properties which may require demolition, based on preliminary illustrative route design.

2.11 The proposed scheme

2.11.1 Having considered all the options outlined above, Highways England's proposed scheme is a new bored tunnel road crossing at Location C, with a dual carriageway using Route 3 north of the river and the Eastern Southern Link south of the river. This route has a strong economic case and best meets the project objectives. It provides good value for money and would provide a 70mph motorway-to-motorway connection with the greatest improvement in journey times and a modern, high quality road along its entire length. A tunnel with two lanes in each direction with additional space to provide future capacity is proposed. User charges would be applied in line with current Government policy.

For the economy

- It would provide the greatest economic benefit of all the options, stimulating local and regional development as well as supporting national growth. This could add over £7bn to the economy and create over 5000 new jobs.
- It would offer the greatest value for money and return on investment.
- It would open up the region, unlocking the potential for investment, housing and regeneration.
- It would improve transport connections at a critical part of the road network supporting both local businesses, national companies and international trade through the Channel and Thames Estuary ports.

For transport

- It would reduce congestion and delays on one of the busiest roads in the country and on approach roads including the A2 and A13.
- It would provide a safer, faster and more reliable road improving journeys for all users.
- It would transform a critical part of the road network by providing additional north-south river capacity and an alternative to the existing Dartford Crossing.

For communities and the environment

- It would connect communities in Kent and Essex and provide better access to jobs, housing, leisure and retail facilities either side of the river.
- It would open up new opportunities for investment, regeneration and housing and would enable local businesses to grow and employ more people.
- It would create jobs, apprenticeships and training opportunities for people both during construction and in the longer term.
- The proposal to cross the river by a bored tunnel has the lowest impact on sensitive and valuable habitats along the river.

- The proposals would impact local communities as well as cultural heritage and landscape, including areas of greenbelt, the Kent Downs AONB and areas of ancient woodland. North of the river we have proposed a route which minimises these impacts. As the scheme develops, additional work will look at how best to avoid and minimise the remaining impacts as we have successfully done on other schemes.
- It would reduce congestion at the existing crossing which would improve air quality and reduce noise for residents nearby. However, it is recognised that there would be noise and air quality impacts in the vicinity of the proposed scheme and further work will be carried out to assess how best to mitigate these.

2.11.2 Highways England recognise that the construction of a new crossing would have impacts on local communities and the environment which would need to be considered in more detail at the next stage of the project.
As successfully implemented on other projects, mitigation plans to reduce and where possible minimise impacts would be developed. On a scheme of this scale there will also be important opportunities to leave a lasting positive legacy at a local level which will be explored and developed during the "Development Phase", once a preferred route has been selected by Government.

2.11.3 User charges would be applied on the new crossing in line with current government policy. Subject to the necessary funding and planning approvals, it is anticipated that the new crossing would be open in 2025, if publicly funded. If private funding is also being used to meet the costs of the project, it is anticipated that the crossing would open by 2027.

3 THE ECONOMIC CASE

3.1 Introduction

3.1.1 The economic case presents the extent to which a new road crossing of the lower Thames would be beneficial to the UK economy and whether it represents value for money. The economic case has been prepared in accordance with DfT's WebTAG documents. WebTAG is the tool that is used to assess transport schemes in accordance with the requirements of HM Treasury's Green Book, which is used across government for investment decisions through identification, selection and appraisal of options.

3.1.2 As outlined in Section 2, the proposed scheme is Route 3 with a bored tunnel and the Eastern Southern Link. Our consultation booklet provides information on the estimated costs of the scheme at opening, together with the Benefit Cost Ratios, a measurement of the benefits generated by the new crossing compared to the cost of construction and operation. These figures are repeated below for ease of reference alongside those for Routes 2 and 4 with the Eastern Southern Link (ESL) and Western Southern Link (WSL).

TABLE 3.1 - SCHEME COSTS AND BCRS FOR ROUTES ASSESSED AS MEETING THE SCHEME OBJECTIVES (£BN AT OPENING DATE OF 2025)

	Route 2 ESL	**Route 3 ESL**	Route 4 ESL
Scheme Costs (Nominal) Most Likely – P90	£4.3bn- £6.0bn	**£4.3bn - £5.9bn**	£4.6bn - £6.4bn
Benefit Cost Ratio (adjusted) Most Likely – P90	3.3 – 2.4	**3.4 – 2.5**	3.1 – 2.2

	Route 2 WSL	Route 3 WSL	Route 4 WSL
Scheme Costs (Nominal) Most Likely – P90	£4.1bn- £5.8bn	£4.1bn - £5.7bn	£4.4bn - £6.2bn
Benefit Cost Ratio (adjusted) Most Likely – P90	3.1 – 2.2	3.1 – 2.2	2.9 -2.1

3.1.3 Table 3.1 shows that the cost of our proposed scheme would be between £4.3bn and £5.9bn. These represent a most likely and upper estimate of the cost at opening (P90). The adjusted Benefit Cost Ratio of between 2.5 and 3.4 represents high value for money in accordance with DfT classifications as detailed in paragraph 3.6.2.

3.1.4 The following sections outline the detailed economic analysis which has been undertaken to determine and compare the costs and benefits of the route options.

3.2 Approach

3.2.1 An economic appraisal of the four shortlisted routes has been undertaken in accordance with the DfT's WebTAG guidance and is summarised in the following economic results:

- Present value of benefits (PVB) giving the monetised value of the benefits arising from the scheme.
- Present value of costs (PVC) giving the net cost to the public sector of constructing, maintaining and operating the new infrastructure after adjustment for the revenue from proposed user charges.
- Benefit Cost Ratios (BCRs) giving the ratio between Present Value Benefits (PVB) divided by the Present Value Costs (PVC).

3.2.2 As required by WebTAG, PVBs and PVCs are all shown in discounted 2010 prices to take account of the differences of when the benefits and costs occur over time.

3.2.3 The standard WebTAG appraisal tools that have been used to calculate the economics costs and benefits of the routes are as follows:

- TUBA for calculating travel time savings, vehicle operating cost savings, scheme costs, user charge revenues and indirect tax changes
- COBALT for calculating accident benefits
- QUADRO for calculating the 'disbenefits' from queues and delays associated with maintenance road works (construction delays are calculated separately)
- Wider Impacts (WI) model for calculating wider impacts benefits
- Journey time reliability using the urban equation provided in WebTAG.

3.2.4 Analysis has been undertaken using the applicable Value of Time as defined by the DfT.

3.2.5 The principal tool used to undertake the assessment is a strategic level computerised traffic model. All traffic model runs have been carried out on the basis that user charges are equal at the new and existing crossings. A "core" growth scenario has been assumed which includes known committed developments in Kent and Essex.

3.2.6 Assumptions within the business case, particularly about traffic, are affected by decisions relating to a number of other projects including the proposed TfL River Crossings, Dart Charge and future developments such as London Paramount on the Swanscombe Peninsula.

3.2.7 The benefits for each route have been assessed, in accordance with WebTAG guidance, relative to the 'without scheme' case over a 60 year appraisal period with an assumed opening year for the new crossing of

2025. The ‘without scheme’ case represents what would happen at Dartford and to the surrounding road network if the new scheme did not go ahead.

3.2.8 Costs for the scheme were developed by Highways England in accordance with Highways England best practice.

3.2.9 For the purpose of the economic analysis, scheme costs have been estimated within a probability range, with a lower estimate (set at the P10 level) and a higher cost estimate (set at the P90 level). The figures presented in the tables within this section are based on the ‘Most Likely’ cost.

3.2.10 The economic analysis case has been carried out on following basis:

- Location A, Route 1 with a bridge crossing providing an additional four lanes
- Location C, Routes 2, 3 and 4 with a dual carriageway road and a tunnel with two lanes in each direction with additional space to provide future capacity. This is based on the proposed crossing type outlined in Section 2 – Strategic Case.

3.3 Economic impacts

3.3.1 Benefits reflect the predicted changes in traffic flow which are determined from the computer traffic model. They are divided into:

- Direct economic benefits
- Other economic impacts

3.3.2 Direct benefits include impacts on those who use the road and own/operate it. These are the changes in travel time, vehicle operating costs, user charges and delays during construction. They are calculated for business users, commuters and other users.

3.3.3 Other economic impacts include the impact on the generation of greenhouse gases, noise, accidents and indirect taxation revenues.

3.3.4 Table 3.2 shows the direct economic benefits and other economic impacts generated by each of the shortlisted routes for both the Eastern and Western Southern Links in accordance with WebTAG, with the proposed scheme highlighted in bold. Travel time savings constitute the bulk of the benefits of which the majority benefit business users.

TABLE 3.2 - DIRECT ECONOMIC BENEFITS AND OTHER ECONOMIC IMPACTS (£BN PVB 2010 PRICES) [BR – BRIDGE; BT – BORED TUNNEL]

£bn PVB 2010 prices	R1 BR	R2 WSL BT	R2 ESL BT	R3 WSL BT	**R3 ESL BT**	R4 WSL BT	R4 ESL BT
Business	1.628	3.020	3.257	2.954	**3.374**	2.965	3.352
Other Consumers	0.279	0.273	0.268	0.159	**0.262**	0.170	0.237
Commuting	0.037	0.023	0.032	0.012	**0.028**	0.009	0.023
Greenhouse gas emissions	-0.144	-0.260	-0.284	-0.273	**-0.288**	-0.289	-0.304
Noise	-0.001	0.003	0.004	0.012	**0.010**	0.015	0.012
Accidents	-0.074	-0.126	-0.118	-0.128	**-0.120**	-0.121	-0.113
Indirect Taxation	0.269	0.550	0.585	0.565	**0.589**	0.603	0.629
Total	*1.995*	*3.483*	*3.745*	*3.300*	***3.856***	*3.353*	*3.836*

3.4 Wider Economic Benefits

3.4.1 Transport schemes are likely to have impacts not only in the transport market but also in the labour, product and land markets. These are known as Wider Economic Benefits (WEBs). These include

- Agglomeration – the concentration of economic activity in an area. Firms derive productivity benefits from being close to one another. These impacts look at the effects the scheme may have on bringing firms closer together and closer to their workforce.
- Output change in imperfectly competitive markets – the welfare impact that results because the increases of goods and services are valued more highly by consumers than the cost of producing them.
- Tax revenues from labour market impacts – the movement of people to more productive jobs

3.4.2 The appraisal of the WEBs relating to the shortlisted routes is summarised in Table 3.3 with the proposed scheme highlighted in bold.

TABLE 3.3 - WIDER ECONOMIC BENEFITS (£BN PVB 2010 PRICES) [BR – BRIDGE; BT – BORED TUNNEL]

	R1 BR	R2 WSL BT	R2 ESL BT	R3 WSL BT	**R3 ESL BT**	R4 WSL BT	R4 ESL BT
Agglomeration	0.553	0.981	1.299	1.056	**1.337**	1.390	1.398
Output change in imperfectly competitive markets	0.184	0.282	0.326	0.295	**0.339**	0.287	0.335
Tax revenue from labour market impacts	0.000	0.001	0.002	0.001	**0.001**	0.001	0.001
Total	*0.737*	*1.264*	*1.626*	*1.353*	***1.677***	*1.678*	*1.735*
WEBs as % of total benefits	37	40	44	41	**43**	50	45

3.4.3 The inclusion of WEBs increases the total benefits by between 37% and 50%. This demonstrates the importance of new crossing capacity to the economic development of the area.

3.5 Scheme costs

3.5.1 Table 3.4 presents the most likely costs for the shortlisted routes. The investment (or construction cost) ranges from £3.4bn to £4.6bn across all four routes. The operating costs for Route 1 with a bridge at £113m are lower than the operating costs for Routes 2, 3 and 4 with a bored tunnel. Table 3.5 shows scheme costs at the maximum likely cost or P90 using a probability range. BCRs are calculated using both, Most Likely and P90 costs.

TABLE 3.4 - MOST LIKELY SCHEME COSTS (£BN OUT-TURN AND PVC 2010 PRICES) [BR – BRIDGE; BT – BORED TUNNEL]

	R1 BR	R2 WSL BT	R2 ESL BT	R3 WSL BT	**R3 ESL BT**	R4 WSL BT	R4 ESL BT
Capital Cost (Outturn)	3.365	4.093	4.294	4.078	**4.279**	4.419	4.620
Present Value Costs (2010)							
Capital Cost	1.698	2.101	2.204	2.098	**2.199**	2.279	2.383
Operating costs	0.113	0.276	0.283	0.293	**0.300**	0.302	0.309
Total costs	*1,811*	*2.377*	*2.487*	*2.391*	***2.499***	*2.580*	*2.692*

TABLE 3.5 - P90 SCHEME COSTS (£BN OUT-TURN & PVC 2010 PRICES) [BR – BRIDGE; BT – BORED TUNNEL]

	R1 BR	R2 WSL BT	R2 ESL BT	R3 WSL BT	**R3 ESL BT**	R4 WSL BT	R4 ESL BT
P90 Capital Cost (Outturn)	4.909	5.767	5.981	5.723	**5.937**	6.177	6.390
Present Value Costs (2010)							
Capital Cost (P90)	2.477	2.977	3.077	2.932	**3.033**	3.197	3.297
Operating costs	0.165	0.391	0.395	0.409	**0.414**	0.423	0.427
Total costs (P90)	2.642	3.368	3.472	3.341	**3.446**	3.620	3.725

3.5.2 Discounted revenues generated from user charges are included in the overall assessment of scheme costs, in accordance with WebTAG guidance. The higher the revenues from user charges, the lower the net scheme costs in PVC terms. As Location C routes attract more traffic, and hence they generate higher revenues compared to Route 1 at Location A, the gap in PVC terms between routes at Location A and C narrows.

3.6 Benefit Cost Ratios

3.6.1 BCRs provide a summary comparative measure for those economic, social and environment impacts that can be expressed in monetary terms. WebTAG outlines the calculation of two BCRs:

- An initial BCR which excludes Wider Economic Benefits
- An Adjusted BCR which includes Wider Economic Benefits and Reliability Impacts

3.6.2 DfT provides guidance on the classification of schemes in respect of their value for money using their BCRs. Refer to Table 3.6

TABLE 3.6 - DFT CLASSIFICATION OF VALUE FOR MONEY

BCR	DfT Classification
< 1	Poor
1-1.5	Low
1.5-2	Medium
> 2	High

3.6.3 Table 3.7 presents the Initial BCRs and Adjusted BCRs for the shortlisted routes, based on Most Likely cost estimates, while Table 3.8 shows BCRs for the higher P90 costs. Economic benefits are identical for the Most Likely and P90 cases. The proposed route is in bold.

TABLE 3.7 - MOST LIKELY BCRS FOR SHORTLISTED ROUTES (£BN PVB 2010 PRICES) [BR – BRIDGE; BT – BORED TUNNEL]

PVB (£bn) 2010 present value prices	R1	R2 WSL	R2 ESL	R3 WSL	**R3 ESL**	R4 WSL	R4ESL
Crossing type	BR	BT	BT	BT	**BT**	BT	BT
PVB (excl WEBs & Reliability)	1.995	3.483	3.745	3.300	**3.856**	3.353	3.837
PVC (1)	1.222	1.578	1.672	1.564	**1.656**	1.757	1.858
Initial BCR	1.6	2.2	2.2	2.1	**2.3**	1.9	2.1
WEBs	0.737	1.264	1.626	1.353	**1.677**	1.678	1.735
Reliability	0.135	0.142	0.146	0.143	**0.147**	0.146	0.150
Adjusted BCR	*2.3*	*3.1*	*3.3*	*3.1*	***3.4***	*2.9*	*3.1*

(1) PVC calculation includes discounted revenues from user charges

TABLE 3.8 - P90 BCRS FOR SHORTLISTED ROUTES (£BN PVB 2010 PRICES) [BR – BRIDGE; BT – BORED TUNNEL]

PVB (£bn) 2010 present value prices	R1	R2 WSL	R2 ESL	R3 WSL	**R3 ESL**	R4 WSL	R4 ESL
Crossing type	BR	BT	BT	BT	**BT**	BT	BT
PVB (excl WEBs & Reliability) (£bn)	1.995	3.483	3.745	3.300	**3.856**	3.353	3.837
PVC (1)	2.053	2.235	2.334	2.185	**2.284**	2.465	2.570
Initial BCR	0.97	1.6	1.6	1.5	**1.7**	1.4	1.5
WEBs (£bn)	0.737	1.264	1.626	1.353	**1.677**	1.678	1.735
Reliability (£bn)	0.135	0.142	0.146	0.143	**0.147**	0.146	0.150
Adjusted BCR	*1.4*	*2.2*	*2.4*	*2.2*	***2.5***	*2.1*	*2.2*

(1) PVC calculation includes discounted revenues from user charges

3.6.4 Overall Route 3 with the Eastern Southern Link has the highest Initial and Adjusted BCR, equivalent to a 'High' value for money in accordance with the DfT classification shown in Table 3.6.

3.6.5 Routes 2 and 4 are also classified as 'High' value for money on the basis of the estimated Initial and Adjusted BCRs. Route 1 is classified as 'Medium' value for money with Initial BCR and high value for money with the adjusted BCR. Route 1 provides weaker value for money in comparison with Routes 2, 3 and 4, despite its lower cost.

3.7 Complementary analysis

3.7.1 A “complementary appraisal” has also been carried out alongside the conventional WebTAG analysis described above. The objective of this analysis is to capture the “transformational” nature of the project. This has been done using “Spatial Computable General Equilibrium” and cutting edge econometrics, on a similar basis to that used for the recent Airports Commission economic appraisal. This approach is widely used by government departments including HM Treasury and HMRC.

3.7.2 This assessment indicates that the proposed scheme could add over £7bn cumulatively to the economy by stimulating investment and business opportunities, and create over 5000 new jobs nationally.

4 THE COMMERCIAL CASE

4.1.1 The Commercial Case outlines the commercial strategy for delivering the proposed scheme.

4.1.2 Highways England is investigating a number of potential commercial and financial structures that could be used to procure the packages of works. There are a number of both publicly and privately financed structures that are considered viable.

4.1.3 Publicly financed contracts, such as Design and Build or Design, Build and Maintain contracts, could enable an earlier opening of the crossing and provide greater control and flexibility in the future operation of the new crossing. However, these structures would also require the greatest level of public funding during the construction period.

4.1.4 Privately financed contracts, which might also include Design, Build, Finance and Maintain contracts, could reduce public funding requirements during the construction period and provide a greater risk transfer to the private sector over an extended period. However, they could take longer to arrange and delay the opening date for the crossing. They may also reduce flexibility for Highways England with respect to operations.

4.1.5 Further work is underway to determine the contractual and finance structures for each work package to suit the delivery of the scheme and ensure value for money. This includes consideration of the most appropriate approach for delivery of the operation and maintenance of the crossing and its approaches. The finance and procurement arrangements are still being developed with a decision on the most appropriate financing method expected before the end of 2016.

4.1.6 Highways England is also preparing for the “Development Phase” of the Project which will be undertaken when a preferred route has been announced by Government following this consultation. This would involve environmental and geotechnical surveys, detailed environmental impact assessments, mitigation methods, wider legacy proposals and developing the design to prepare more detailed scheme proposals. Highways England will consult on the more developed proposals before development consent is sought. As the scheme is nationally significant, development consent will be sought using a Development Consent Order (DCO).

4.1.7 In terms of delivering the scheme, it is envisaged that the contract for the crossing would be based on a robust reference design to enable the construction supply chain to bring its expertise and innovation to the final detailed design.

4.1.8 Construction contracts are expected to be let through a public tender through the Official Journal of the European Union (OJEU), reflecting the need to engage the best experience and capability internationally.

5 THE FINANCIAL CASE

5.1 Introduction

5.1.1 The Financial Case sets out the project cost for the proposed scheme.

5.2 Capital costs

5.2.1 Cost estimates have been prepared by Highways England using internal standards. These include both the development costs in the period before construction starts, and the actual costs of construction of the new crossing and link roads.

5.2.2 The estimated capital costs of the Proposed Scheme (Route 3, with bored tunnel and Eastern Southern Link) are shown below at a P10, most likely and P90 level of confidence. P10 and P90 represent the low and high probabilities of cost.

TABLE 5.1 - ESTIMATED CAPITAL COSTS

Figures in £billions (nominal)	Route 3 with bored tunnel and Eastern Southern Link		
	P10 cost estimate	Most likely cost estimate	P90 cost estimate
Estimated out-turn cost	3.2	4.3	5.9

5.3 Operating costs

5.3.1 Cost estimates have also been prepared for the operating and maintenance costs of the new crossing and link roads once they are constructed. These include the additional costs involved in collecting charges at the new crossing. Over a 25 year period from opening until 2051, the average annual nominal cost is estimated to be £50m.

5.4 User charging

5.4.1 Users of the existing Dartford Crossing are currently required to make a user payment via the Dart Charge system. It is anticipated that these charges will continue to be applied in the future.

5.4.2 It is proposed that user charges would be applied to the new crossing in line with current Government policy. The revenue from user charges will be one of the sources of income to repay the cost of delivering a new crossing.

5.4.3 Using the same user charging mechanism for both the existing and new crossing could provide opportunities to manage traffic across both crossings and could offer customers a common payment system. Details of this will be considered during the Development Phase of the project.

6 THE MANAGEMENT CASE

6.1.1 The Management Case presents the project plan and describes the governance and management arrangements in place for the Options and Delivery phases of the project.

6.1.2 Highways England has significant experience of delivering major road infrastructure projects in England and is currently investing over £11bn in the modernisation of the road network and maintenance of existing assets. This includes projects such as the A14 Cambridge to Huntingdon Improvement Scheme, the Smart Motorways programme and providing additional capacity to the M60 and M62.

6.1.3 In delivering the Lower Thames Crossing, Highways England will seek continuous improvement to ensure excellent delivery and operational practice, engaging with other major schemes in the UK and overseas.

6.1.4 Highways England has a well-established project organisation for undertaking the current Options Phase and is carrying out the project using Highways England's Project Control Framework. This has included the production of an Integrated Assurance and Approvals Plan (IAAP) which has been provided to the DfT and the Infrastructure Projects Authority.

6.1.5 The scale and complexity of the Lower Thames Crossing has been recognised in its classification as a Tier 1 project and inclusion in the Government's Major Projects Portfolio (GMPP). It is therefore subject to reviews by the Infrastructure and Project Authority (the recently merged body from Major Projects Authority and Infrastructure UK).

6.1.6 During the Development Phase, Highways England's resource will be supported by a Technical Partner for the duration of the project. Highways England is in the final stages of selecting a Technical partner. The tender has attracted the best capability from the UK and international market.

6.1.7 Highways England intends to use the DCO process to secure the consents required to construct the scheme, rather than pursue a Hybrid Bill. This is because the DCO process offers more certainty regarding the development and construction schedule.

6.1.8 The high-level project milestones are shown in the Figure 6.1 on the basis of a publicly funded commercial structure.

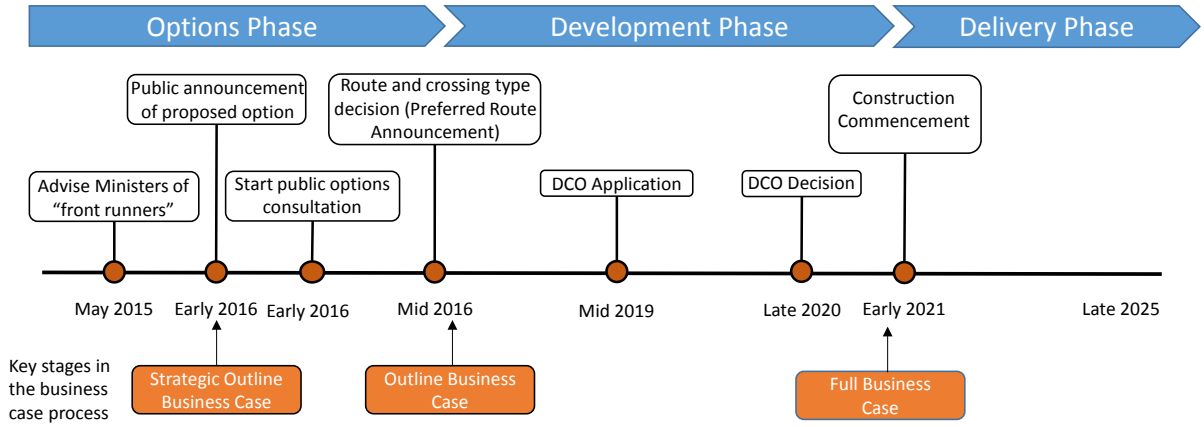

FIGURE 6.1 - HIGH-LEVEL PROJECT MILESTONES (ASSUMING PUBLIC FUNDING)

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Highways England creative job number S150698
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Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ
Highways England Company Limited registered in England and Wales number 09346363