

Lower Thames Crossing

Pre-Consultation Scheme Assessment Report
Volume 2: Introduction and Existing Conditions

Volume 2

Lower Thames Crossing
Route Consultation 2016

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1 Introduction

1.1 Structure of Pre-Consultation Scheme Assessment Report

- 1.1.1 The Pre-Consultation Scheme Assessment Report (SAR) brings together the engineering, safety, operational, traffic, economic, social and environmental appraisal of the shortlist routes for the Lower Thames Crossing. The appraisal of the longlist options was reported in the *Technical Appraisal Report* (TAR) (refer to Sections 2 and 3 of Volume 3).
- 1.1.2 Drawing on the results of the appraisal the SAR recommends which routes should be taken to public consultation. It also sets out Highways England's proposed solution.
- 1.1.3 The SAR is set out in a number of Volumes, as follows:
- Volume 1 – Executive Summary. Provides an overall summary of the SAR.
 - **Volume 2 – Introduction and Existing Conditions (this volume).** Describes the scheme background, including previous studies undertaken, existing traffic, physical and environmental conditions, the future conditions without an improvement, the need for improvement and the scheme objectives.
 - Volume 3 – Identification and Description of Shortlist Routes. Describes the option identification and selection, summarises the appraisal of the longlist of options, and describes the shortlist routes.
 - Volume 4 – Engineering, Safety and Cost Appraisal. Describes the engineering, safety and cost appraisal of the shortlist routes.
 - Volume 5 – Traffic and Economics Appraisal. Describes the traffic and economic appraisal of the shortlist routes.
 - Volume 6 – Environmental Appraisal. Describes the environmental appraisal of the shortlist routes.
 - Volume 7 – Appraisal Conclusions and Recommendations. Summarises the appraisal of the shortlist routes against the scheme objectives, and recommends the proposed scheme and routes for consultation.
- 1.1.4 Following public consultation, this document will be reviewed and updated to produce a final Post-Consultation Scheme Assessment Report that takes account of the comments received. It will also include the report on public consultation, and the recommendation for the Preferred Option. The Preferred Option will be the scheme that Highways England recommends should be taken forward into an application for development consent.

1.2 Structure of this Volume

1.2.1 The structure of this volume is as follows:

- Section 2 sets out the scheme background and gives an overview of previous studies
- Section 3 describes the surrounding highway network, an overview of existing performance and existing physical conditions
- Section 4 sets out the environmental background and context
- Section 5 describes the policy context for a new crossing
- Section 6 describes existing land use in the study area
- Section 7 sets out socio-economic factors
- Section 8 describes future development plans and impacts of the existing traffic conditions on economic growth
- Section 9 sets out what will happen if nothing is done (the Without Scheme scenario)
- Section 10 provides a summary of the existing problems at Dartford and sets out the scheme objectives and scheme requirements for a new crossing

2 Scheme Background

2.1 Introduction

2.1.1 The A282 Dartford-Thurrock river crossing consists of two bored tunnels and the QEII Bridge, and is the only river crossing on the Strategic Road Network (SRN) to the east of London. The A282 trunk road forms part of the M25 orbital route around London, and is an important link in the SRN, as shown in **Figure 2.1**. The route serves traffic travelling to and from north of the River Thames to south London, Kent, Sussex and continental Europe via the Kent ports and the Channel Tunnel, whilst also serving local traffic. Currently around 140,000 vehicles per day use the crossing paying a user charge, via an electronic collection system (Dart Charge).

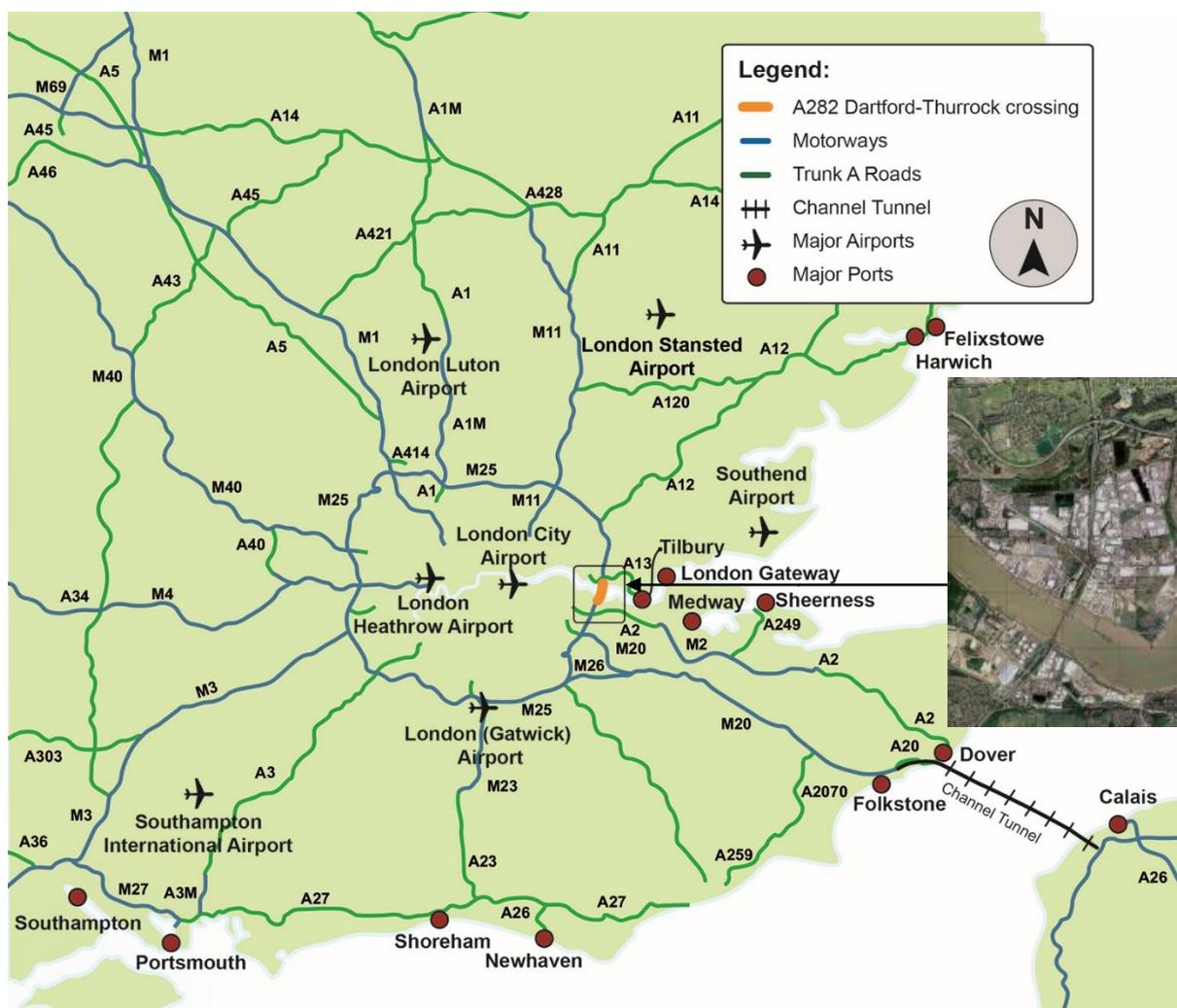


FIGURE 2.1 - LOCATION OF THE DARTFORD CROSSING IN RELATION TO THE STRATEGIC ROAD NETWORK

2.1.2 The existing crossing consists of two bored tunnels for northbound traffic and the QEII Bridge for southbound traffic (refer to **Figure 2.2**).



FIGURE 2.2 - THE EXISTING DARTFORD CROSSING STRUCTURES

2.1.3 Approximately 50 million vehicle trips are made at the Dartford Crossing each year. Average daily two-way traffic flows are around 140,000 vehicles per day (vpd). Peak daily throughputs vary; a maximum flow of 181,000 vpd has been recorded. This level of traffic frequently results in significant congestion, queuing traffic and a high level of incidents with long delays and knock-on congestion to the local road network.

2.2 Previous Studies

- 2.2.1 **Figure 2.3** shows the timeline of previous studies carried out for the Department for Transport (DfT) and the local authorities in the area of the crossing (Kent County Council, Essex County Council and Thurrock Council). More details of these studies are included in **Appendix 2.1**.
- 2.2.2 In 2009, the DfT commissioned consultants Parsons Brinckerhoff, to carry out a study to look at options to relieve congestion at the Dartford-Thurrock river crossing. The study identified six possible locations and concluded that three options (A, B and C) offered the greatest benefits in terms of relieving congestion at the existing crossing and should be assessed further.
- 2.2.3 Following the study in June 2011 the DfT consulted on a two-step increase in road user charges at the Crossing that would result in a short term reduction in traffic flow and an increase in revenue which would allow the DfT to continue to prioritise investment in the following areas:
- Short term – suspension of the charges to allow free use of the Crossing at times of severe congestion.
 - Medium term – introduction of ‘free-flow’ charging which was developed as “Dart Charge” (refer to Section 3.3).
 - Long term – a review of options for additional crossing capacity.
- 2.2.4 The DfT appointed consultants AECOM in April 2012 to investigate the three options (A, B and C) for a new Lower Thames Crossing. Following this

assessment and public consultation, the DfT announced in December 2013 that there were sufficient grounds to disregard Option B.

- 2.2.5 The Secretary of State for Transport announced on 15 July 2014 the Government's response to the May 2013 consultation on options A, B and C for a new Lower Thames Crossing. The response confirmed that there is a need for a new crossing, that there is currently no clear preference on its location and that further work would be carried out to develop and appraise route options for both Location A and C before choosing where to site a new crossing. Location A is at or close to the existing crossing and Location C is a new route connecting the A2/ M2 near Gravesend with the A13 and M25 north of the River Thames. C_{variant}, an improvement of the A229 connection between the M20 Junction 6 and the M2 Junction 3 was also included. The response noted that the government expected to consult on a proposed solution in late 2015 or early 2016.

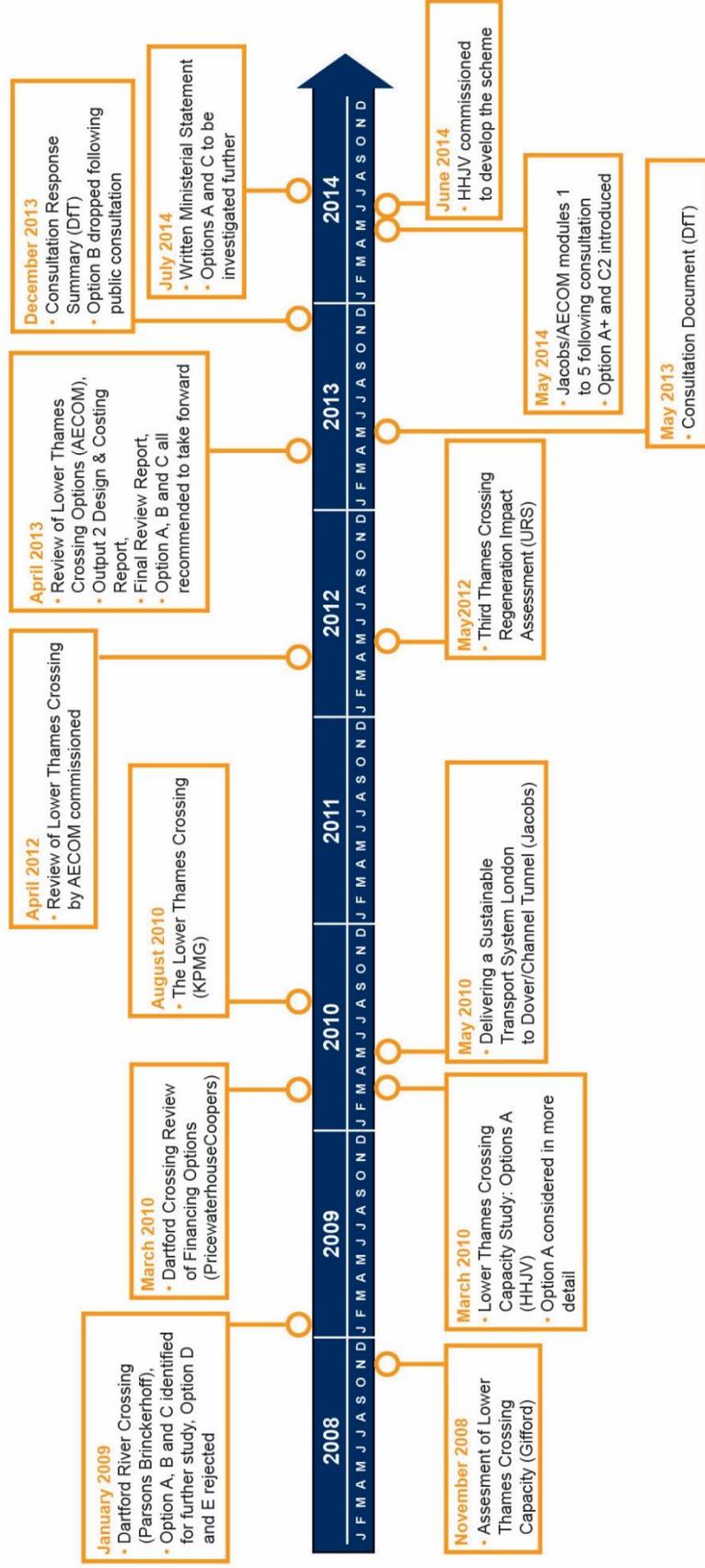


FIGURE 2.3 - TIMELINE OF PREVIOUS STUDIES

2.2.6 **Figure 2.4** shows the Study Area for the options development and appraisal. The Study Area is the area within which route options at Locations A and C have been identified and appraised.

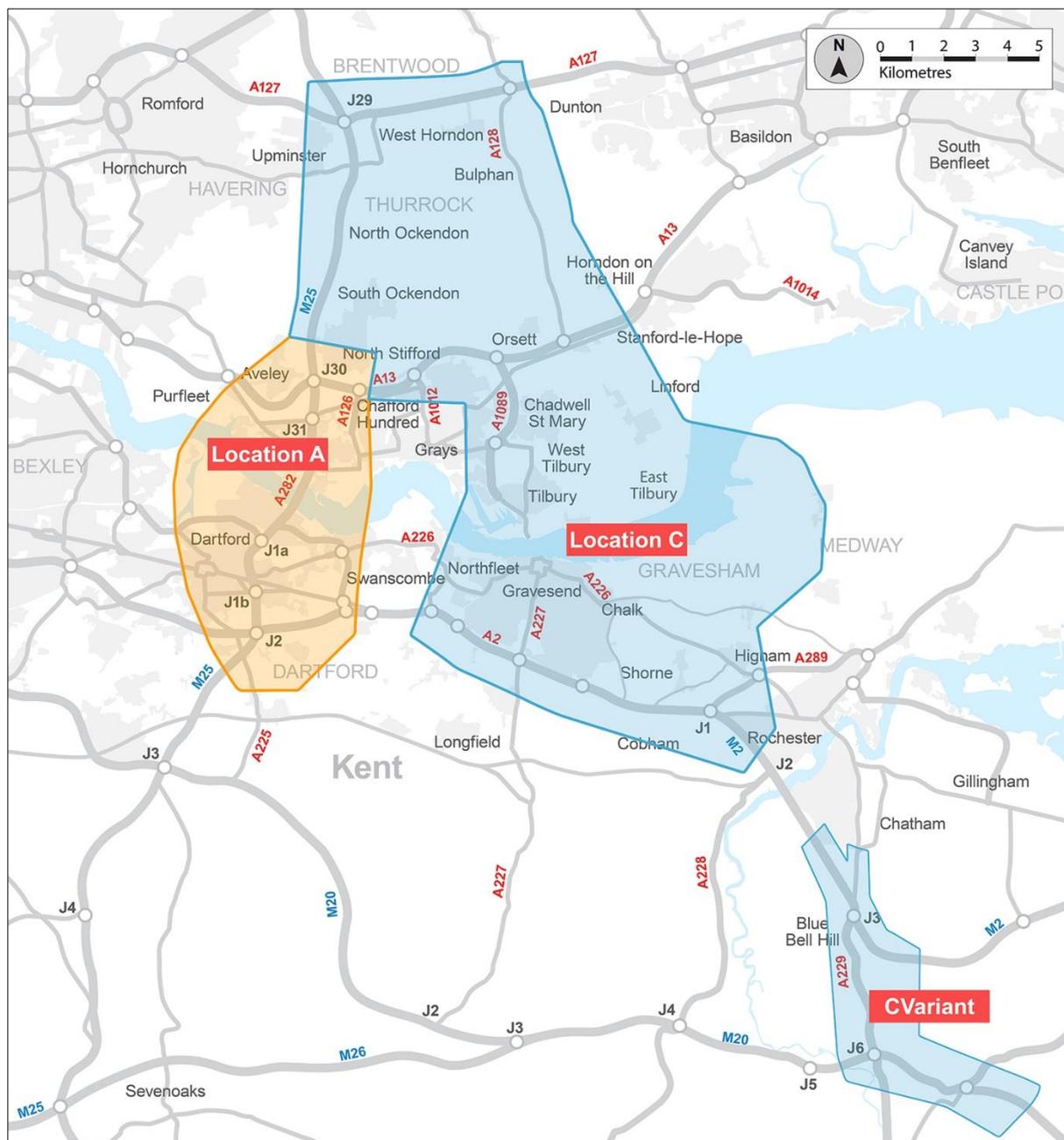


FIGURE 2.4 - STUDY AREA

2.2.7 In May 2014, DfT handed over the scheme to the Highways Agency (now Highways England) to develop the scheme through the options phase, including identification and appraisal of route options at Locations A and C (including C_{Variant}), and development of a proposed scheme. Halcrow Hyder Joint Venture (HHJV) was appointed as technical adviser by Highways England in June 2014.

3 Existing Traffic and Physical Conditions

3.1 Existing Network

3.1.1 **Figure 3.1** shows the existing road network in the Study Area and the surrounding area. Reference should also be made to **Appendix 2.2, Key Plan**, which shows place names which are referred to throughout the SAR.

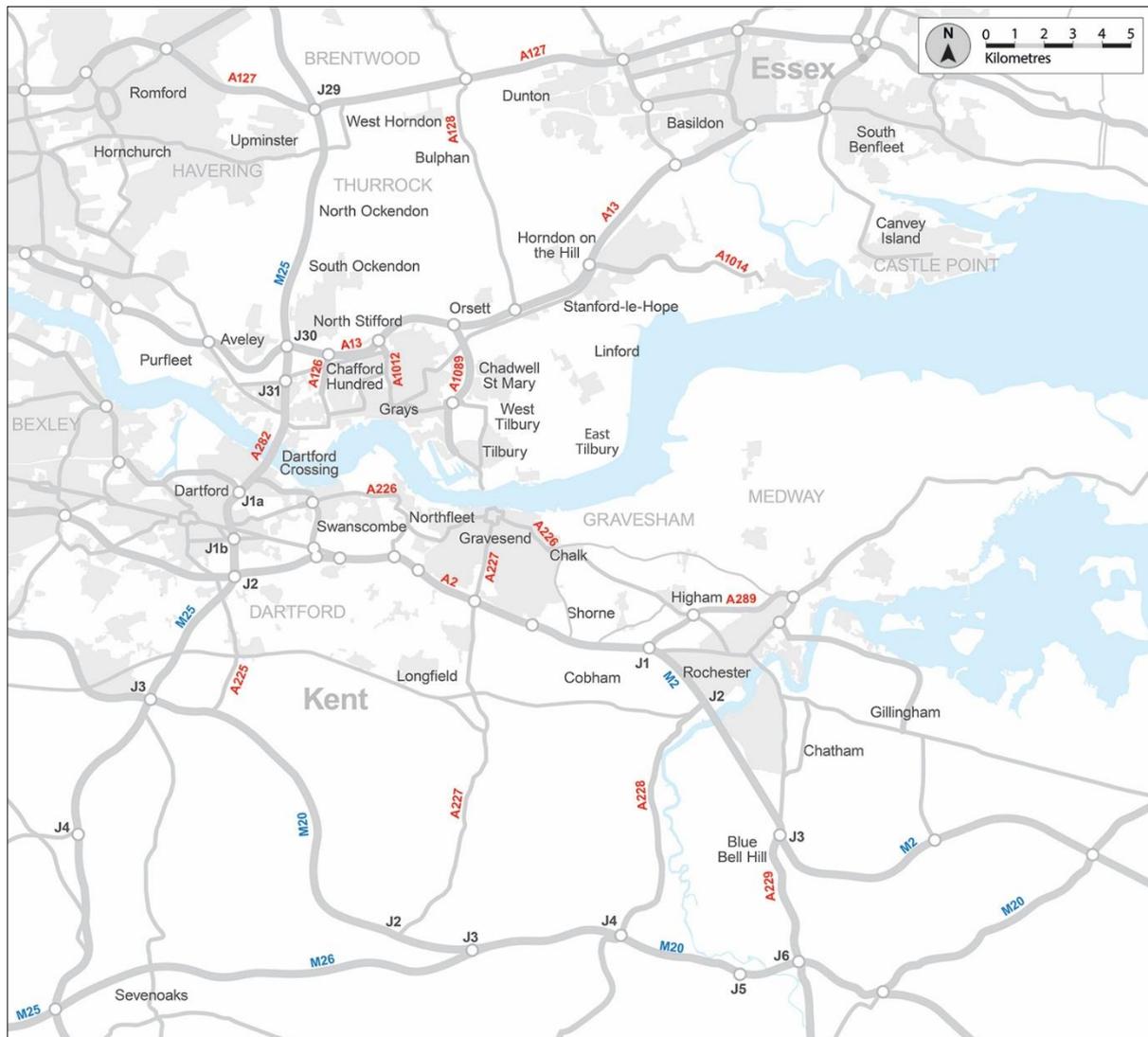


FIGURE 3.1 - EXISTING ROAD NETWORK IN STUDY AREA

3.2 A282 Corridor

Northbound (including tunnels)

3.2.1 The Dartford West Tunnel was opened to traffic in 1963, and carries two lanes of traffic. It has a headroom of 4.8m, which is too small to accept larger vehicles. The Dartford East Tunnel, situated to the east of Dartford West Tunnel, also has 2 lanes and was opened to traffic in 1980. It has a headroom of 5.0m, which is also below current headroom standard requirements. Initially it was designed to carry southbound traffic, but now

carries northbound traffic, except in adverse weather or emergency conditions, when it is operated as a 2-lane crossing for southbound traffic when the QEII Bridge is closed. Both tunnels have been extensively refurbished.

- 3.2.2 The tunnels and their approaches are subject to a 50mph speed limit due to geometry and clearances inside the tunnels. Although the posted speed limit is 50mph the restricted geometry, particularly in the west tunnel, means that traffic speeds through the tunnels are generally lower than this. Traffic must therefore slow down prior to entering the tunnels.
- 3.2.3 The use of the tunnels by large vehicles and vehicles with dangerous loads is restricted. This is managed through a Traffic Management Cell (TMC) – refer to Section 3.4. One reason for the restrictions on vehicles with dangerous loads is that the existing cross passages between the two tunnels are substandard in terms of width and gradient (and cannot be upgraded economically) meaning that the tunnels cannot be made fully compliant with European Regulations that would allow unrestricted access by dangerous loads.
- 3.2.4 On the A282 northbound there are three lanes and a hard shoulder running through Junction 2, one lane merges from the Junction 2 roundabout northbound on-slip and then a fourth lane is added from the A2 westbound free-flow on-slip. The route then continues at four lanes through Junctions 1b and 1a.
- 3.2.5 At the crossing there are two lanes in each tunnel which continue to the Junction 31 northbound off-slip, where a lane is dropped. From Junction 31 to Junction 30 there are three lanes and a hard shoulder. North of Junction 30, a fourth lane is added. The road layout is shown schematically in **Figure 3.2**.

Southbound including the QEII Bridge

- 3.2.6 The QEII Bridge was opened to traffic in October 1991. The cable-stayed bridge has a 450m main span with four lanes and no hard shoulder. The overall length including approach structures is nearly 2.9km. The bridge and its approaches have a 50mph speed limit.
- 3.2.7 Southbound there are three lanes and a hard shoulder from Junction 30 as far as the Junction 31 southbound on-slip where one lane is added to provide four lanes on the QEII Bridge which continue through Junctions 1a and 1b. One lane is dropped to provide an off-slip movement to Junction 2 joining the southbound on-slip from Junction 1b which continues to Junction 2. On the A282 there are three lanes running under the B260 overbridge, which then widens locally to five lanes with two lanes being dropped to the A2 eastbound as a free-flow movement. Three lanes and hard shoulder continue on the M25 southbound through Junction 2. South of Junction 2, a fourth lane is added. The road layout is shown schematically in **Figure 3.2**.

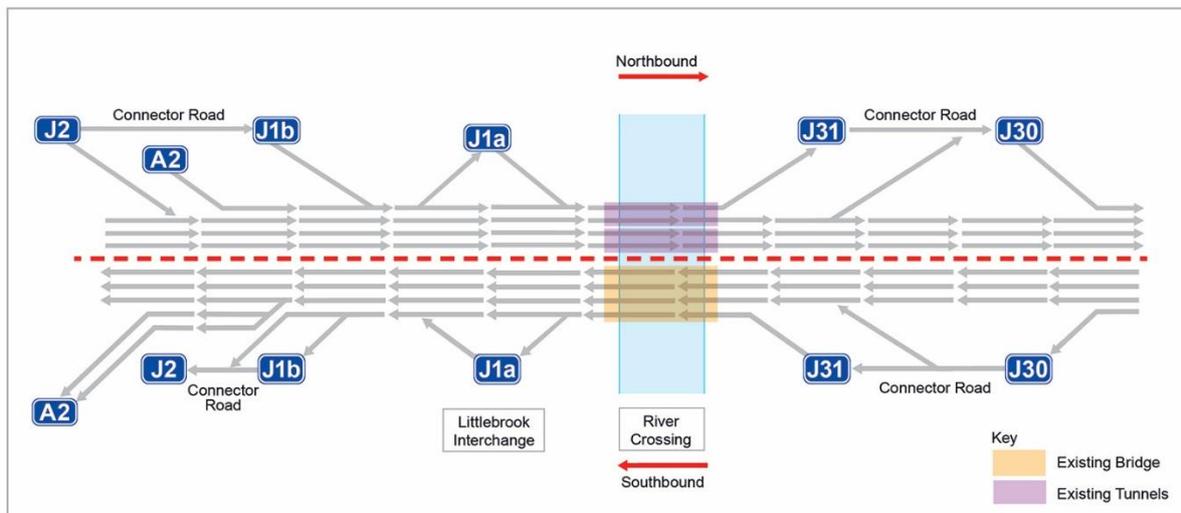


FIGURE 3.2 - EXISTING ROAD LAYOUT ALONG M25/ A282 CORRIDOR

A282 Corridor Summary

3.2.8 **Table 3.1** provides a summary of A282 corridor capacity issues.

TABLE 3.1 - SUMMARY OF A282 CORRIDOR CAPACITY ISSUES

Feature	Northbound	Southbound
Crossing	2 tunnels each with 2 lanes and no hard shoulders	4 lane bridge with no hard shoulder
Lanes (J3-J29)	Mainly 4 lanes. Some 3 lane sections at junctions	Mainly 4 lanes. Some 3 lane sections at junctions
Capacity constraints	TMC, escort of restricted vehicles and tunnel geometry reduces capacity. Lane reductions through junctions.	Lane reductions through junctions.
Speed Limit at Crossing	50 mph	
Resilience	High load and dangerous goods vehicle restrictions	Closures during high winds

3.3 Dart Charge

3.3.1 The existing crossing operates a free-flow charging system known as Dart Charge which was introduced in November 2014. The scheme allows road users to pay the charge remotely without the need to stop at toll plazas (refer to **Photo 3.1**). The arrangements include a TMC to control the passage of restricted vehicles in the tunnels (refer to Section 3.4). The Dart Charge payment system means that users no longer pay for the crossing at the

barriers. Payment is by a pre-pay account or through a one-off payment online, by an authorised retail outlet, by phone or by post.



PHOTO 3.1 - DART CHARGE IN OPERATION (NORTHBOUND)

- 3.3.2 In line with current policy, user charges apply for using the crossing in both northbound and southbound directions between 06.00 and 22.00. The current charges for cars are set at £2.50 for non-account holders and £1.67 for account holders. Motorcycles are free, and charges for two axle goods vehicles and multi-axle goods vehicles are £3.00 and £6.00 respectively (account holders £2.63/ £5.19).
- 3.3.3 Dart Charge has been fully operational since summer 2015. Initial results show:
- Reduction in journey times southbound and northbound. The reduction in journey times southbound has been greater than the reduction northbound.
 - Traffic flows have increased by up to 4% from pre-Dart Charge levels, based on the current information post-Dart Charge.

3.4 Traffic Management Cell

- 3.4.1 In order to implement Dart Charge, and allow the toll plazas to be removed, a Traffic Management Cell (TMC) was implemented. The TMC controls the passage of restricted vehicles, comprising over-height, over-width, over-length and dangerous goods vehicles, through the tunnels. Over height and dangerous goods vehicles are detected using over-height sensors and ANPR cameras capable of reading the hazardous load codes displayed on vehicles carrying such loads. The system is coordinated by the TMC control system, and upon detection of a non-compliant vehicle a system of traffic lights and physical barriers are used to stop the vehicle. A traffic officer vehicle is then dispatched to intercept and re-route the vehicle, before traffic held in the traffic management system is released.
- 3.4.2 The TMC enables segregation of restricted vehicles, to enable them to be escorted through the tunnels safely, and stops traffic in the event of an incident in the tunnels.

- 3.4.3 The high usage of the tunnels by goods vehicles, including foreign registered vehicles, means that vehicles need to be frequently intercepted and this is very disruptive to free flowing traffic, and acts as a constraint on capacity. As a result, the northbound capacity at Dartford crossing is less than the southbound.

3.5 A2 and M2 Corridor

- 3.5.1 The A282 connects with the A2 at Junction 2. To the east, the A2 connects to the M2, which provides a link towards Dover and the Channel Tunnel. The A2 also runs west from Junction 2 towards London.
- 3.5.2 The A2 is a four lane dual carriageway from the A282/ M25 Junction 2 to M2 Junction 1 with 6 grade separated interchanges along this length at Bean (B255), Ebbsfleet (B259), Northfleet (B262) and three junctions for Gravesend with the middle junction connecting with the A227. The M2 then continues south east with four lanes in each direction, except through junctions, to its junction with the A229 (Junction 3). The M2 then continues south east towards Canterbury and becoming the A2 again before Dover.

3.6 Other Roads in Kent

- 3.6.1 The A289 is a dual carriageway which connects Junction 1 on the M2 through to London Thamesport and Grain power station.
- 3.6.2 To the south of the River Thames there are several single carriageway roads including Lower Higham Road, the A226 and Thong Lane. These roads provide a connection between Gravesend and the A2/ M2 and smaller villages including Shorne and Higham.

3.7 A13, A1089 and A127 in Thurrock and Essex

- 3.7.1 North of the River Thames there are three main A-roads, the A13, A1089 and A127. These roads form strategic commercial connections from the M25 to Tilbury Port and London Gateway Port (DP World) and connections to towns including Basildon, Tilbury, Grays, Corringham, Southend-on-Sea and Canvey Island.
- 3.7.2 East of the M25 the A13 runs west-east with 5 grade separated interchanges along this length at A126, A1012, A1089, A128 and A1014. The carriageway is predominantly dual three lanes between the M25 Junction 30 and the A128 Junction. The section between A128 and the A1014 is currently a two-lane dual carriageway, but Thurrock Council have plans to widen this section (refer to Section 3.10). The A13 also runs west from M25 Junction 30 to London. An improvement scheme on the A13 at M25 Junction 30 is currently under construction (refer to Section 3.10).
- 3.7.3 The A1089 is a link between the A13 and Tilbury Port. The majority is two lane dual carriageway with the southern end a single carriageway.
- 3.7.4 The A127 which is an Essex County Council and Southend on Sea Council road is located towards the northern limit of the study area and is a two lane dual carriageway linking London to Southend-on-Sea. The A127 runs west and east from M25 Junction 29.

3.8 Other Roads in Thurrock and Essex

3.8.1 To the north of the River Thames there are several single carriageway roads including the A128, Fort Road, Brentwood Road, Orsett Road and Muckingford Road. These roads provide connections between Tilbury and the surrounding urban areas, East Tilbury, Orsett and north to the A127.

3.9 Recent Improvements to the Existing Road Network

3.9.1 Recent improvements to the network in the study area include the following schemes:

- M25 Junction 27 to Junction 30. Widening generally from three lanes to four lanes. Opened in 2012.
- M25 Junction 1b to Junction 3. Widening carried out in conjunction with the A2/ A282 Improvement. Opened in 2008.
- A2/ A282 Improvement incorporating viaducts linking A2 westbound to M25/ A282 northbound and M25/ A282 southbound to A2 eastbound, a free-flow slip road for traffic travelling from the A2 westbound onto the M25 southbound, and widening of the A2 from three to four lanes in each direction between the M25/ A282 and the Bean (B255) junction. Opened in December 2007.
- M25 Junction 30 Interim scheme. Minor improvements at Junction 30 to accommodate initial additional traffic from the London Gateway Port. Opened in 2013.

3.10 Future Highway Schemes

3.10.1 Transport for London (TfL) is consulting on three new river crossings at Silvertown (consultation ended in November 2015), Gallions Reach and Belvedere (consultation ends February 2016), west of the Dartford Crossing as shown in **Figure 3.3**.

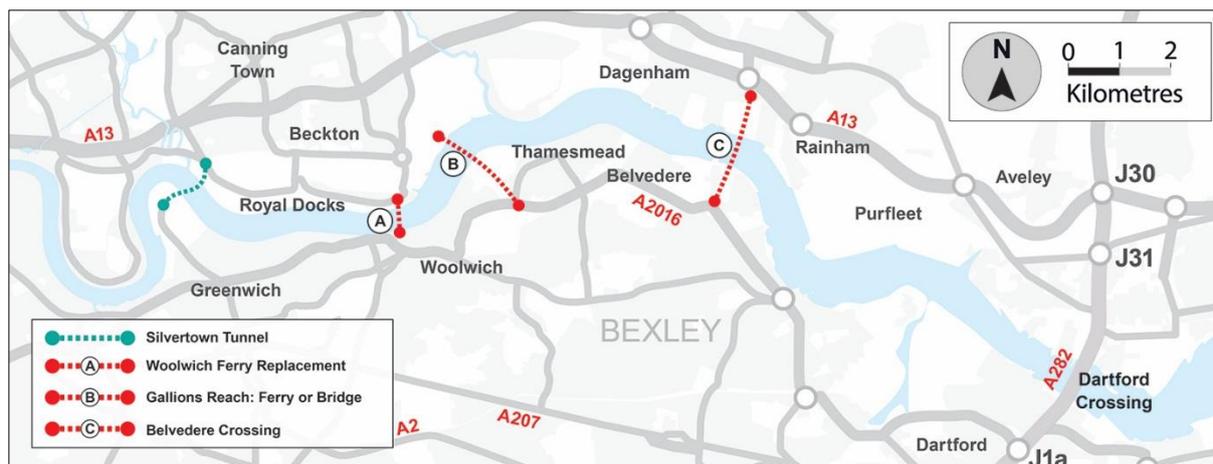


FIGURE 3.3 - TRANSPORT FOR LONDON (TFL) RIVER CROSSINGS

3.10.2 Thurrock Council is currently preparing a scheme to upgrade the section of the A13 between the A128 junction at Orsett Cock and the A1014 junction from a two-lane dual carriageway to a three-lane dual carriageway as part of the London Gateway Port (DP World) development.

- 3.10.3 The M25 Junction 30/ A13 Congestion Relief Scheme is currently under construction having started in spring 2015. The scheme involves an online widening from dual three lanes to dual four lanes in both directions between Junction 30 and A126 Lakeside junction, improvements to Junction 30 slip roads and dedicated left turn lanes from the A13 westbound to the A282 southbound and M25 southbound to the A13 eastbound. The scheme is due to open in 2017.
- 3.10.4 Highways England is developing proposals for improvements to A2 Bean and A2 Ebbsfleet junctions. Refer also to Section 4.3 of Volume 5 of the SAR, which describes future schemes included in the traffic model.

3.11 Existing Traffic Conditions

- 3.11.1 The transport problems today can be considered under the following headings:
- Traffic flows
 - Congestion at Dartford
 - Journey Time Reliability
 - Network Resilience
 - Road Safety
- 3.11.2 Future conditions without any improvements being undertaken, the Without Scheme scenario, are described in Section 9.

3.12 Traffic Flows

- 3.12.1 At the Dartford-Thurrock River Crossing there is an average daily flow of 140,000 vehicles, and the crossing often now operates at maximum capacity. Analysis shows that the Congestion Reference Flow (flow at which congestion would be expected in peak periods) is 135,000 vehicles. This can be seen in **Figure 3.4** which also shows the growth in traffic since the crossing first opened in 1963.

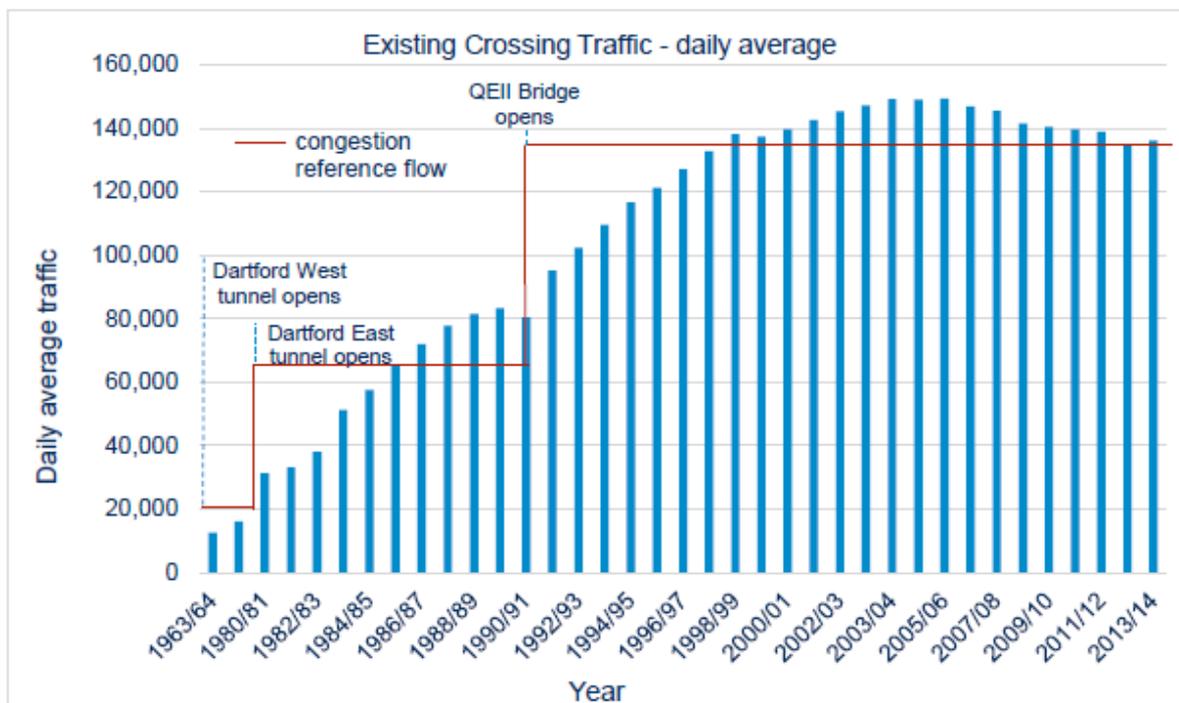


FIGURE 3.4 - AVERAGE ANNUAL DAILY TRAFFIC FLOW ACROSS THE DARTFORD CROSSING SINCE OPENING IN 1963 (2-WAY ANNUAL AVERAGE DAILY TRAFFIC)

- 3.12.2 Dartford Crossing traffic growth fell sharply between 2008 and 2013 and is recovering more slowly than the districts surrounding it as capacity is constrained in the peaks. Around 20% of the traffic is made up of HGVs, including those connecting ports and distribution centres in the south east and the midlands/ north.
- 3.12.3 **Figure 3.5** shows current usage of Dartford Crossing. Approximately 40% of traffic northbound and southbound continues on M25 beyond A13 and A2 (international/ national traffic). Approximately 30% uses A13 and A2 corridors in Essex and Kent (regional traffic). Approximately 30% of crossing traffic is around Dartford/ Thurrock (local traffic). **Figure 3.6** shows the origin and destination of traffic using Dartford Crossing. Each red area represents an origin and each green area a destination. As can be seen the crossing is a major artery serving the South-East and beyond.

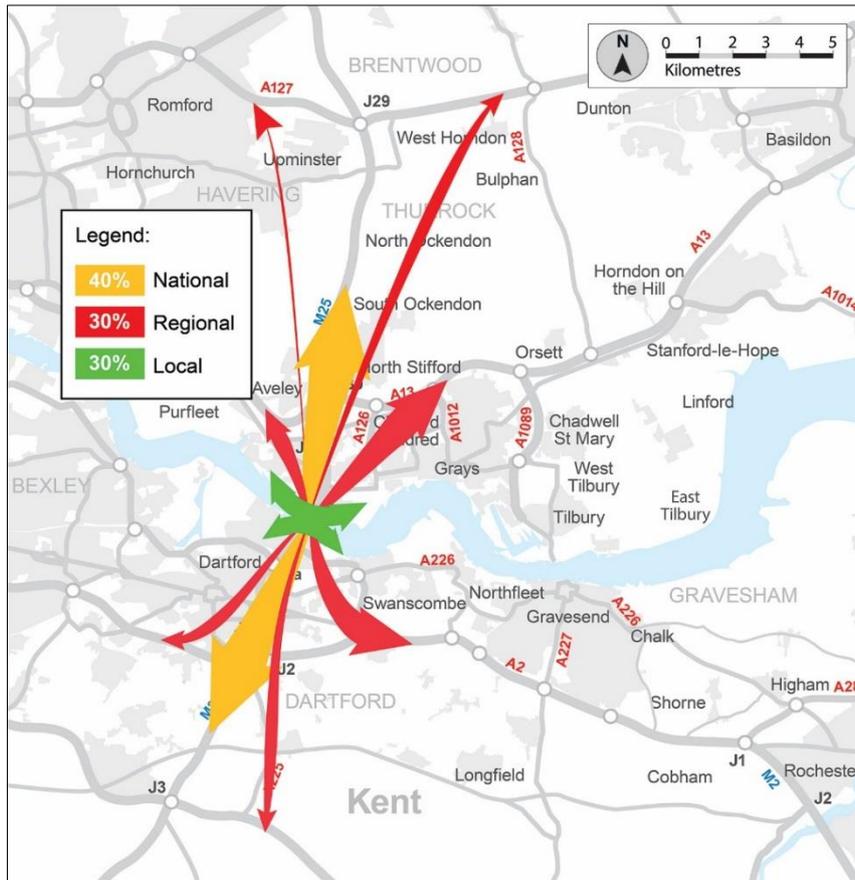


FIGURE 3.5 - EXISTING USE OF DARTFORD CROSSING

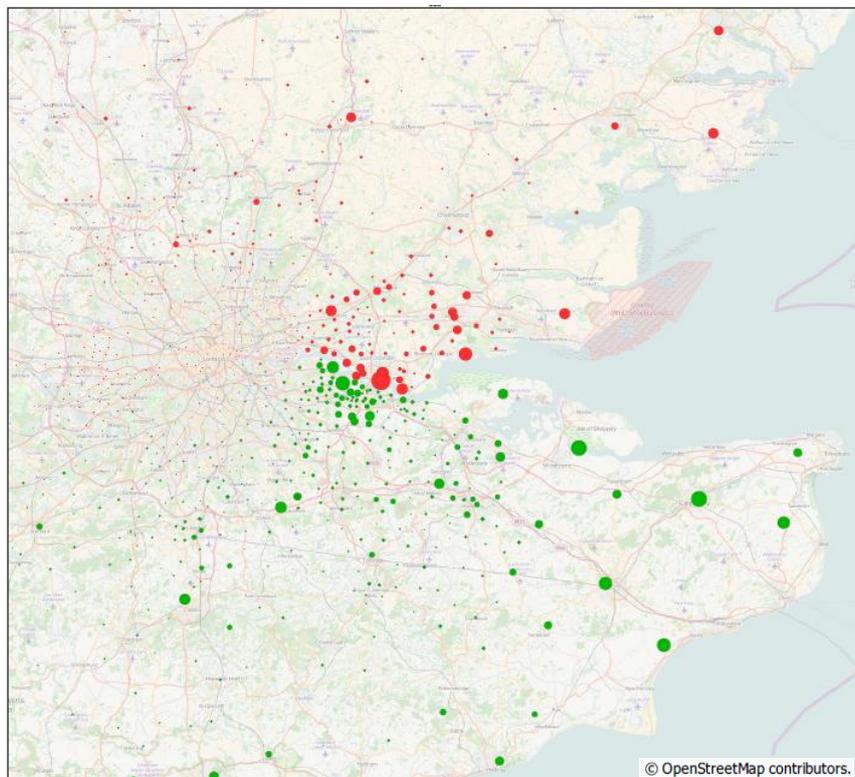


FIGURE 3.6 - ORIGINS AND DESTINATIONS OF DARTFORD CROSSING USERS

3.13 Congestion at Dartford Crossing

3.13.1 **Figure 3.7** shows the existing daily profile of traffic in each direction in 2014. The crossing is full in the morning and evening peak hours, and any increase in demand will increase the number of hours during which congestion is likely to occur. The consequences of this congestion are widespread not only on the traffic using the crossing and the adjacent road networks, including arterial and radial routes in and out of London, but also on wider economic development, and the health and welfare of the local community (refer to Sections 4.2 and 4.3 for details of existing noise and air quality).

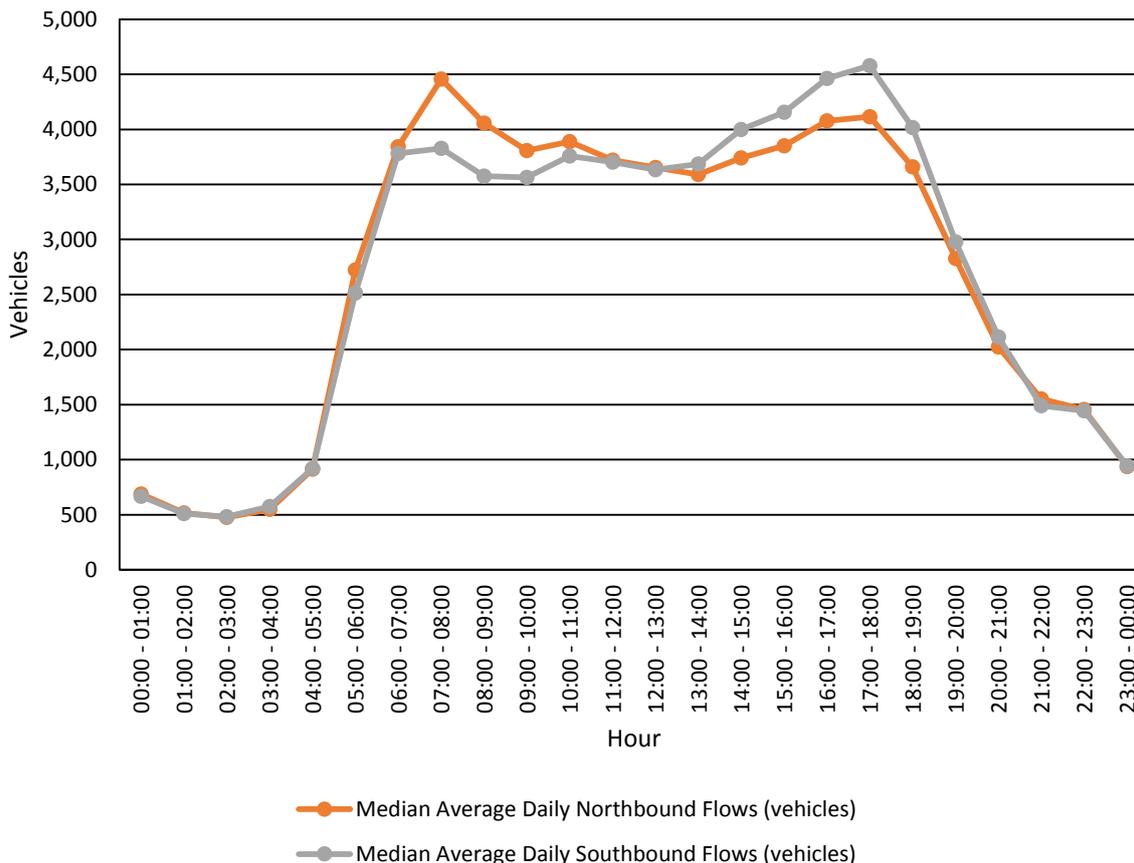


FIGURE 3.7 - DAILY PROFILE OF TRAFFIC FLOW AT THE DARTFORD CROSSING 2014

3.13.2 Whilst the crossing is effectively running full, traffic growth is starting to increase again on the surrounding network as the effects of the recession recede and the economy slowly recovers. **Figure 3.8** shows the relative annual growth in traffic volumes comparing Dartford Crossing with areas adjacent to the crossing. Growth was relatively stagnant during the recession years from 2008 to 2012, but it can be seen that growth in Essex, Kent, Medway, and Thurrock is now rising at between 2% to 4% per annum since 2012. Dartford Crossing traffic has risen at a lower rate implying suppressed demand and a constraint on growth imposed by the existing crossing.

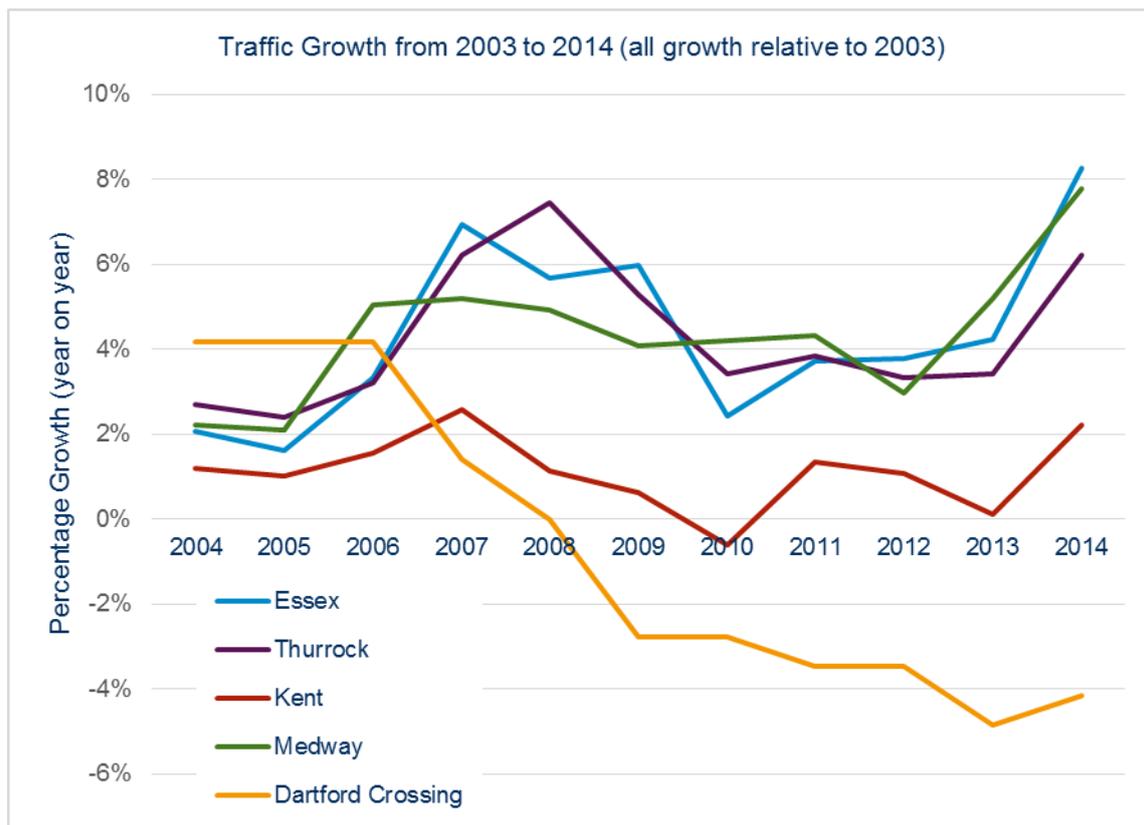


FIGURE 3.8 - RELATIVE ANNUAL TRAFFIC GROWTH COMPARING DARTFORD CROSSING WITH ADJACENT AREAS

3.13.3 The growing demand for the crossing is the primary reason for the increasing congestion at the crossing. As a strategic link in the orbital road network around London, it will always attract significant traffic trying to avoid the eastern side of London.

3.14 Journey Time Reliability

3.14.1 The existing Dartford Crossing is the only river crossing on the SRN east of London. It is one of the worst sections in the SRN nationally for user delay, congestion, reliability and resilience. Operational resilience is poor as the crossing experiences closures on an almost daily basis due to incidents, which have a disproportionate effect on reliability of the strategic and local road networks.

3.14.2 Between March 2011 and October 2014, the percentage of journeys completed 'on-time' fell from 63.4% to 38.4% southbound and from 55.2% to 47.3% northbound, making it one of the least reliable roads on the Highways England network.

3.14.3 Journey times and speeds between Junction 2 and Junction 30 in 2014 were:

- Northbound - only 64% of journeys achieved their target journey time, with 1 in 5 journeys having an average speed of less than 20mph in the evening peak;

- Southbound - only 60% of journeys achieved their target journey time, with 1 in 4 journeys having an average speed of less than 20mph in the morning and evening peaks;
- This equates to more than 2 million wasted hours every year because of the unreliability of journey times between Junction 2 and Junction 30.

3.14.4 The journey time data presented above is pre-Dart Charge, which only became fully operational in summer 2015. Whilst Dart Charge has led to some reduction in journey times, as described in Section 3.3, reliability of journey times continues to be poor because of a combination of configuration constraints, operational constraints and incidents:

- As described in Section 3.2, both northbound tunnels have restricted headroom and, in the case of the Dartford West Tunnel, poor geometry that restricts the practical travel speed to 30-40mph.
- The impacts of the TMC and escorting of vehicles through the tunnels, as described in Section 3.4.
- Between Junction 2 and Junction 30 there are closely spaced junctions, with high volumes of traffic undertaking extensive weaving movements, which leads to more incidents that cause delay.

3.14.5 These operational issues increase the likelihood of incidents and this is demonstrated in **Figure 3.9**. This shows the number of unplanned closures of a single lane or more at the crossing in 2014; there were 25 unplanned closures due to incidents of between 1 and 3 hours, and 350 unplanned closures of up to an hour. On average there was a closure a day with a 27 minute closure time.

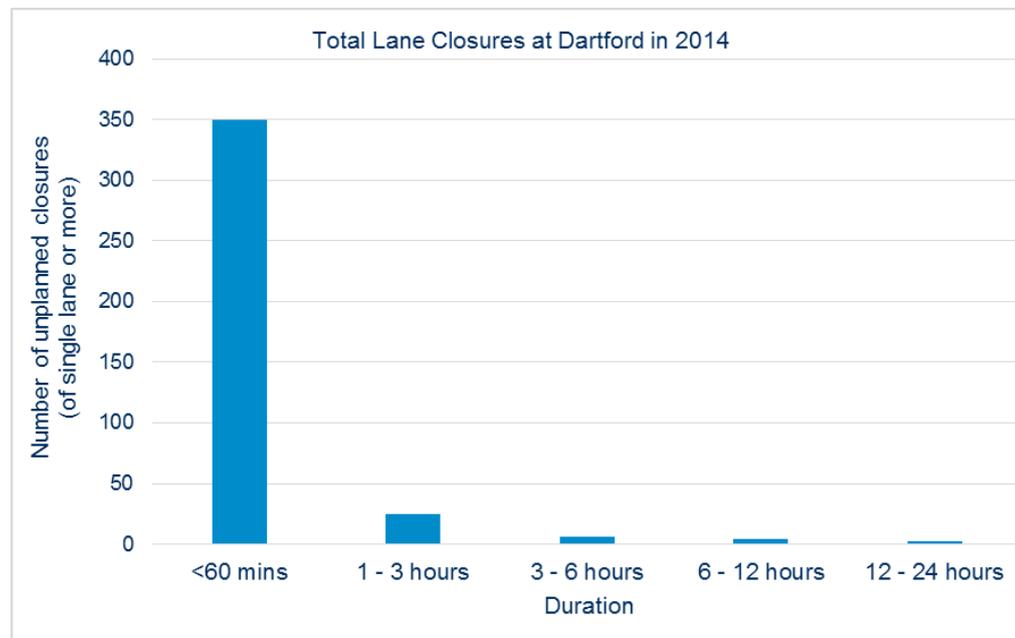


FIGURE 3.9 - TOTAL NUMBER OF LANE CLOSURES AT DARTFORD IN 2014

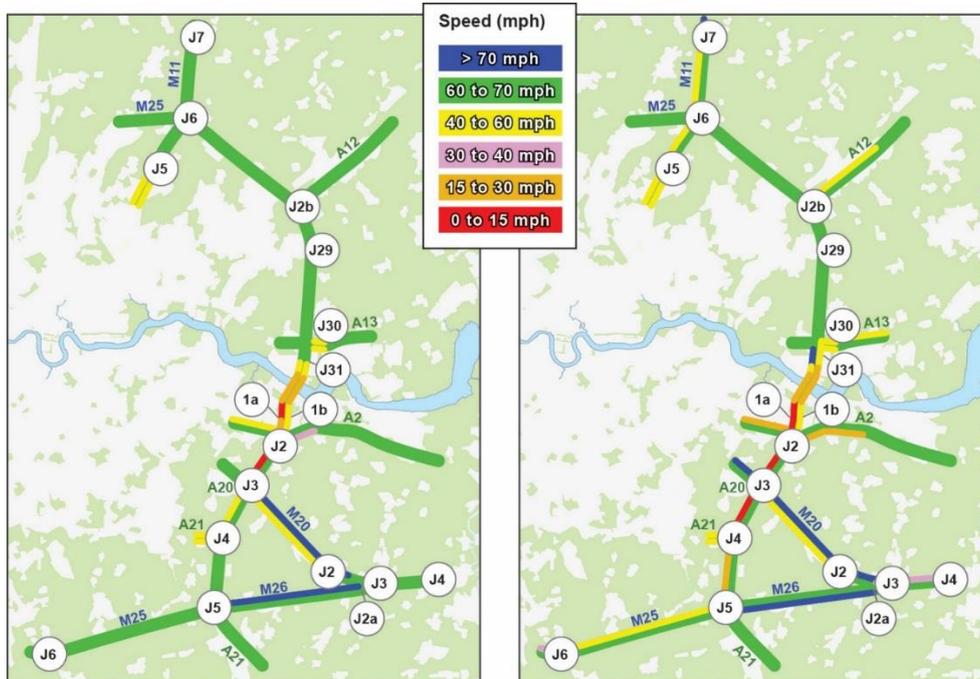
3.14.6 Vehicles carrying dangerous substances require on average 800-900 vehicle escorts per week; each of which can hold up traffic for 2 minutes; full

closures of up to 10 minutes are sometimes required. These delays are caused by vehicles being held back to enable the convoys to proceed.

3.15 Network Resilience

3.15.1 The congestion and incidents do not only affect crossing users. The strategic location and importance of the crossing means that any disruption at the crossing has a ripple effect on the surrounding network. This can be demonstrated by reference to an incident in July 2014, when the west tunnel was shut at about 12.30pm because of an accident. **Figure 3.10** shows the resulting congestion on the network at 1pm and 5pm on the day of the 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 before congestion was relieved as the capacity of the single open tunnel was sufficient for the overnight traffic volumes. The closed tunnel was reopened at 5.30am the following morning, following resurfacing, before the morning peak traffic period.

3.15.2 Whilst this incident occurred pre-Dart Charge, it is still considered to be representative of the post-Dart Charge situation. Although Dart Charge has removed the incidents associated with the toll plazas, it has not improved the other problems relating to the closely spaced junctions, and in the case of the northbound direction the need for traffic management to control restricted vehicles and poor tunnel geometry. In addition, traffic now has to slow and possibly weave as it approaches the tunnels (this was previously controlled by the plaza barriers) and this will increase the likelihood of incidents at this location. Also, the higher volumes of traffic in the future will inevitably erode any benefits from Dart Charge in terms of total incident numbers.



Average Speeds between 1pm and 2pm

Average Speeds between 5pm and 6pm

FIGURE 3.10 - ILLUSTRATION OF AVERAGE TRAVEL SPEEDS ON CROSSING AND ADJACENT NETWORK AFTER INCIDENT IN JULY 2014

3.16 Road Safety

3.16.1 Road safety along the existing M25/ A282 corridor is affected by the following:

- High traffic flows
- High level of weaving traffic and closely spaced junctions
- Horizontal and vertical alignment constraints at the crossing and elsewhere along the corridor
- Operational constraints northbound at the tunnels, including the TMC and the proximity of existing junctions.

3.16.2 These features affect the road safety characteristics of the route. **Figure 3.11** shows where accidents occurred in 2014, together with their severity. The high traffic flows and poor network characteristics increase the probability of accidents and incidents. It can be seen that accidents are dispersed across the area, and there are significant concentrations at junctions.

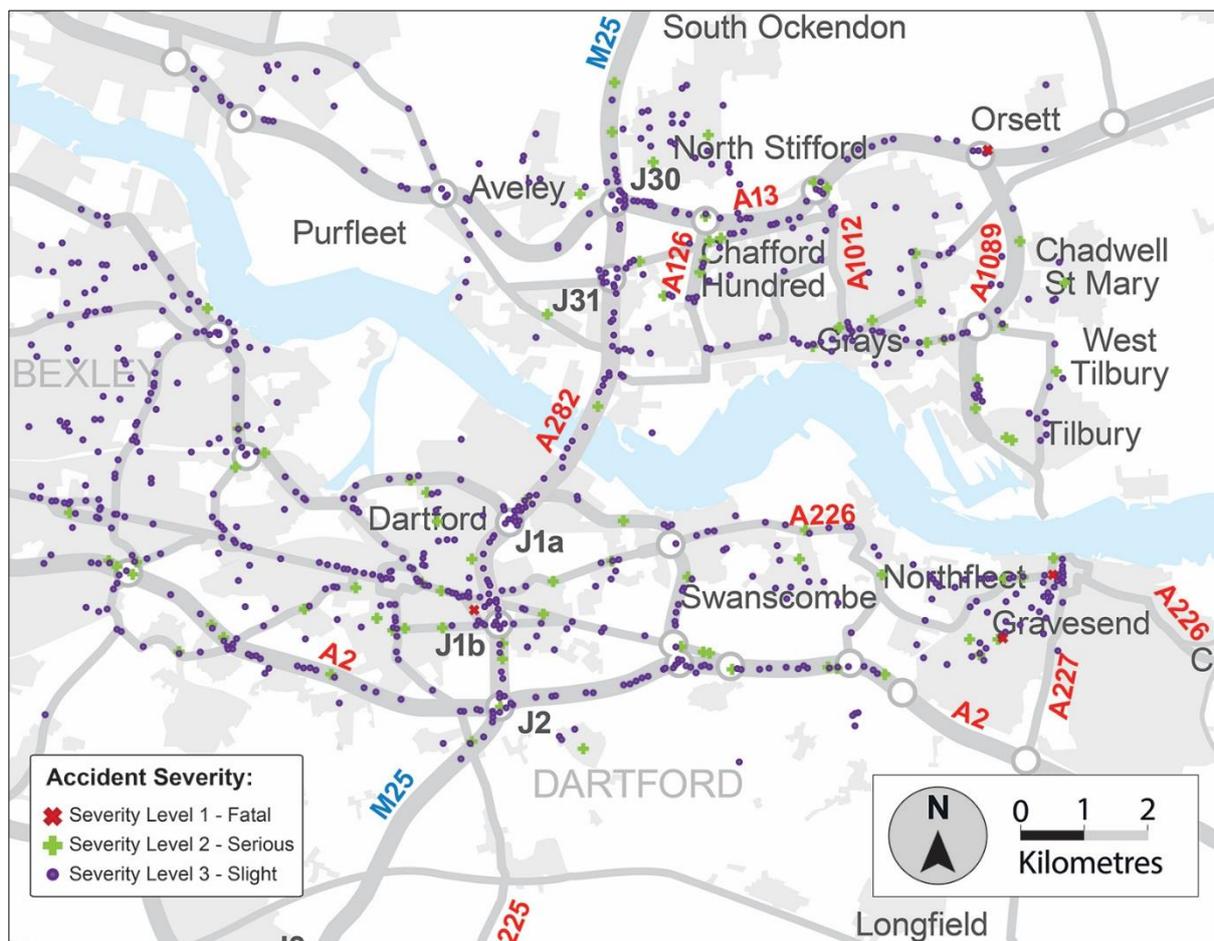


FIGURE 3.11 - LOCATION OF ACCIDENTS IN THE AREA OF THE CROSSING IN 2014

3.16.3 **Figure 3.12** shows the Fatal and Weighted Injury (FWI) collision rates per billion vehicle kilometres for the road network in the Study Area for the period 2009 to 2013, compared to national average figures for the respective links of the road network.

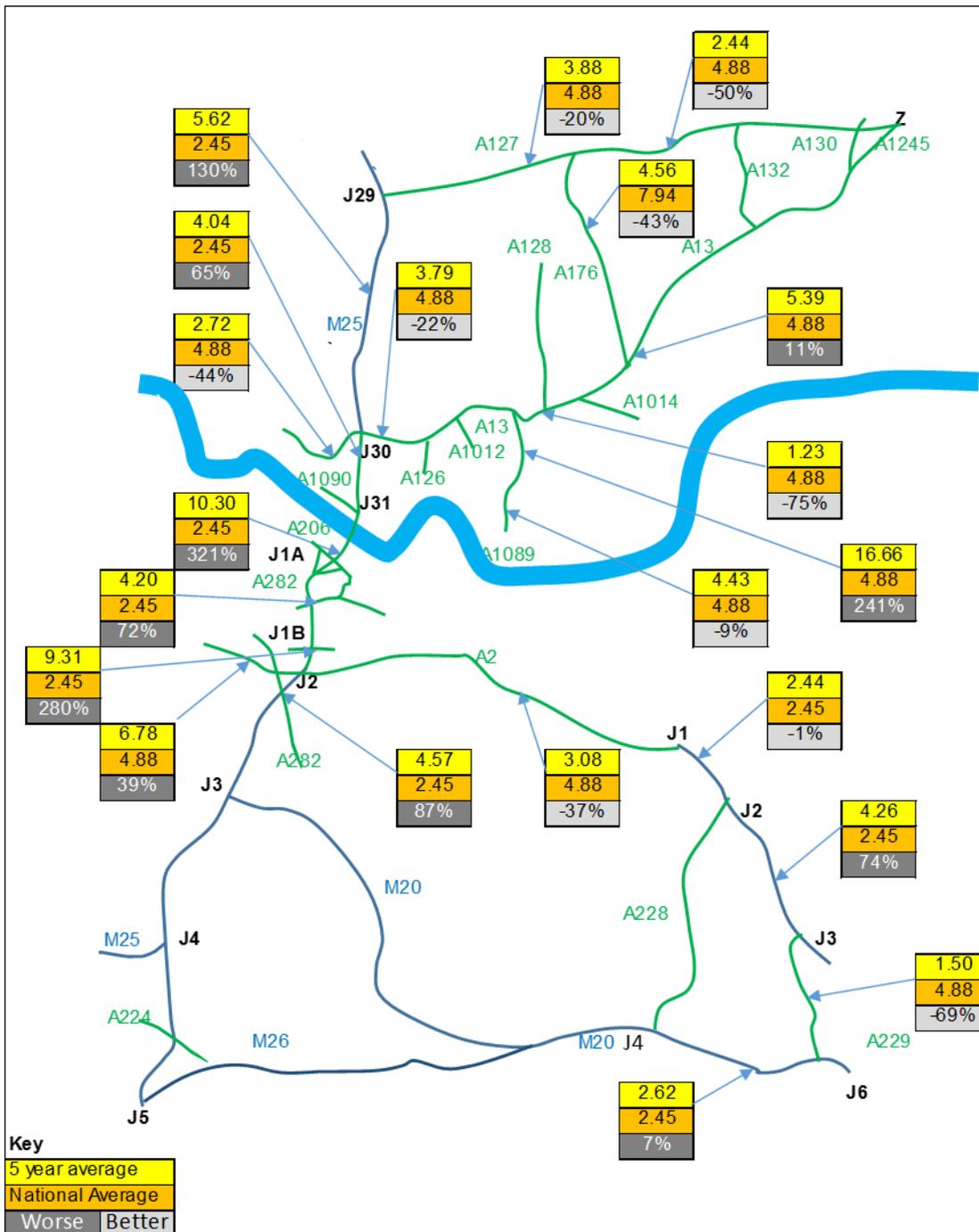


FIGURE 3.12 - 5 YEAR AVERAGE FWI COLLISIONS PER BILLION VEH KM

3.16.4 Figure 3.12 shows that the existing M25/ A282 corridor has a poor safety record compared to national average safety figures. This is summarised below:

- At the crossing (Junction 1a - Junction 31), the existing FWI rate is 321% higher than the national average.

- On the M25 Junction 2 - Junction 3, the existing FWI rate is 87% higher than national average.
- On the A282 Junction 1b - Junction 2, the existing FWI rate is 280% higher than the national average.
- On the A282 Junction 1a - Junction 1b, the existing FWI rate is 72% higher than the national average.
- On the M25 Junction 31 - Junction 30, the existing FWI rate is 65% higher than the national average.
- On the M25 Junction 30 - Junction 29, the existing FWI rate is 130% higher than the national average.

3.16.1 As stated above, the existing accident data is based on a five year period prior to Dart Charge becoming fully operational in summer 2015. The effect of Dart Charge on accident and collision patterns around the crossing has not yet been fully assessed, as only limited data is currently available. Initial indications of the impact of Dart Charge are that the number of incidents on the A282 between J1a and J31 has fallen, although the proportion of injury incidents to all incidents has increased. This is based on limited information available since completion of the Dart Charge works in July 15. Data will continue to be collected and monitored on the road network post-Dart Charge; this data will be assessed as part of the next phase of the scheme.

3.16.2 From **Figure 3.12**, it can be seen that there are other sections of the existing road network which have a poor safety record as follows:

- M2 between Junction 2 and Junction 3 (existing FWI 74% higher than the national average)
- A2 west of the M25 (existing FWI 39% higher than the national average)
- A1089 to Tilbury Docks (existing FWI 241% higher than the national average).

3.16.3 Junction 1a and Junction 2 have a poor safety record, with the third worst casualty rates in the country for roads of these types (referenced from the London Orbital and M23 Route-Based Strategy Report, dated April 2014).

3.16.4 Overall the safety record for the crossing and the approach roads to the crossing is poor. Incidents take time to clear and the high level of incidents leads to congestion, delays and unreliable journeys.

3.17 Non-Motorised Users

- 3.17.1 The area contains numerous facilities for pedestrians, equestrians and cyclists (non-motorised users, NMUs). These include footpaths, bridleways, Sustrans routes forming part of the National Cycle Network, local cycle routes and trails. These features are shown in **Appendix 2.3**, Public Rights of Way and Cycle Routes. The footpath network is particularly well developed in certain areas including in the vicinity of Shorne and from Chadwell St Mary northwards. Bridleways are also a feature of the area to the east and north of Chadwell St Mary. Sustrans routes run west to east at the A2 and north and south of the River Thames. The Saxon Shore Way also runs along the south bank of the River Thames.
- 3.17.2 Existing river crossing provision for NMUs is limited to a vehicle that drives cyclists across the Dartford Crossing on a limited timetable, and the Gravesend to Tilbury ferry which operates about every 30 minutes between 6am and 7pm. The usage of the facility at the Dartford Crossing varied between about 120 crossings per week and 195 crossings per week between 2013 and 2015. There are currently about 50,000 trips per year on the Gravesend to Tilbury ferry.

3.18 Geology and Mining

- 3.18.1 The generalised geological succession within the study area comprises chalk deposits, sands and clays and London Clay, overlain by alluvium and sands and gravels. Generally north of the Mardyke channel around Ockenden and Orsett there are outcrops of London Clay, where there are old quarries and pits. South of the River Thames there are chalk outcrops. Further details on the existing geological conditions are provided in **Appendix 2.4**.

3.19 Existing Utilities

- 3.19.1 Details of existing utilities within the study area have been obtained from utility companies. At Location A, the principal existing utilities include gas and oil pipelines, overhead high voltage electricity cables, the Dartford Cable Tunnel carrying National Grid high voltage cables, underground cables (including those associated with the existing tunnel ventilation buildings) and drainage. At Location C, the principal utilities are overhead high voltage electricity cables, a cable tunnel which runs beneath the River Thames, a National Grid gas pipeline also crossing the river in a tunnel, and underground cables and drainage. Further details are provided in **Appendix 2.5**.

3.20 Operation and Maintenance

Highway operations and maintenance

- 3.20.1 There are two Highways England maintenance areas within the study area – Area 5 (M25) and Area 4. Connect Plus operate and maintain Area 5, which includes the Dartford Crossing and its approaches, under the M25 DBFO Contract, a 30 year concession contract which commenced in 2009. Area 4 is maintained by Balfour Beatty Mott Macdonald.

- 3.20.2 The existing tunnel and bridge systems are operated from the Dartford River Crossing Control Centre located at the southern end of Dartford Crossing.
- 3.20.3 Regular overnight closures of the individual tunnels occur for planned maintenance. Under these circumstances all northbound traffic is diverted through the other tunnel. If closure is required of the QE11 Bridge, e.g. due to high winds or a major incident, then southbound traffic is diverted through the east tunnel and northbound traffic uses the west tunnel.
- 3.20.4 A Traffic Management Cell manages the passage of restricted vehicles in the tunnels, as described in Section 3.4.
- 3.20.5 Further details on highways operation and maintenance are provided in **Appendix 2.6**.

River Operations

- 3.20.6 The River Thames is Britain's busiest inland waterway. High numbers of commercial and leisure vessels pass within the Port of London's 95 miles of river and estuary between Teddington and the North Sea each year; in 2014, this accounted for nearly 45m tonnes of cargo handled and over 5m tonnes of inland waterways freight. Of these vessel movements, over 11,000 were with pilotage services guided by Thames pilots.
- 3.20.7 River operations are managed by the Port of London Authority. Further details of vessel movements and future marine traffic requirements are provided in **Appendix 2.6**.

4 Environmental Conditions

4.1 Environmental Overview

- 4.1.1 The environmental constraints maps in **Appendix 2.7** and **Appendix 2.8** show the location and status of key environmental features across Location A and Location C study areas.
- 4.1.2 The River Thames (**Photo 4.1**) runs through the centre of the study area with a diverse and highly designated environment both north and south of the river. Designated sites include: the internationally important Thames Estuary and Marshes Special Protection Area (SPA) and Ramsar site; a large number of nationally important ecological sites including Sites of Special Scientific Interest (SSSI); areas of ancient woodland; and the River Thames recommended Marine Conservation Zone (rMCZ). Nationally important heritage features include scheduled monuments such as Tilbury Fort and Coalhouse Fort Battery and Artillery Defences on the north side of the River Thames and a large number of listed buildings and conservation areas.



**PHOTO 4.1 - RIVER THAMES FROM SHORNE MARSHES
(FROM THE SAXON SHORNE WAY - LOOKING WEST)**

- 4.1.3 To the south of the River Thames there is also the nationally important Kent Downs Area of Outstanding Natural Beauty (AONB) (**Photo 4.2**). There are also Registered Parks and Gardens both north and south of the river. There are large population centres particularly Dartford, Gravesend, Grays and Tilbury as well as a number of smaller settlements across the more rural parts of the study area. The key environmental features and the value of these are described in more detail in the subsequent sections of this report.



**PHOTO 4.2 - KENT DOWNS AREA OF OUTSTANDING NATURAL BEAUTY
(PUBLIC FOOTPATH BETWEEN THE A2 AND SHORNE RIDGEWAY -
LOOKING EAST TOWARDS GREAT CRABBLES WOOD)**

4.2 Noise

Location A

- 4.2.1 There are Noise Important Areas (NIAs) located throughout the southern section of the study area, in particular along the M25/ A282, A225, and A2. NIAs are designated by Defra to identify the noisiest routes. The NIAs are shown on the constraints maps in **Appendix 2.7**.
- 4.2.2 **Figure 4.1** provides details of existing noise levels at properties along the A282 corridor south of the crossing. This indicates that properties immediately adjacent to the A282 experience very high noise levels, in excess of 75dB(A).

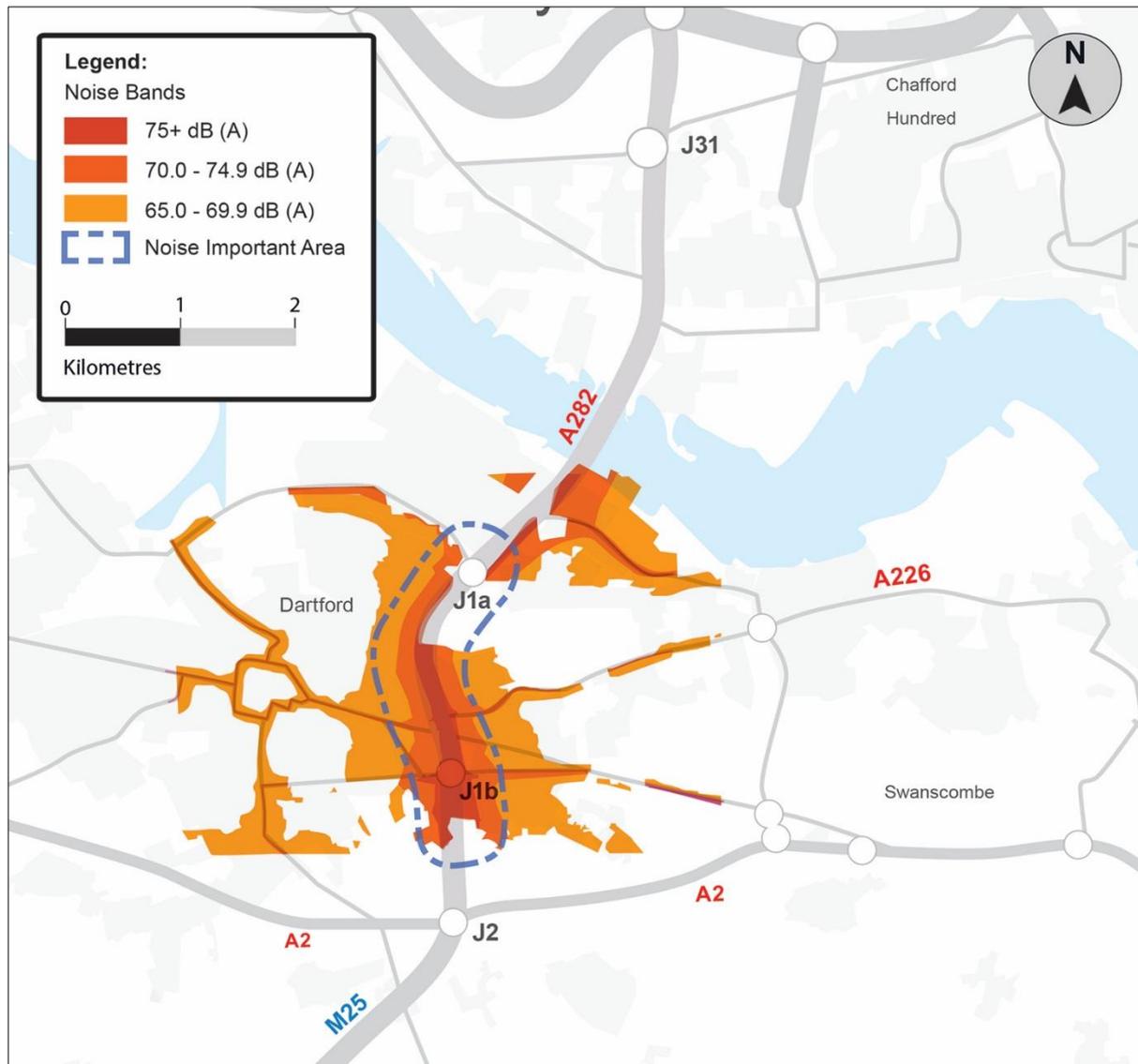


FIGURE 4.1 - EXISTING NOISE LEVELS ALONG THE A282 CORRIDOR AT DARTFORD

- 4.2.3 Key noise sensitive receptors south of the River Thames include the residential areas of Dartford.
- 4.2.4 Key sensitive receptors north of the River Thames include the residential areas of West Thurrock, particularly around Junction 31, where they border the existing highway alignment. Further north is the Belhus Park Registered Park and Garden, which could be considered sensitive to an increase in noise levels, however, given the close proximity to the existing M25 the park is already subject to background road noise.

Location C

- 4.2.5 There are NIAs located throughout the southern section of the study area. In particular around the A2/ M2 junction south of Higham; this designation continues south along the M2 towards Rochester. Three further NIAs are designated along the A2 south of Gravesend.
- 4.2.6 Sensitive receptors within the southern section include residential areas, particularly Chalk, Thong, Shorne, Higham and the eastern suburbs of

Gravesend. Along the southern bank of the River Thames are mudflats and other habitats that support large populations of birds; these areas should be considered sensitive due to the disturbance risk to these species.

- 4.2.7 There are four NIAs within the northern section of the study area, along the A13 and A1089, north of Grays and Chadwell St Mary.
- 4.2.8 Sensitive receptors throughout the northern section include the residential areas of Tilbury, Linford, East Tilbury, Orsett, West Horndon, North Ockenden, South Ockenden and North Stifford. East Tilbury Marshes along the bank of the River Thames, is considered sensitive due to the potential to disturb important bird populations. However, it is noted that different species of bird have different levels of tolerance to noise and this would need to be assessed along with other factors to determine the effects on them. This would need to be considered at the next development stage of the scheme.

Scheme Implications

- 4.2.9 The presence of Noise Important Areas demonstrates that there are existing noise and vibration issues associated with road infrastructure in both locations. Therefore, there will be a need for the next development stage to complete an assessment of the noise and vibration effects and to include appropriate mitigation within the design. This is reiterated in paragraph 5.194 of the National Policy Statement for National Networks (NPSNN).

4.3 Local Air Quality

- 4.3.1 Baseline air quality information has been gathered from the following sources for Locations A and C:

- Boundaries of Air Quality Management Areas (AQMA). These are areas declared by a local authority, where air quality monitoring does not meet Defra's national air quality objectives.
- Department for Environment, Food and Rural Affairs (Defra) Pollution Climate Mapping (PCM) GIS data for latest available year (2012).
- Defra's Automatic Rural and Urban Network (AURN) continuous monitoring data.
- Local Authority air quality monitoring data.
- Highways England air quality monitoring data.
- Location of receptors both human and ecological.
- Boundaries of ecological sites.

- 4.3.2 **Appendix 2.7** contains a drawing showing the AQMAs, Defra PCM links and monitoring locations close to Locations A and C. The following sections provide an overview of the monitoring data that has been obtained and the distribution of AQMAs across each of the locations.

Location A

- 4.3.3 It is apparent from the data collated that air quality presents a significant challenge owing to existing high levels of traffic flow and congestion. In particular there are many locations north of the River Thames in the vicinity

of the M25 and A13 and south of the River Thames in the vicinity of the A282 and A226 where the annual mean nitrogen dioxide (NO₂) Air Quality Strategy Objective (AQSO) of 40 ug/m³ is routinely exceeded or is at risk of being exceeded. The area therefore experiences air quality problems.

Air Quality Management Areas

- 4.3.4 There are a number of Air Quality Management Areas (AQMAs) that have been designated close to Location A. Location A is within the Local Authorities of Dartford and Thurrock. It passes directly through one AQMA, designated by Dartford which is located along the A282 Dartford Tunnel approach road from Junction 1a to 300m south of Junction 1b. **Figure 4.2** shows the location of this AQMA together with the location of receptors along the A282 corridor which have been used for air quality modelling.
- 4.3.5 Dartford has also designated AQMAs on the major roads that cross Location A: the A226/ B2500 and the A225. This is shown as orange on the Air and Noise Constraints and Air Quality Modelling Receptor Locations contained in **Appendix 2.7**. Location A also passes through Thurrock's AQMA designated on the A13 and A1306 (shown as blue). The AQMAs have been designated as exceeding both the annual mean NO₂ objective and the 24hr PM₁₀ objective.
- 4.3.6 Although there are AQMAs that have been designated within Location A there is the potential for impacts on AQMAs designated in the wider area dependent on changes in traffic flows as a result of the scheme.

Defra PCM Compliance Links

- 4.3.7 There are a number of Defra PCM links that intersect Location A. These are the main east/ west routes: including the A225, A226, A206 and A1306. The A282 between Dartford crossing and the M25 Junction 31 is also modelled by Defra as part of the reporting on compliance with the *Ambient Air Quality Directive* 2008/50/EC. The modelled concentrations in 2020 for these links are well below the EU Limit Values. It must however be noted that Defra has updated the air quality modelling and action plans which have recently been submitted to the European Commission.

Monitoring

- 4.3.8 There are automatic monitoring stations and a large number of NO₂ diffusion tubes located within Location A at both Thurrock and Dartford (refer to **Appendix 2.7**). The majority of annual average NO₂ concentrations for these stations and tubes located within the vicinity of the approach roads to the existing crossing exceed the EU Limit Value.

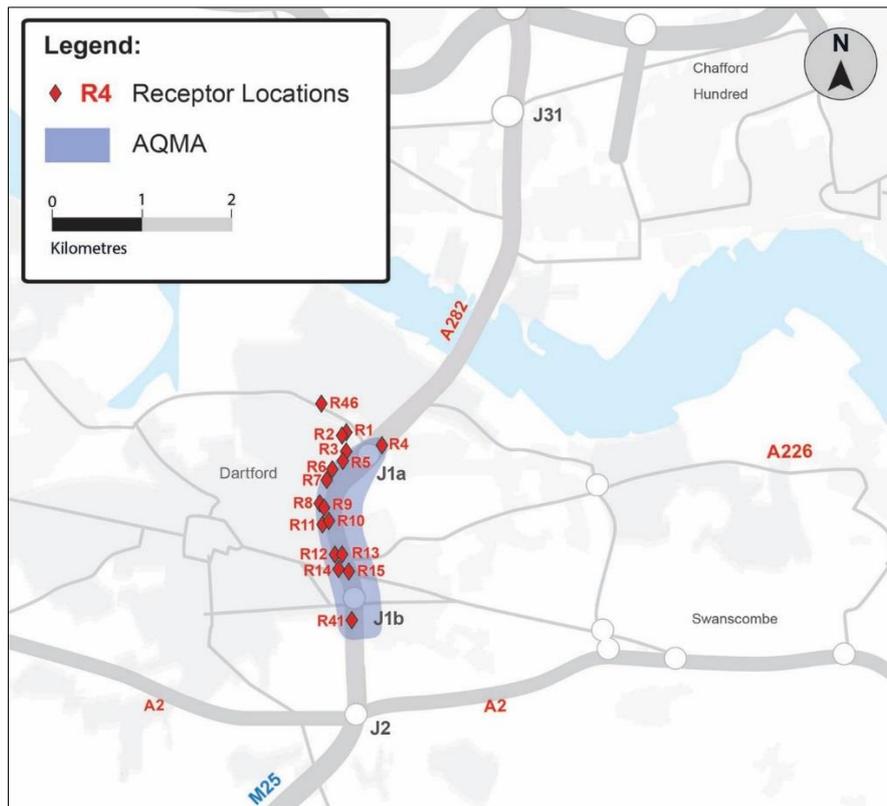


FIGURE 4.2 - AIR QUALITY RECEPTORS SOUTH OF EXISTING CROSSING, JUNCTIONS 1A-1B

Location C

- 4.3.9 Location C passes through a number of populated areas, from south to north including Gravesham, Grays and Tilbury. There are also ecological sites including the Shorne and Ashenbank Woods and the Great Crabbles Wood which are designated SSSIs (refer to Section 4.6).
- 4.3.10 North of the River Thames there are many receptors located on the A1089 at Tilbury and Orsett Heath, the A13 at North Stifford and the M25 at South Ockendon. There are very few receptors further north in Location C with a few pockets of receptors located on the A128 at Orsett, Bulphan and West Horndon. Receptors in the wider area are likely to be affected by Location C options given the impacts of the scheme on traffic flows. As explained in more detail below, the monitoring data records very few instances of exceedances of the AQSO within Location C with the exception of a concentration of exceedances in the centre of Gravesend.

Air Quality Management Areas

- 4.3.11 There are a number of AQMAs that have been designated close to Location C as shown in **Appendix 2.7**. Location C lies in the local authorities of Havering, Gravesham, Thurrock and Brentwood. Location C passes directly through three AQMAs. The first designated by Gravesham which is located along the area extending either side of the A2 within the borough. Location C also passes through Thurrock's AQMA designated on the A13 and A1306. The Havering AQMA encompasses the entire borough. The AQMAs have been designated as exceeding both the annual mean NO₂ objective and the 24hr PM₁₀ objective.

- 4.3.12 Although there are AQMAs that have been designated within Location C there is the potential for impacts on AQMAs designated in the wider area (refer to **Appendix 2.7**) dependent on changes in traffic flows as a result of the scheme.

Defra PCM Compliance Links

- 4.3.13 There are a number of Defra PCM links that intersect Location C, these include the A226, A126 and A1012. The modelled concentrations in 2020 for these links are well below the EU Limit Values. It must however be noted that Defra has updated the air quality modelling and action plans which have recently been submitted to the European Commission.

Monitoring

- 4.3.14 There are no automatic monitoring stations located within Location C. There are a large number of NO₂ diffusion tubes located at the south end of Location C in the Borough of Gravesham. The majority of annual average NO₂ concentrations for these tubes located on or closest to the south end of Location C are below that of the EU Limit Value (refer to drawing in **Appendix 2.7**). The data for these diffusion tubes were supplied by Gravesham Council for the year 2014 and Highways England for the year 2013/14.
- 4.3.15 Location C passes through Thurrock, where there are a large number of diffusion tubes located throughout the Location. The majority of these diffusion tubes measured annual average NO₂ concentrations below the EU Limit Value (refer to **Appendix 2.7**). The diffusion tubes located at the north end of Location C have annual average concentrations of NO₂ lower than the EU Limit Value as the corridor enters the Borough of Brentwood and the boundary of the Havering AQMA.

Scheme Implications

- 4.3.16 The presence of AQMAs and exceedances of the AQSO north and south of the River Thames at Dartford and in Gravesend demonstrate that there are significant air quality issues. Therefore, there will be a requirement for detailed modelling at the next development stage of the scheme to ensure that effects on residential properties are understood. As outlined in the NPSNN in para 5.13 the Secretary of State should refuse consent where *'...the air quality impacts of the scheme will:*
- *Result in a zone/ agglomeration which is currently reported as being compliant with the Air Quality Directive becoming non-compliant; or*
 - *Affect the ability of a non-compliant area to achieve compliance within most recent timescales reported to the European Commission at the time of the decision'.*

4.4 Landscape

Location A - Townscape

- 4.4.1 Location A study area straddles three of Natural England's National Character Areas¹. The southern part of the corridor lies within the western part of the North Kent Plain. This part of the character area is heavily influenced by the urban area of Dartford. The area is an important transport corridor with major rail and road links connecting Kent's coastal towns with London. The central part of this location immediately adjacent to the River Thames falls within the National Character Area Greater Thames Estuary, with the existing QEII Bridge and elevated approach roads forming a strong linear visual feature set against a large scale industrial townscape backdrop. Crayford marshes forms a relatively tranquil area in the west part of Location A. The north part of Location A falls within National Character Area Northern Thames Basin.
- 4.4.2 On the southern bank of the river, industry including the Littlebrook Power Station lies to the west of the QEII Bridge, the Crossways Business Park and other industrial land uses lie to the east. The elevated roads and pylons provide vertical scale within the townscape. The urban area of Dartford lies to the south of the River Thames and to the south of the A206. To the north of the A206, the industrial townscape is broken by the Littlebrook Nature Park that comprises two reclaimed lakes.
- 4.4.3 On the northern side of the River Thames, industrial land uses, road and rail infrastructure dominate the townscape. Two railway lines, High Speed 1 and the London Tilbury Southend line, pass along the northern bank of the River Thames. The High Speed 1 railway line is elevated where it crosses the existing Dartford-Thurrock Crossing. The townscape is characterised by very large industrial units and storage containers located within compounds. Many of the industrial estates and the Lakeside Shopping Centre that lies to the east of the A282 have open landscaped areas and extensive car parking. The townscape north of Junction 31 of the M25 contrasts with that to the south being smaller in scale, more rural in character and comprises the Mardyke Valley, smaller residential settlements such as Aveley and Belhus Park Registered Park and Garden.
- 4.4.4 A number of large scale developments are planned in the future that will further contribute to the existing urban nature of the existing townscape.

Location C - Landscape

- 4.4.5 The landscape within Location C is varied with a very different character south and north of the River Thames. The southern limits of Location C study area lie within the Kent Downs AONB as shown in **Appendix 2.8 and Figure 4.3**. The National Parks and Access to the Countryside Act 1949 legislated for the designation of AONBs with a key purpose to conserve and enhance natural beauty. This area is of national landscape importance and also performs a valuable recreation function which is outlined further in the Kent Downs AONB Management Plan. This Management Plan also sets out

¹ National Character Areas are prepared by Natural England and are guidance documents that can be used to inform decision-making. They are areas that share similar landscape characteristics and follow natural lines in the landscape rather than administrative boundaries.

the special characteristics and qualities of the AONB. The development of the scheme and mitigation measures would have to have special regard to the impacts on the AONB and views into and out of the area. Whilst farmland dominates a lot of the AONB it is also one of Britain’s most wooded landscapes. This is evident within the study area by the designation of a number of areas of ancient woodland, particularly in the area around the A2 within and surrounding the Cobham Hall Registered Park and Garden. This comprises 18th century parkland, estate woodlands and a golf course. The A2/ M2 junction and the High Speed 1 rail corridor are prominent, intrusive landscape features.

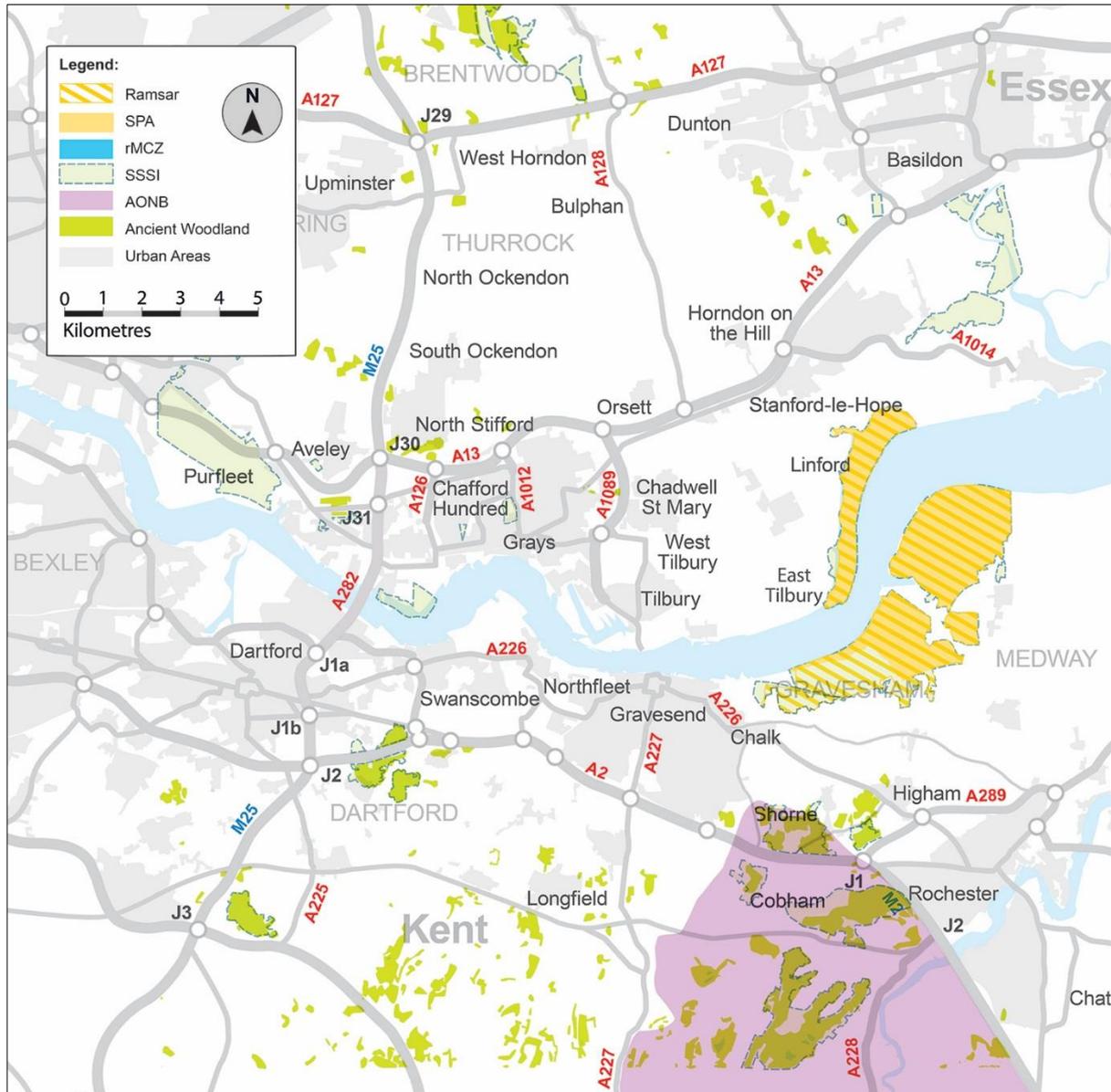


FIGURE 4.3 - KEY LANDSCAPE AND BIODIVERSITY CONSTRAINTS

4.4.6 Location C straddles three Natural England National Character Areas, the North Kent Plain, the Greater Thames Estuary and the Northern Thames Basin. The southern part of Location C study area lies within the North Kent Plain and is characterised by open, low and gently undulating land that is

highly productive agricultural (arable) land. The area has a strong urban influence.

- 4.4.7 The River Thames and the southern and northern banks of the river lie within the Greater Thames Estuary. This is a remote and tranquil coastline landscape of shallow creeks, drowned estuaries, low-lying islands, mudflats and areas of tidal salt marsh. Historic military landmarks are characteristic features of this coastal landscape.
- 4.4.8 The northern part of Location C lies within the Northern Thames Basin. The area is important for its biodiversity and geology. A key feature of this character type is the medieval pattern of small villages and dispersed farming settlement. The area is under great pressure from urbanisation.
- 4.4.9 The landscape character south of the A2 falls within the North Downs. This is a more open and rural landscape interspersed with smaller settlements such as Cobham. North of the A2 near to the M2 junction, the landscape is dominated by areas of woodland including Great Crabbles Wood, Shorne Woods Country Park, as well as small settlements such as Shorne and Thong. Between the A226 and the southern bank of the River Thames the landscape is less wooded and again quite rural in character which is in contrast to the more urban area of Gravesend that lies further west.
- 4.4.10 The River Thames corridor comprises raised dykes backed by expansive flat open marshlands with rough grazing and sparse scrub. Man-made elements including pylons, river traffic and jetties, as well as industry closer to the existing QEII Bridge form part of distant views.
- 4.4.11 Prominent features on the banks of the River Thames include a number of forts that are also designated scheduled monuments. The Heritage and Historic Resources section (Section 4.5) provides details about the historic landscape character and **Appendix 2.9** shows the location of scheduled monuments.
- 4.4.12 North of the River Thames, the landscape in the eastern part of Location C is flat and open comprising extensive areas of marshland such as the East and West Tilbury Marshes and the Mucking Marshes. This open landscape includes small settlements of distinctive character (East Tilbury and West Tilbury) that are also designated as conservation areas and include a number of listed buildings (refer to drawing in **Appendix 2.9**). The western part of Location C is more urban in character with main roads (A1089, A13) and the settlements of Tilbury, Chadwell St Mary and Grays. North of the A13 the landscape is again very rural and open with small isolated settlements including Horndon-on-the-Hill, Orsett and Bulphan which again include a number of listed buildings.

Scheme Implications

- 4.4.13 The presence of the AONB is a national level constraint that will require robust assessment and potentially significant mitigation especially for a Location C route. As outlined in para 5.151 of the NPSNN consent would be refused for a scheme in an AONB, except in exceptional circumstances and where it can be demonstrated that it would be in the public interest. If consent is granted the scheme would have to be carried out to high

environmental standards and where possible include measures to enhance other aspects of the environment.

4.5 Heritage and Historic Resources

General - Heritage and Historic Resources

- 4.5.1 As outlined in the *Thames Gateway Historic Environment Characterisation* study², the Thames Gateway that lies at the centre of the study areas has been a vital corridor for trade, travel and industry throughout history and is a vitally important area for heritage assets. The Thames Gateway comprises the river and inland areas that have been inhabited since prehistory and there is no period when the land has not been used. Whilst the area includes a large number of designated sites as outlined in the description below, the characterisation study and consultation with English Heritage and other stakeholders including Essex and Kent County Councils has confirmed that where there is an absence of designated archaeological remains this is because they have not been found yet, rather than then being absent. There is therefore, significant potential through this scheme to identify undiscovered archaeological remains.

Location A - Heritage and Historic Resources

- 4.5.2 **Appendix 2.9:** Historic Environment Constraints identifies locations of heritage features and their value which are described in the following paragraphs.
- 4.5.3 Within Location A there are a number of listed buildings both of regional and national value located to the south of the River Thames and within the eastern part of the corridor around the A226 and the A206. The nearest scheduled monument to the existing A282 is the Anglo Saxon Cemetery at Darenth Park. Parts of Location A also lie within an Archaeological Potential Area. Scheduled monuments are of national value.
- 4.5.4 North of the River Thames, the designated assets comprise listed buildings with a number to the north of the A13 both east and west of M25 Junction 30. North of M25 Junction 30 and spanning the M25 lies the Belhus Park Grade 2 Registered Park and Garden which is of national value. This is approximately 119 hectares in size and is bordered by the small settlements of Aveley and South Ockendon and to the north by Belhus Woods Country Park. The M25 lies in a cutting which runs north/ south through the eastern half of the park, separating the woodland areas from the open parkland.

Location C - Heritage and Historic Resources

- 4.5.5 Cobham Hall Registered Park and Garden occupies a significant area of Location C and lies to the south of the A2, close to the A2/ M2 junction, at the east end of the village of Cobham (refer to **Appendix 2.9**). Within this park lies a Romano-British villa and 19th century reservoir scheduled monument, as well as a number of other listed buildings, the majority being Grade II listed (regional value) and Cobham Hall itself that is Grade I listed (national value). The village of Cobham is also designated a conservation area and includes a number of listed buildings (Grade I, II and II*). To the

² English Heritage, Kent CC and Essex CC, Thames Gateway Historic Environment Characterisation Project

north of the A2 there are a number of listed buildings around the settlement of Shorne as well as conservation areas at Shorne and Shorne Ridgeway. There are a number of listed buildings, mainly Grade II located along the A226 and a significant number within Gravesend, north of the A226 and bordering the south bank of the River Thames (refer to **Appendix 2.9**).

- 4.5.6 Along the banks of the River Thames, there are four prominent scheduled monuments: New Tavern Fort and Cliffe Fort on the southern bank and Tilbury Fort and Coalhouse Fort and Battery and artillery defences (**Photo 4.3**) on the northern bank. Consultation with Historic England has highlighted the value of the setting surrounding and between each of these sites which is relevant to the potential location of either a bridge crossing or the portals of a tunnel. The presence of existing industry in this area was also acknowledged as already impacting on the setting of these features.



**PHOTO 4.3 - COALHOUSE FORT SCHEDULED MONUMENT
(FROM PUBLIC FOOTPATH AND NATIONAL CYCLE ROUTE 13 FROM THE WEST)**

- 4.5.7 North of the above monuments and in the eastern part of Location C there is a marshland landscape and the two distinctive villages of East Tilbury and West Tilbury that are also designated conservation areas. The setting and importance of these villages locally has been highlighted in discussions with Historic England and Essex County Council. Around and in both of these settlements there are a number of listed buildings, primarily Grade II and II*. North of the A1013 there are a number of listed buildings particularly near and within Horndon-on-the-Hill and Orsett. Between these settlements and the A127 designated heritage assets are more sporadic in their distribution.
- 4.5.8 There is a large scheduled monument at Orsett, a crop mark complex, as well as numerous listed buildings. The scheduled monument has been impacted by the A13 and the A1089. North of the A13, there is less information regarding archaeological remains, although at the junction of the A127 and the M25 (Junction 29), a significant number of remains were identified when the site was used as a compound for the M25 widening.

- 4.5.9 However, as acknowledged above, the lack of designated assets is not a reflection on the lack of importance of this area or the presence of undiscovered archaeology. During a meeting with Essex County Council Historic Environment team, crop mark data was reviewed which demonstrated the extensive areas of archaeology within Location C, particularly around East Tilbury and West Tilbury and in proximity to Orsett, and north and south of the A13/ A1013.
- 4.5.10 At Location C there are a number of challenges owing to the presence of statutory heritage features. At the next development phase of the scheme an assessment of the effects both direct and indirect on these features would need to be undertaken including the effect on setting. There is also the potential for undiscovered archaeological features to be affected. Effects on both known and unknown assets would need to be further investigated through a Desk Based Assessment, appropriate field evaluation (if deemed necessary by the Desk Based Assessment) and then implementation of mitigation in consultation with all relevant parties (Historic England and the relevant County Archaeologists).
- 4.5.11 The same approach would need to be adopted for the assessment and mitigation of a proposed solution at Location A although there are fewer cultural heritage constraints.

Scheme Implications

- 4.5.12 The presence of national level constraints including scheduled monuments, Registered Parks and Gardens and listed buildings as well as a number of valuable heritage features will require further assessment and mitigation. As outlined in para 5.132 of the NPSNN any harmful impact on the significance of a designated heritage asset should be weighed against the public benefit of development, recognising that the greater harm to the significance of the heritage asset, the greater the justification that will be needed for any loss.

4.6 Biodiversity

European Sites/ River Thames – Biodiversity

- 4.6.1 Both locations have the potential to directly or indirectly affect European and nationally designated sites at and within the vicinity of the River Thames.
- 4.6.2 Council Directive 92/43/EC of 21 May 1992 on the conservation of natural habitats and wild fauna and flora which is also known as the Habitats Directive and is implemented by the Conservation of Habitats and Species Regulations 2010 requires an assessment of the effects of a scheme on European Sites. European Sites are taken to comprise Special Protection Areas (SPA), Special Areas of Conservation (SAC), Ramsar sites, candidate SACs, potential SPAs and potential Ramsar sites.
- 4.6.3 As shown in **Appendix 2.10**, Biodiversity Constraints, the Thames Estuary and Marshes Ramsar and SPA are located on both sides of the River Thames to the east of Gravesend; refer also to **Figure 4.3** in Section 4.5 above. The SPA is protected under Directive 2009/147/EC on the conservation of wild birds. SPAs are classified for rare and vulnerable birds and for regularly occurring migratory species. A Ramsar site is a wetland of international importance designated under the Ramsar Convention. These

sites therefore have the highest level of protection and decision makers must determine whether a scheme is likely to have a significant effect on them. Under the Habitats Regulations (refer to Section 5), where impacts are unavoidable derogation (variation) procedures exist which allow projects to proceed under the following specific circumstances:

- That no feasible, less-damaging alternative solutions exist.
- That there are Imperative Reasons of Overriding Public Interest (IROPI) for the proposal to go ahead.
- That adequate and timely compensatory measures will be put in place to ensure the overall coherence of the network of protected sites is maintained.

4.6.4 The River Thames is designated as a recommended Marine Conservation Zone (rMCZ). However, the rMCZ is on hold at the moment as Defra has stated that there is a need better to understand the implications of the designation of the site on potential developments within the Thames Estuary. Key habitats and species of the rMCZ comprise: intertidal sand/ muddy sand, intertidal mixed sediments, subtidal coarse sediments, subtidal sand, subtidal mud, sheltered muddy gravels, tentacled lagoon worm (*Alkmaria romijni*), European eel (*Anguilla anguilla*) and Smelt (*Osmerus eperlanus*). The latter two species are UK Biodiversity Action Plan (BAP) priority species. The site is an important fish nursery and spawning ground. The rMCZ is a national level designation. Any effect on habitats and species associated with the site (e.g. due to dredging or sediment mobilisation) would need to be assessed at the next development phase of the scheme through survey as appropriate depending on the crossing type.

4.6.5 Depending upon the type of crossing selected there is potential for the scheme to affect the hydrodynamics of the River Thames which may also have an impact on the rMCZ.

Location A - Biodiversity

4.6.6 There are a number of areas of ancient woodland along the A2 to the south of the River Thames with some of these areas forming the Darenth Wood SSSI. This site comprises some of the most valuable areas of ancient semi-natural woodland in northwest Kent and includes several rare woodland types as well as a range of rare invertebrate fauna.

4.6.7 Within Location A the West Thurrock Lagoon and Marshes SSSI lies to the east of the existing QEII Bridge. This is one of the most important sites for wintering waders and wildfowl on the Inner Thames estuary. The combination of extensive intertidal mudflats combined with a large and secure high tide roost attract waders in nationally important numbers, with significant populations of other bird species. The mudflats form the single largest intertidal feeding area, for wintering waders and wildfowl, on the inner Thames estuary. The site comprises two SSSI units. The condition of Unit 1 is “Unfavourable - No change”, with dunlin and redshank numbers being below threshold and the site subject to physical disturbance. The condition of Unit 2 is “Unfavourable – Declining”, with dunlin and redshank numbers below threshold and the intertidal mudflats and saltmarsh suffering from

coastal squeeze. Bird populations at this nationally important site could be affected by direct habitat loss, changes to noise and light levels as well as any changes in the hydrodynamic regime or water quality.

- 4.6.8 The Inner Thames Marshes SSSI lies 3.2km upstream of the existing QEII Bridge. This forms the largest remaining expanse of wetland bordering the upper reaches of the Thames estuary. The site is of value for its diverse and ornithological interest and especially for the variety of breeding birds and the numbers of wintering wildfowl, waders, finches and birds of prey, with wintering teal populations reaching levels of international importance. The site also supports a wide range of wetland plants and insects with a restricted distribution in the London area. This site could be affected by changes to the hydrodynamic regime. The site is in “Unfavourable – Declining” condition with coastal squeeze being the factor affecting its condition.
- 4.6.9 The Purfleet Chalk Pits SSSI lies to the west of the A282 and comprises Mid-Pleistocene sand and gravel deposits overlying Chalk exposed in a series of disused quarries at Purfleet, Essex.
- 4.6.10 There are areas of ancient woodland to the east of Junction 30 of the M25 as shown in **Appendix 2.10**.

Location C - Biodiversity

- 4.6.11 On the outer limits of the study area and to the west of the M2 and south of the M2/ A2 junction lies the Cobham Woods SSSI. This woodland and old parkland is representative of woods in North Kent which occur in part on acidic Thanet Sands and in part on chalk soils. The site supports an outstanding assemblage of plants which is also important for breeding birds. The woodland is largely sweet chestnut with some coniferous plantations whilst the woodland is mature woodland with some clearings, of oak, sweet chestnut, beech, hornbeam, and other species.
- 4.6.12 The Shorne and Ashenbank Woods SSSI straddles the A2, to the south east of the residential area of Gravesend. This site is a complex of ancient and plantation woodland. The site supports an important and diverse invertebrate fauna especially beetles, true bugs and dragonflies and includes a number of areas of ancient woodland.
- 4.6.13 Great Crabbles Wood SSSI lies to the east of the Shorne and Ashenbank Woods SSSI and to the east of the settlement of Shorne. This site is representative of woods on North West Kent tertiary sediments; these comprise a succession of strata over Upper Chalk ranging from Blackheath gravels to Woolwich loams and Thanet sands which provide a range of soil types. This site is also coincident with a number of areas of ancient woodland. Sweet chestnut is the dominant species as well as a number of scarce plants including lady *Orchis purpurea* and man orchid *Aceras anthroporum*.
- 4.6.14 Along the A2 there are a number of areas of ancient woodland that lie outside the SSSIs. To the east of Shorne there are several local wildlife sites.

- 4.6.15 All of the above woodland sites are susceptible to and could be affected by changes in nitrogen deposition as a result of changing traffic flows.
- 4.6.16 North of the A226, east of Gravesend and bordering the south bank of the River Thames lies the Thames Estuary and Marshes Ramsar site, SPA and SSSI. The extents of these sites are slightly different as shown by the shading on the drawings in **Appendix 2.10**. These sites support a complex of brackish, floodplain grazing marsh ditches, saline lagoons and intertidal saltmarsh and mudflat. These habitats together support internationally important numbers of wintering waterbirds. The saltmarsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates.
- 4.6.17 On the northern bank of the River Thames east of East Tilbury and south of Stanford-le-Hope lies the Mucking Flats and Marshes SSSI which is also coincident with the Thames Estuary and Marshes SPA and Ramsar site.
- 4.6.18 There are also a number of areas of functional habitat associated with these sites. Functional habitat is the term used to describe an area of undesignated land lying beyond the boundary of a designated site that is used by designated bird populations for roosting, nesting or foraging. Our current interpretation of functionally linked land associated with the Thames Estuary and Marshes Ramsar site, SPA and SSSI has been developed using Wetland Bird Survey Data and British Trust for Ornithology (BTO) dot density maps. At this stage of the scheme's development ornithological surveys have not been completed. Completion of such surveys for the preferred option will enable the area of functional habitat to be further defined.
- 4.6.19 North of the River Thames within Location C there are some smaller isolated areas of ancient woodland and far fewer designated sites compared to south of the river. The only other SSSIs are two small sites to the west of the A1089, Hangman's Wood and Denehole's SSSI and Globe Pit SSSI. The Globe Pit SSSI is designated for geological reasons and is an important site for the interrelationship between archaeology and geology for its correlation of the Lower Palaeolithic chronology with the Pleistocene Thames Terrace sequence. Hangman's Wood and Denehole's SSSI comprises the remains of medieval chalk mines and is the most important underground hibernation site for bats in Essex. Three species have been recorded: Brown longeared bat *Plecotus auritus*, Natterer's bat *Myotis nattereri* and Daubenton's bat *Myotis daubentonii*.
- 4.6.20 At Junction 29 there are areas of ancient woodland and wildlife sites to the north west, north east and south east.

Scheme Implications

- 4.6.21 The presence of international and national ecological constraints as well as a wealth of other sites and the potential for protected species presence will require considerable assessment and mitigation including surveys. As noted earlier, there is also a requirement for a Habitats Regulations Assessment in accordance with the Habitats Directive. Paragraph 5.25 of the NPSNN states as a general principle development should avoid significant harm to biodiversity interests including through mitigation and consideration of

reasonable alternatives. Paragraph 5.26 states that the Secretary of State should ensure that appropriate weight is attached to designated sites of international, national and local importance, protected species, habitats and other species of principal importance.

4.7 Water Environment

- 4.7.1 The location of the water environment features and constraints described in this section is shown in **Appendix 2.11**, water constraints.

Location A - Water Environment

South of the River Thames

- 4.7.2 Minor watercourses are found at Stone Marshes and parallel with the A282. There are also associated natural and man-made lakes and small ponds. To the west are the man-made lakes of Littlebrook Nature Park. Of local importance, these have some recreational (and potentially) biodiversity interest.
- 4.7.3 The south is underlain by the Principal Aquifer of the Seaford and Newhaven Chalk Formations. This is important for local and regional public water supplies, and for commercial and industrial use. The West Kent Darent and Cray Chalk water body currently has “poor” Water Framework Directive (WFD) status. The Chalk is overlain by Alluvium (a secondary aquifer) and by the Taplow and Boyn Hill Terrace Gravels which are “Secondary A” aquifers and may contain groundwater at shallow depth. Their WFD status is not defined. To the extreme south, Location A passes over Source Protection Zones (SPZs) 2, 3 and possibly 1 for public water supplies from the underlying Principal Aquifer. The SPZ is used as a screening tool within the Environment Agency *Groundwater Protection: Principles and Practice* (GP3) policy which provides position statements with respect to permitted activities within these zones.

River Thames and Immediate Environs

- 4.7.4 The River Thames is of international importance with significant economic and social value. It carries commercial shipping, has significant biodiversity interest and is important for dilution of effluent discharges. The floodplain of the River Thames within Flood Zone 3 (0.05% or 1 in 200 or greater annual probability of flooding) extends about 1.3 km to the south and about 2.6 km to the north, where the floodplain is more extensive. The area benefits from the Thames tidal flood defences. These are subject to the long term planning set out in *Thames Estuary 2100* (TE2100 Plan, November 2012). Under TE2100, the area is within Action Zone 6, for which the adopted planning policy is “*Take further action to keep up with climate and land use change so that flood risk does not increase*”. The integrity of these defences (and their planning) are of regional and national importance. The estuarine/transitional waters of the Thames Middle water body currently have a WFD status of “moderate potential”. Habitat and biodiversity interest is recognised in the Thames Estuary rMCZ.

North of the River Thames

- 4.7.5 Within the defended part of the Thames floodplain, there are a number of watercourses within the West Thurrock Marshes. These features are of local importance, with some potential biodiversity interest. Further north, adjacent to the A1306 and Thurrock Lakeside, there are man-made lakes with local recreational and amenity interest.
- 4.7.6 Just south of M25 Junction 30, there is the Mardyke main river and its associated floodplain. The Zone 3 floodplain (refer to paragraph 4.7.4) is about 350m wide and is also defended, forming part of the overall River Thames flood defences. The Mardyke is classified as a heavily modified water body under WFD and currently has “poor potential” WFD status.
- 4.7.7 The area is also underlain by the Principal Aquifer of the Seaford and Newhaven Chalk Formations, as above, important for local and regional public water supplies and local commercial and industrial use. Location A overlies SPZs 1, 2, and 3 in the extreme north east. The groundwater (WFD) water body is identified separately as the South Essex Thurrock Chalk, currently with “poor” WFD status. The Chalk here is also overlain by the “Secondary A” aquifers of the Taplow and Lynch Hill Terrace Gravels. In part these form the Essex Gravels groundwater body, currently with “poor” WFD status.

Location C - Water Environment*South of the River Thames*

- 4.7.8 There are watercourses, drains and standing water associated with the South Thames Estuary and Marshes Ramsar site and SSSI with associated significant biodiversity interest. These include Shorne, Eastcourt, Great Clane Lane and Filborough Marshes. The Thames and Medway Canal is a WFD artificial water body with “moderate potential”.
- 4.7.9 The area is underlain by the Principal Aquifer of the Seaford and Newhaven Chalk Formations, important for local and regional public water supplies, and for commercial and industrial use. Currently the WFD status of the West Kent Darent and Cray Chalk water body is “poor”. The Chalk is overlain in parts by Alluvium which is a secondary aquifer and River Terrace Gravels which are “Secondary A” aquifers and may contain groundwater at shallow depth. Their WFD status is not defined. To the extreme south, Location C passes over SPZs 2, 3 for public water supplies from the underlying Principal Aquifer.

River Thames and Immediate Area

- 4.7.10 At Location C the floodplain of the River Thames within Flood Zone 3 extends about 1.1km south of the southern shoreline across the Ramsar site and about 2.3 km to the north across Tilbury Marshes where the floodplain is more extensive. Parts of the area benefit from the Thames tidal flood defences.

North of the River Thames

- 4.7.11 The northern end of Location C crosses the Mardyke flood plain and its associated water bodies. The flood plain (Zone 3) is up to 2km wide (varying

according to the crossing point) and, as above, benefits from flood defences. There are a number of locally important and separately defined water bodies, including the “West Tilbury Main” within the Mardyke system, with variously poor or “moderate potential” WFD status.

4.7.12 West and East Tilbury Marshes and associated watercourses occur within the floodplain immediately north of the River Thames.

4.7.13 The area is also underlain by the Principal Aquifer of the Seaford and Newhaven Chalk Formations, important for local and regional public water supplies and local commercial and industrial use. To the east SPZs 1, 2, and 3 are present in the vicinity of Chadwell St Mary. The groundwater (WFD) water body is identified separately as the South Essex Thurrock Chalk, currently with “poor” WFD status. The Chalk here is also overlain in parts by Alluvium which is a secondary aquifer and by terrace gravels (Taplow, Lynch Hill and Boyn Terrace Gravels) which are “Secondary A” aquifers. In part these form the Essex Gravels WFD groundwater body, currently with “poor” status.

Thames Estuary Hydrodynamic and Geomorphological Characteristics

4.7.14 Preliminary hydrodynamic modelling has been undertaken as part of the options development and selection to inform the appraisal of potential impacts on the river. The work examined impacts on water level, current velocities and sediment dispersions arising from selected scenarios of new bridge piers in the river and dredging activities associated with forming a trench for construction of an immersed tunnel crossing. The baseline mean high water spring level assumed for the study is 3.4m Above Ordnance Datum (AOD) at Location A and 3.6m AOD at Location C. The baseline flow conditions were based on assumed flood and ebb current speeds of 1.3m/s and 1.8m/s respectively.

4.7.15 Tidal range increases up-estuary from 5.3m at Southend-on-Sea to 6.6m at London Bridge. The construction of flood defence structures in the early 20th century has caused the tidal range to increase over time (1930 to 1970) with a greater rate occurring at Tower Bridge than Southend-on-Sea. Predicted tide levels can be raised by as much as 2.5m at high water, and up to 4m on the rising tide by positive storm surges. Overall, vertical accretion of most intertidal mudflats downstream of Gravesend has kept pace with (and likely exceeded) relative sea level rise over the last 30 years. This suggests that historically, sediment supply to these areas has been sufficient to enable this level of accretion to take place. With the present day agitation dredging which retains fine sediment the trend of accretion on intertidal areas landward of Lower Hope Reach is expected to continue.

Scheme Implications

4.7.16 The next development stage of the scheme will include a Flood Risk Assessment and WFD assessment as well as a robust assessment of potential impacts on groundwater and other water resources. The NPSNN requirements in relation to climate change and project resilience will also need to be taken into consideration in the design and assessment. Paragraph 5.225 of the NPSNN states that the Secretary of State will generally need to give impacts on the water environment more weight where

a project would have adverse effects on the achievement of the environmental objectives established under the WFD.

4.8 Climate

- 4.8.1 The low-lying margins of the Thames Estuary have been subject to inundation from tides and storm surges for hundreds of years. Climate change is expected to increase the frequency and severity of these storm surges within the estuary and surrounding environment. There are several studies being completed at present by the Environment Agency to evaluate and model potential scenarios and propose strategies to defend the population centres along the estuary and ultimately London.
- 4.8.2 The Lower Thames Crossing scheme will also require detailed modelling and forecasting of expected increase in sea levels throughout the scheme area to enable robust design of any bridge height, the placement of piers or location of tunnel portals. It is presently predicted that the sea level range due to climate change is assumed to be as follows:
- 0.4m (60 years)
 - 0.6m (120 years)³
- 4.8.3 The design life of any crossing option for the Lower Thames Crossing is 120 years, with use potentially being for longer, therefore in accordance with the NPSNN the UK Climate Projections should be used, meaning the predicted rise in sea levels of 0.6m should be accounted for within the design specification of any crossing option.
- 4.8.4 It is also a requirement to demonstrate that “there are no critical features of the design of new national networks infrastructure which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK climate projections.⁴ (NPSNN). In addition, if any adaptation measures of the scheme give rise to consequential impacts, then consideration of the impacts should be assessed using specialist guidance set out in the NPSNN (e.g. flooding, water resources, biodiversity, landscape and coastal change)..

³ Based upon UK Climate Projections for London. The expected sea level rise due to climate change at the two Option Locations is to be defined.

⁴ National Policy Statement for National Networks 2015

5 Planning Policy

- 5.1.1 This section describes the policy context for a new crossing, looking at European, national, regional and local planning and transport policy. Successive governments have recognised that London and the South East are critical to the UK's future growth prospects and identified the Thames Gateway as a national priority. Traffic problems at the existing crossing and the need for improvements have been recognised, and the need for a new crossing was included in the National Infrastructure Plan 2014.
- 5.1.2 The NPSNN recognises the critical need to improve the national networks to address road congestion, to facilitate safe and reliable journeys, and to provide a transport network that is capable of stimulating and supporting economic growth. It also identifies an equally important need to ensure improvements have minimal impact on the environment, are well designed and improve safety. This policy statement sets out the basis upon which the Secretary of State for Transport will make decisions on applications for development consent for nationally significant infrastructure projects.

European Policy

- 5.1.3 The *Roadmap to a single European transport area - Towards a competitive and Resource Efficient transport system* supports the growth in transport through the provision of modern infrastructure, smart pricing and funding, whilst meeting the 60% emission reduction targets.
- 5.1.4 A key aim of the proposed Lower Thames Crossing is reducing congestion at one of the busiest parts of the national transport system and through the increased capacity across the Lower Thames to reduce traffic congestion and delay.
- 5.1.5 The *Trans-European transport network* (TEN-T) guidelines identify core network corridors as the primary focus of European funding as part of an EU development strategy until 2030. Nine core network corridors have been defined across Member States covering the full range of transport modes. This includes the existing Dartford Crossing.

Habitats Regulations

- 5.1.6 The Thames Estuary and Marshes SPA and Ramsar sites as well as other European designated sites lie within the option study areas. The *Habitats Directive* 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna provides legal protection for habitats and species of European importance. The Directive is transposed into UK law by the *Conservation of Habitats and Species Regulations* 2010, as amended (hereafter referred to as the 'Habitats Regulations'). Regulation 61 of the *Habitats Regulations* requires the competent authority, before deciding to give consent for a plan or project which:
- Is likely to have a significant effect on a European site (either alone or in combination with other plans or projects)
 - Is not directly connected with or necessary to the management of that site,

to make an 'Appropriate Assessment' of the implications for that site in view of its conservation objectives.

5.1.7 Where impacts are unavoidable derogation (variation) procedures exist which allow projects to proceed under the following specific circumstances:

- That no feasible, less-damaging alternative solutions exist.
- That there are Imperative Reasons of Overriding Public Interest (IROPI) for the proposal to go ahead.
- That adequate and timely compensatory measures will be put in place to ensure the overall coherence of the network of protected sites is maintained.

5.1.8 In the light of the conclusions of the assessment, the competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European Site; for the purposes of this scheme the competent authority would be the Secretary of State for Transport.

Air Quality Directive

5.1.9 During April 2015 a Supreme Court judgement on air quality was issued relating to the failure by the United Kingdom since 2010 to secure compliance with the limits for nitrogen dioxide levels set by European law, under the *Ambient Air Quality Directive 2008/50/EC* on ambient air quality and cleaner air for Europe. The UK has been divided into 43 air quality zones or agglomerations and within 40 out of the 43 zones, acceptable levels of nitrogen dioxide are being exceeded. There are no compliant zones in the south east. Defra has updated the air quality modelling and action plans, which have recently been submitted to the European Commission.

Water Framework Directive

5.1.10 In October 2000 the *Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy* (WFD) was adopted and came into force in December 2000. The purpose of the Directive is to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater. Under this Directive, the River Thames is designated as a heavily modified water body and is considered to have moderate ecological potential. The main potentially significant impact as a result of a future river crossing would be changes to the physical form and process of the River Thames.

National Policy

National Infrastructure Plan (2014)

5.1.11 The HM Treasury *National Infrastructure Plan (2014)* states the Government's aim to create a national network fit for the 21st century. In support of its objectives for the roads sector, the Lower Thames Crossing is included within the Government's Top 40 priority infrastructure investments. The plan highlights the expected increase in travel on the SRN and notes

that without the required level of investment, this is likely to have a significant impact on levels of congestion.

National Policy Statement for National Networks (NPSNN)

- 5.1.12 The NPSNN provides planning guidance for promoters of Nationally Significant Infrastructure Projects (NSIPs) on the road and rail networks and sets out the policy basis for the examination by the Examining Authority and decisions by the Secretary of State.
- 5.1.13 The NPSNN recognises the significant role to be played by the national road network in supporting economic growth, highlighting that the pressure on the network is expected to increase. The need for development on the national networks to support national and local economic growth and regeneration, particularly within the most disadvantaged areas is also recognised. For these reasons the NPSNN advises that the Government has concluded that at a strategic level, there is a compelling need for development of the national road networks.
- 5.1.14 The NPSNN highlights the impact of traffic congestion on the economy and that the forecast pressures on the road network are likely to be greatest in and around areas of high population density and along key inter-urban corridors.
- 5.1.15 The NPSNN sets-out the Government's wider policies for national networks, particularly in the delivery of environmental and social benefits. It also sets out the assessment principles and general policies against which applications relating to national networks infrastructure will be determined and details a range of generic impacts relevant to any national network infrastructure and describes how these impacts should be considered by applicants.

The NPSNN will play an important role in informing the development of the Lower Thames Crossing scheme to ensure that all relevant issues are considered in its development, design and assessment. As the primary factor on which development consent decisions are based, the NPSNN references the compelling need for the development of the national road network, although the assessment of the Scheme in support of the DCO application will need to demonstrate its compliance with the policy.

Action for Roads: A network for the 21st century (DfT, 2013)

- 5.1.16 The Department for Transport 'Action for Roads: A network for the 21st century' (2013) maintains that well-connected road infrastructure with sufficient capacity is vital for economic success, although advises the latest estimates show that traffic levels on strategic roads will be 24% higher in 2040 than today. The document goes on to say that without investment, conditions on the most important routes will worsen by then, with around 15% of the entire SRN experiencing regular peak-time congestion.

Road Investment Strategy

- 5.1.17 The DfT's first 'Road Investment Strategy' (RIS) (2014) sets out the Department's longer term investment and planning, outlining how it will invest in the SRN between 2015/ 16 and 2020/ 21. The RIS underlines the importance of the SRN to British businesses and the successful functioning

of the economy, though it also acknowledges that capacity has become a major issue in recent years, with parts of the network becoming increasingly congested.

- 5.1.18 In response, Highways England has published its first '*Strategic Business Plan 2015-2020*' setting out how the newly established company will deliver the performance requirements set by the Government and progress delivery of the Investment Strategy in line with the timescales proposed. The Business Plan states its '*support for regional and local growth by addressing a number of specific bottlenecks and heavily congested routes across the country.*' This includes consulting '*the public on options for a much needed further Lower Thames Crossing in early 2016, which subject to the necessary planning consents and funding mechanisms, will start construction by 2021.*'

DfT Business Plan 2012-2015

- 5.1.19 The Department for Transport's '*Business Plan 2012-2015*' (2012) identified seven priorities, including a need to '*invest in the strategic road network to promote growth and address the congestion that affects people and businesses, and continue to improve road safety.*' The Plan set out the key actions that the Department would take, including '*an appraisal of options for significant new investment in additional capacity for crossing the Lower Thames, and set out the way forward.*'

House of Commons Transport Committee "Strategic River Crossings"

- 5.1.20 The House of Commons Transport Committee '*Strategic river crossings*' Tenth Report of Session 2014-15 (March 2015) highlights the extent of traffic delays on the existing crossing, noting also the continuing delays in providing a new crossing. The Report raises concerns over the little progress that has been made on delivering a new river crossing in the Lower Thames during the last Parliament and concludes by stating that, '*over the next (current) Parliament important decisions will be made on where to locate new river crossings in east London and the Lower Thames.*'

The Strategic Road Network and the Delivery of Sustainable Development (DfT, 2013)

- 5.1.21 The DfT published '*The Strategic Road Network and the Delivery of Sustainable Development*,' (2013) in which it advises that the Highways Agency '*will work with strategic delivery bodies to identify infrastructure and access needs at the earliest possible opportunity in order to assess suitability, viability and deliverability of such proposals, including the identification of potential funding arrangements.*' Highways England has continued to take a proactive role in its engagement with strategic delivery bodies and local authorities to ensure that the capacity enhancements and infrastructure requirements are built-in to the scheme development at the earliest opportunity.

National Planning Policy Framework (NPPF), Department for Communities and Local Government (2012)

- 5.1.22 The NPPF, Department for Communities and Local Government (2012), sets out the Government's planning policies for England. The strategic aims of the NPPF and the NPSNN are consistent. The NPPF is likely to be an important and relevant consideration in decisions on NSIPs. However, the NPPF is not intended to contain specific policies for NSIPs as the NPSNN provides this function and transport policy which guides individual development brought under it.

Regional Policy

- 5.1.23 The South East Local Economic Partnership (SE LEP) published the '*Growth Deal an Economic Plan 2014.*' This seeks directly to obtain governmental funding for the Lower Thames Crossing, along with funding for improvements, including the A13 in Thurrock and Essex to serve the new deep sea container port at London Gateway through Thurrock. The SE LEP recognises that these national network improvements are fundamental to the future prosperity of the SE LEP area and the nation as a whole.

Local Planning and Transport Policy

- 5.1.24 Whilst the planning policy framework for the Lower Thames Crossing NSIP is set out in the NPSNN, the local planning and transport framework is of relevance to the consideration of such projects. This is principally achieved through the Local Impact Reports and any other representations that local planning authorities may wish to make to the Secretary of State. The local planning context will also be of relevance in the event that local planning authorities seek to agree Statements of Common Ground with the applicant.
- 5.1.25 Following approval of the DCO application, local planning authorities will be the decision makers for any elements of development associated with or ancillary to the NSIP development, to be dealt with under their powers as local planning authorities. Any such development will be considered by the local planning authorities against relevant national and local planning policy.
- 5.1.26 Relevant local planning and transport policy is summarised in **Table 5.1** below.

TABLE 5.1 - SUMMARY OF LOCAL PLANNING AND TRANSPORT POLICY

Essex County Council (Locations A and C)
<i>Transport Strategy</i> (2011) key aims are connectivity for Essex communities, international gateways, reducing carbon dioxide emissions and improving air quality.
Kent County Council (Locations A and C)
<i>Strategic Policy Statement</i> (2014-2015) seeks funds for infrastructure and economy. <i>Transport Delivery Plan for Kent</i> (2010) recognises transport network capacity to accommodate Thames Gateway, Ashford growth area and Dover and Maidstone growth points. <i>Kent and Medway Structure Plan</i> (2006) seeks Government support for LTC and protection of Marine Conservation Zone.

<p>Greater London Authority (Locations A and C)</p> <p>Adopted <i>London Local Plan</i> (January 2015) seeks resources for optimum development of growth areas and corridors and improve and expand London's international and national transport links. Development should not encroach within green belt.</p>
<p>Brentwood Borough Council (Location C)</p> <p><i>Corporate Plan</i> (2014-2016) promotes economic growth, sustainable development and infrastructure delivery. <i>Replacement Local Plan</i> (2005) provides guidance on development in green belt, safeguarding of woodlands and listed buildings.</p>
<p>Dartford Borough Council (Location A)</p> <p><i>Corporate Plan</i> (2013-2016) seeks long term solution to Dartford crossing. Kent Thameside Strategic Transport Programme includes investment package for local infrastructure schemes in Dartford. <i>Core Strategy</i> (2026) seeks protection and enhancement of green belt.</p>
<p>Gravesham Borough Council (Locations A and C)</p> <p><i>Corporate Business Plan</i> (2011-15) sets out commitment for high quality transport infrastructure. <i>Adopted Core Strategy</i> (2014) highlights importance of Dartford Crossing as one of UK's most important strategic connections. Policy guidance on green belt, Kent Downs AONB, heritage assets and sites designated for biodiversity value.</p>
<p>Havering Borough Council (Location C)</p> <p><i>Corporate Plan</i> (2014 -2015) supports infrastructure and transport links to London and surrounding areas. <i>Local Implementation Plan</i> (2007) highlights improved transport connectivity for key regeneration areas. <i>Adopted Core Strategy and Development Control Policies Development Plan</i> (2008) policies on green belt, biodiversity and buildings of special architectural or historic importance.</p>
<p>Medway Council (Location C)</p> <p><i>Medway Council Plan</i> (2014 - 2015) seeks to secure a local transport network to support regeneration, economic competitiveness and growth. LTC is seen as enabling this planned growth. <i>Local Plan</i> (2003) provides guidance on green belt and Kent Downs AONB.</p>
<p>Thurrock Borough Council (Locations A and C)</p> <p><i>Corporate Plan and Medium Term Financial Strategy</i> (2013 – 2016) aims to lobby for key infrastructure improvements including free-flowing tolls at Dartford Crossing. <i>Adopted Core Strategy and Policies for Management of Development</i> (2011) provides guidance on listed buildings and scheduled monuments and green belt. <i>Transport Strategy</i> (2013-2026) aims to improve air quality.</p>
<p>London Borough of Bexley (Location A)</p> <p><i>Adopted Core Strategy</i> (2012) is supportive of major new infrastructure proposals. <i>Local Implementation Plan</i> (2014/15-2016/17) seeks development of improved transport systems to support regeneration and economic development.</p>

6 Existing Land Use

6.1.1 This section provides a summary of the key land use features of Locations A and C that need to be considered when developing routes. The constraints have been taken into account in formulating the options and will continue to be relevant at the next development phase of the scheme.

Location A

6.1.2 Dartford is the principal settlement south of the River Thames, which lies within the Dartford Borough Council jurisdiction, within Kent County Council. The settlements of Swanscombe to the east, Crayford to the west and Darenth to the south surround Location A.

6.1.3 The predominant land use includes concentrated industrial and residential areas interspersed with existing road and rail infrastructure, including the M25, A282 and A206. The Littlebrook Power Station, Longreach Sewage Treatment Works, Bluewater Shopping Centre and Darenth Valley Hospital are located in close proximity to the existing highway. Fuel storage depots and related large tanks are located along the southern bank of the River Thames.

6.1.4 The River Thames is currently crossed by the QEII Bridge and the existing Dartford Crossing tunnels between Purfleet and Dartford. This area is heavily modified by the present and historic industrial and transport infrastructure. Located within the river channel are numerous piers and jetties that contribute to the surrounding industrial uses and freight terminals.

6.1.5 To the north of the River Thames, the route passes through Thurrock Unitary Authority. The settlements of Grays to the east and Purfleet to the west surround the option corridor.

6.1.6 In continuation of the land use south of the river, the area is heavily developed for industrial, retail and residential land uses. Key features include Thurrock Services, Lakeside Shopping Centre and a large oil storage depot at Grays. Hanson UK is located adjacent to the existing highway on the northern bank of the River Thames. Lafarge quarry is located to the east of the study area within a large chalk pit.

6.1.7 Major transport infrastructure is present throughout the area including the existing M25, A282 QEII Bridge and tunnel, High Speed 1 (HS1) railway line and the A13 arterial route.

Location C

6.1.8 The southern bank of the River Thames is wholly located within the county of Kent. The area is generally open countryside with scattered urban settlements, particularly Gravesend to the west and Rochester to the east.

6.1.9 The predominant land use is agricultural, associated infrastructure and local roads are present throughout the option corridor. The HS1 railway line runs close to the southern boundary of Location C providing important transport links. The Thames and Medway Canal is also in close proximity, although this is currently disused but proposed to be reinstated for recreation. Along the southern bank of the River Thames are internationally important wildlife

sites, including Thames Estuary and Marshes Ramsar site, SPA and SSSI. The Milton Rifle Range is also located in close proximity to the River Thames and is an area of open grassland and buried structures for use by the Metropolitan Police.

- 6.1.10 The characteristics of the Thames Estuary are predominantly intertidal mudflats, supporting large and internationally important populations of birds. The area is scattered with many small watercourses, drainage ditches and historic features.
- 6.1.11 The scheme area north of the Thames Estuary is within the unitary authority of Thurrock and the Essex County boundary. The topography along the edge of the River Thames includes the location of further mudflats, moving into agricultural land and settlements further north. The area is relatively flat with extensive drainage ditches and watercourses throughout.
- 6.1.12 The area is characterised by large areas of open countryside interspersed with the urban developments of West Thurrock, Grays, Chadwell St Mary, Tilbury and South Ockendon. Industrial assets include Tilbury power station, Tilbury docks and Tilbury sewage treatment works which are present along the immediate northern bank of the River Thames. Further north, the area returns to open countryside with many cultural heritage assets and historic landscapes/ townscapes, especially around East Tilbury. The scheme area is intersected by several arterial commuter roads connecting Essex and environs with London, notably the A13, A1089 and the A127.

Community Land Use

- 6.1.13 Land used by the community is shown in **Appendix 2.12**, Community Land Use Constraints. The area includes golf courses, woodland walks, country parks including Shorne Woods, Thorndon and Belhus Woods, recreation grounds, hospitals, schools and associated playing fields and places of worship.

7 Socio-Economic Analysis

7.1 Introduction

7.1.1 This section provides a high level overview of national and regional economic trends, and the socio-economic characteristics of the local area affected by LTC (the study area for socio-economic analysis). This study area covers two counties (Kent and Essex) and three unitary authorities (Medway, Thurrock and Southend-on-Sea). The purpose of the section is to provide socio-economic context to the appraisal of LTC and it is based on an analysis of socio-economic indicators, the growth of industrial clusters and policy developments. This analysis was carried out in response to a recommendation in a 2014 independent academic report to the DfT that appraisals should include information about local economic conditions.⁵ The findings of the analysis were used to inform the LTC appraisal of wider economic and social impacts. The analysis also informed the supporting narrative for the complementary Spatial Computable General Equilibrium (S-CGE) economic modelling of LTC options.

7.2 National Economic Trends

- 7.2.1 The repercussions of the recent recession play a large part in the formation of current national economic trends. Gross Value Added (GVA), earnings and the employment rate are recovering to pre-recession levels, and the composition of employment by sector has changed.⁶ People have also become more educated, possibly as an effect of a period with decreased employment prospects.
- 7.2.2 Since 2009, annual growth in GVA per head (productivity) at the national level has fallen to approximately 2.5% per annum from 5% in the 2003-2008 period.⁷ The health and education sectors have seen the largest GVA growth (by industry) since 2008, though this is tapering off; real estate and retail have recently recovered rapidly, though it remains to be seen if this will continue. Transportation, financial services and public administration have continued to decline.⁸
- 7.2.3 The employment rate has recovered from a low of 70.1% in 2010-11 to 71.9% in 2013-14, though this does not yet match the steady 72.5% average of the last five pre-recession years.⁹ Earnings have remained somewhat static since 2008, with an average increase of 1% per annum at the national level.¹⁰ This represents an increase from median per capita pay of £479.10 per week in 2008 to £518.40 in 2014.

⁵ Venables A, Laird J, Overman H (2014) Department of Transport, Transport investment and economic performance, implications for project appraisal <https://www.gov.uk/government/publications/transport-investment-and-economic-performance-tiep-report>

⁶ GVA is a measure of the contribution to the UK economy of each individual producer, industry or sector.

⁷ 2012 estimate, ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables

⁸ Refer to footnote 7

⁹ ONS, 2014, Annual Population Survey

¹⁰ 2013-2014 estimate, ONS (accessed 2015) Annual Survey of Hours and Earnings

- 7.2.4 Changes in employment share across sectors are relatively small compared to the changes that have occurred in individual regions of the country. Over a seven-year period, the most notable declines in overall employment share have been in the construction and public administration and defence sectors, which have both reduced by 0.7%.¹¹ Conversely, the professional, scientific and technical, business administration and support, and health sectors have seen increases in employment share of approximately 0.7% each. It is of interest that the construction sector in many of the non-London LTC districts has remained strong and even grown in this period.¹²
- 7.2.5 Education levels have increased sharply since the beginning of the recession, with over 7% more people possessing at least NVQ1 level qualifications at the national level since 2008.¹³ In particular, 73.1% of the population aged 16-64 have attained NVQ3+ degrees, an increase of 8.9% from the 2008 level, 56.5% of the working age population possess NVQ3+ degrees, an increase of 8.1% from the 2008 level and 35.8% now have NVQ4+ degrees, up from 28.5% in 2008.¹⁴

7.3 Regional Economic Trends

- 7.3.1 The study area stretches across three regions: London, South East and East of England. At the regional level, key economic indicators show all three regions are performing either above or close to the national average. For example they have the highest productivity in England. London is the highest-performing region in the country, outperforming the national productivity index by an average of 29% per year. The South East also outperforms the index, and is currently running slightly above its 9% average outperformance for the 2004-2012 period. The East of England trends closely to the national average, though it has declined slightly in recent years.¹⁵
- 7.3.2 Employment rates in the South East (75.8%) and East of England (75.7%) are higher than the national average (72.2%). The employment rate in London is slightly lower than average at 71.2%.¹⁶
- 7.3.3 Although London, South East and East of England are economically the most successful regions in the UK, there are pockets of deprivation within them, particularly in the unitary authorities of Thurrock and Medway. This is explored in more detail in the local level analysis.
- 7.3.4 There is significant interdependency between the regions. In particular working age residents in Essex and Kent rely on commuting to London for higher value jobs than they could find in their local area.

¹¹ ONS (2015) Business Register and Employment Survey

¹² Refer to footnote 11

¹³ ONS (2014) Annual Population Survey

¹⁴ Refer to footnote 13

¹⁵ Based on analysis of ONS (2014) Nominal (smoothed) GVA per hour worked indices, 2004 – 2012

¹⁶ ONS (2014) Annual Population Survey

7.4 Local Economic Trends

Kent

- 7.4.1 A summary of the socio-economic indicators in Kent is given in **Table 7.1**. The GVA in Kent is £19,146 per annum, which is lower than the national average (£23,168 per annum), although this is skewed by the significantly higher value in Inner London at £69,660 per annum.¹⁷ Resident wages in Kent are above the UK average at £659 per week, whereas workplace earnings are lower than average at £576 per week.¹⁸
- 7.4.2 Kent's industrial structure is relatively similar to that in Essex, with transport distribution, real estate and public administration having the largest share of GVA in the county. Transport distribution and logistics is a key cluster based on employment quotient and business count data.
- 7.4.3 Studies and policy on Kent and Medway are often combined as Medway was historically part of Kent until it became a unitary authority in the 1990s. Their employment and housing targets are also combined. Estimates for the employment and housing targets vary between those provided by the South East Local Enterprise Partnerships and the Kent and Medway Economic Partnership (KMEP). The more conservative estimates published by KMEP are presented here. A total of 47,500 new jobs are projected for Kent and Medway combined from 2013 to 2020 with 23,000 new homes built during the same period. Key sector opportunities in Kent identified by the South East Local Enterprise Partnership are in manufacturing, tourism and leisure, and construction. The focus for economic policy in the coming years will be overcoming the key challenges of skill shortages and poor access to the labour market.¹⁹

TABLE 7.1 - SOCIO-ECONOMIC INDICATORS - KENT

Key indicators	Kent	UK	Source
Working Age Population (2013-14)	896,200	40,343,800	ONS (2014) Annual Population Survey (APS)
GVA per Head (2012)	£19,146	£23,168	ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables
Employment & rate (2013-14)	659,300 (73.6%)	29,021,600 (72.9%)	ONS (2014) APS
Average resident skills level (2011)	22% with Level 4 or above qualifications	27% with Level 4 or above qualifications	ONS 2011 Census
Average resident weekly earnings (2014)	£659	£620	ONS (2014) Annual Survey of Hours and Earnings

¹⁷ ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables

¹⁸ 2013-2014 estimate, ONS (accessed 2015) Annual Survey of Hours and Earnings (resident & workplace)

¹⁹ South East Local Enterprise Partnership (2014) Kent and Medway Growth Deal

Key indicators	Kent	UK	Source
Average workplace weekly earnings (2014)	£576	£620	ONS (2014) Annual Survey of Hours and Earnings
Proportion of Lower Super Output Areas in the top 20 most deprived in the UK (2010) ²⁰	11%		Communities & Local Government (2010) Indices of Multiple Deprivation
Key industrial clusters	Transport distribution and logistics		CH2M analysis of ONS (2014) APS
Employment policy target	47,500 new jobs combined for Kent and Medway (2013-2020)		Kent and Medway Economic Partnership (draft 2013) Unlocking the Potential: Going Forward
Housing policy target	23,000 new homes combined for and Medway (2013-2020) Medway target is 17,930 (by 2028)		Kent and Medway Economic Partnership (draft 2013) Unlocking the Potential: Going Forward

Essex

- 7.4.8 A summary of the socio-economic indicators in Essex is given in **Table 7.2**. There is a notable difference between the resident based population and the workplace population in Essex. Local residents enjoy above average weekly incomes of £692 compared to the UK average of £620, ²¹ possibly due to high levels of commuting to London and a higher than national average employment rate at 73.9% in 2013 compared to the UK average of 72.9%.²² In comparison local workplace based workers have lower than average incomes. The GVA per head of the workplace population is lower than average at £19,237 per annum in 2014 compared to the national average of £23,168 per annum.²³ The demographics paint a picture of a county that has varied wealth with a dependency on commuting to London for higher value jobs.
- 7.4.9 Despite income levels being higher than the national average, education levels of the resident based population are lower than average with just 23% achieving Level 4 or above compared to 27% nationally. (Level 4 equates to a Certificate of Higher Education, Key Skills Level 4, NVQ Level 4, BTEC Professional award, certificate and diploma Level 4, and HNC).
- 7.4.10 Key industries in the county include distribution transport and logistics, construction and real estate, all of which have a higher share of local GVA than the national average. The industry cluster quotient analysis based on employment shares relative to the national average and business counts

²⁰ Lower Super Output Areas are areas, defined by the Office for National Statistics that are used to produce local area statistics for populations of between 1,000 and 3,000 people.

²¹ 2013-2014 estimate, ONS (accessed 2015) Annual Survey of Hours and Earnings (resident & workplace)

²² ONS (accessed 2015) Annual Population Survey (resident based)

²³ 2012 estimate, ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables

supports the GVA analysis, indicating that there are clusters of activity in distribution transport and logistics, manufacturing and construction. When industry size is measured by the total number of employees rather than employment share, the sector breakdown looks more similar to the national average, with health, education and retail acting as the largest employment sectors. Priority areas for future local government support are advanced manufacturing, logistics, life sciences and healthcare, low carbon and renewables and creative industries.²⁴

7.4.11 Based on the comparison of socio economic indicators in this section, it can be concluded that the overall level of deprivation is low in Essex compared to the rest of the study area.

TABLE 7.2 - SOCIO-ECONOMIC INDICATORS - ESSEX

Key indicators	Essex	UK	Source
Working Age Population (2013-14)	900,700	40,343,800	ONS (2014) Annual Population Survey (APS)
GVA per Head (2012)	£19,237	£23,168	ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables
Employment & rate (2013-14)	666,000 (73.9%)	29,021,600 (72.9%)	ONS (2014) APS
Average resident skills level (2011)	23% with Level 4 or above qualifications	27% with Level 4 or above qualifications	ONS 2011 Census
Average resident weekly earnings (2014)	£692	£620	ONS (2014) Annual Survey of Hours and Earnings
Average workplace weekly earnings (2014)	£593	£620	ONS (2014) Annual Survey of Hours and Earnings
Proportion of Lower Super Output Areas in the top 20 most deprived in the UK (2010)	6.0%		Communities & Local Government (2010) Indices of Multiple Deprivation
Key industrial clusters	Distribution, logistics and transport; Manufacturing; Construction		CH2M analysis of ONS (2014) APS
Employment policy target	42,000 new jobs (2014- 2021)		Essex CC (2012) Essex Economic Growth Strategy
Housing policy target	No formal housing targets at county level		

²⁴ Essex County Council (2012) Strategic Economic Plan

Medway

- 7.4.17 Medway is a unitary authority south of the Thames which was originally part of the County of Kent. A summary of the socio-economic indicators is given in **Table 7.3**. In contrast to Essex, Thurrock and Kent, workplace earnings at £653.7 per week are higher than the national average although resident earnings at £609.3 per week are close to the UK average.²⁵ However Medway, like Thurrock, has experienced a large (6%) drop in productivity from 2004 to 2012 (compared to 8% in Thurrock). This is in part due to the recession, and partly due to the gradual decline of manufacturing upon which Medway and Thurrock have depended. In Medway 14% of its Lower Super Output Areas (LSOAs) are in the top 20 most deprived in the country and just 19% of the resident population are educated to level 4 or above. Medway is still struggling to recover from the recession with unemployment at 10% in 2013-14 which is much higher than the rest of the study area which ranges between 6% in Kent to 7.6% in Thurrock.²⁶
- 7.4.18 In terms of industrial make up, Medway has a larger than average share of GVA in the transport and distribution, production and public administration education and health sectors. The cluster analysis identified that transport and distribution is a key cluster for Medway with both a high employment location quotient and high business counts.
- 7.4.19 Targets for employment and housing are combined with Kent. Across the area there is a housing shortage which is not being met by construction of new homes. High infrastructure costs for roads and utilities has been identified as an issue impacting on viability of housing growth.²⁷

TABLE 7.3 - SOCIO-ECONOMIC INDICATORS - MEDWAY

Key indicators	Medway	UK	Source
Working Age Population (2013-14)	167,300	40,343,800	ONS (2014) Annual Population Survey (APS)
GVA per Head (2012)	£18,616	£23,168	ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables
Employment & rate (2013-14)	116,500 (69.6%)	29,021,600 (72.9%)	ONS (2014) APS
Average resident skills level (2011)	19% with Level 4 or above qualifications	27% with Level 4 or above qualifications	ONS 2011 Census
Average resident weekly earnings (2014)	£609	£620	ONS (2014) Annual Survey of Hours and Earnings

²⁵ 2013-2014 estimate, ONS (accessed 2015) Annual Survey of Hours and Earnings (resident & workplace)

²⁶ 2013-2014 estimate, ONS (accessed 2015) Annual Population Survey

²⁷ Kent and Medway Economic Partnership (draft 2013) Unlocking the Potential: Going for Growth Kent and Medway's Growth Plan: Opportunities, Challenges and Solutions

Average workplace weekly earnings (2014)	£654	£620	ONS (2014) Annual Survey of Hours and Earnings
Proportion of Lower Super Output Areas in the top 20 most deprived in the UK (2010)	14%		Communities & Local Government (2010) Indices of Multiple Deprivation
Key industrial clusters	Transport distribution and logistics		CH2M analysis of ONS (2014) APS
Employment policy target	47,500 new jobs combined for Kent and Medway (2013-2020)		Kent and Medway Economic Partnership (draft 2013) Unlocking the Potential: Going Forward
Housing policy target	23,000 new homes combined for Kent and Medway (2013-2020)		Kent and Medway Economic Partnership (draft 2013) Unlocking the Potential: Going Forward

Thurrock

- 7.4.25 Thurrock is a unitary authority situated between Essex and London on the north bank of the Thames Estuary and is part of the wider Thames Gateway South Essex development area. A summary of the socio-economic indicators is provided in **Table 7.4**. It has a lower than average GVA per head at £16,240 compared to both Essex and the national average.²⁸ It also has lower than average resident and workplace wages, with workplace wages almost 25% lower than the national average.²⁹ There are pockets of significant deprivation with 12.6% of its LSOAs in the top 20 most deprived in the UK (more than double than Essex).³⁰ It also experienced an 8% drop in productivity between 2004 and 2012.³¹
- 7.4.26 The largest industries in Thurrock by share of GVA are distribution, transportation, accommodation and food, manufacturing, and public administration. The cluster analysis using employment share also identifies transport distribution and logistics as a key cluster as well as retail and wholesale. Manufacturing, a former key employer, has declined by almost 10% over the last 15 years. In its place, employment in the retail and the motor trade has grown, though at slower rates than the decline in manufacturing. In particular, Lakeside Shopping Centre provides a high proportion of all of Thurrock's retail employment.
- 7.4.27 The local authority plan to support employment and business growth in key sectors particularly storage, freight transport and logistics, construction, and retail. It aims to support the creation of 26,000 new jobs between 2001 and 2026. Key Strategic Economic Hubs and other sites will supply approximately 456 gross hectares (Ha) of employment land, including

²⁸ 2012 estimate, ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables

²⁹ 2013-2014 estimate, ONS (accessed 2015) Annual Survey of Hours and Earnings (resident & workplace)

³⁰ Communities & Local Government (2010) Indices of Multiple Deprivation

³¹ 2012 estimate, ONS (2014) Subregional Productivity

around 245 Ha at the London Gateway development site.³² The Port of Tilbury is a key centre for logistics and distribution employment, with an additional 1,500 jobs expected to be created in the coming decade due to planned expansions.

TABLE 7.4 - SOCIO-ECONOMIC INDICATORS - THURROCK

Key indicators	Thurrock	UK	Source
Working Age Population (2013-14)	106,200	40,343,800	ONS (2014) Annual Population Survey (APS)
GVA per Head (2012)	£16,240	£23,168	ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables
Employment & rate (2013-14)	79,300 (73.3%)	29,021,600 (72.9%)	ONS (2014) APS
Average resident skills level (2011)	17% with Level 4 or above qualifications	27% with Level 4 or above qualifications	ONS 2011 Census
Average resident weekly earnings (2014)	£607	£620	ONS (2014) Annual Survey of Hours and Earnings
Average workplace weekly earnings (2014)	£539	£620	ONS (2014) Annual Survey of Hours and Earnings
Proportion of Lower Super Output Areas in the top 20 most deprived in the UK (2010)	12.6%		Communities & Local Government (2010) Indices of Multiple Deprivation
Key industrial clusters	Transportation, Distribution and Logistics; Retail and Wholesale		CH2M analysis of ONS (2014) APS
Employment policy target	26,000 (2001-2026) ³³		Thurrock Borough Council (Proposed draft submission, May 2013) Thurrock Core Strategy Local Plan - Focused Review: consistency with National Planning Policy Framework
Housing policy target	18,500 (2006-2021)		See above

Southend-on-Sea

7.4.28 Southend-on-Sea is a unitary authority which has a similar level of economic wealth to Thurrock, but has a different industrial structure and greater inequality. A summary of the socio-economic indicators is given in **Table 7.5**. Workplace GVA per head at £16,276 per annum is lower than the national

³² Thurrock Borough Council (Proposed draft submission, May 2013) Thurrock Core Strategy Local Plan - Focused Review: consistency with National Planning Policy Framework

average and is similar to that in Thurrock.³⁴ The productivity index at 90.1 is the lowest in the study area and is much lower than the national level of 100.³⁵ 21% of Southend on Sea's LSOAs are in the top 20% most deprived in the country indicating that there are large pockets of deprivation.³⁶ Average workplace weekly earnings at £537.5³⁷ are well below the national average and the employment rate is also below average. However average resident based weekly earnings of £639.9 are well above the national average.³⁸ With workplace earnings more than £100 a week lower than resident earnings, it is likely that many residents are commuting out of the area to find higher value earning jobs.

7.4.29 The largest industrial sectors in terms of GVA are public administration, distribution and transport and real estate, accommodation and food. In terms of industry clusters, food and beverages and retail have higher shares of employment in Southend on Sea than the national average as well as high business counts. The management and health sectors also have high employment quotients, but this is not reflected in the business count data.

7.4.30 Local targets for employment and housing growth are based on former South East Regional Development Agency targets for the area which were 13,000 new jobs and 6,500 new homes from 2001 to 2021. The Core Strategy identifies the issue of a lack of transport infrastructure which is restricting the potential for the unitary authority and wider Thames Gateway area to develop and reach planned economic targets.³⁹

TABLE 7.5 - SOCIO-ECONOMIC INDICATORS - SOUTHEND-ON-SEA

Key indicators	Southend on Sea	UK	Source
Working Age Population (2013-14)	104,100	40,343,800	ONS (2014) Annual Population Survey (APS)
GVA per Head (2012)	£16,276	£23,168	ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables
Employment & rate (2013-14)	73,600 (70.7%)	29,021,600 (72.9%)	ONS (2014) APS
Average resident skills level (2011)	22% with Level 4 or above qualifications	27% with Level 4 or above qualifications	ONS 2011 Census
Average resident weekly earnings (2014)	£640	£620	ONS (2014) Annual Survey of Hours and Earnings

³⁴ 2012 estimate, ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables

³⁵ 2012 estimate, ONS (2014) Subregional Productivity

³⁶ Based on Communities & Local Government (2010) Indices of Multiple Deprivation

³⁷ ONS (2014) Annual Survey of Hours and Earnings (resident & workplace)

³⁸ 2013-2014 estimate, ONS (accessed 2015) Annual Survey of Hours and Earnings (resident & workplace)

³⁹ Southend on Sea Borough Council (2007) Core Strategy

Key indicators	Southend on Sea	UK	Source
Average workplace weekly earnings (2014)	£538	£620	ONS (2014) Annual Survey of Hours and Earnings
Proportion of Lower Super Output Areas in the top 20 most deprived in the UK (2010)	21%		Communities & Local Government (2010) Indices of Multiple Deprivation
Key industrial clusters	Food and beverages, retail		CH2M analysis of ONS (2014) APS
Employment policy target	13,000 jobs (2001-2021)		Southend on Sea Borough Council (2007) Core Strategy
Housing policy target	6,500 homes (2001 to 2021)		Southend on Sea Borough Council (2007) Core Strategy

Summary of Findings

7.4.36 There are socio-economic differences across the study area. The unitary authorities of Medway, Thurrock and Southend on Sea perform worse, across most indicators, compared to the counties of Essex and Kent and the national average. Deprivation is relatively low in Essex and much of Kent compared to the rest of the study area though there are disparities within these counties with local workers worse off than the resident commuter population.

7.4.37 The study area has the following key socio-economic characteristics:

- i. High population growth across the study area except for Medway.
- ii. Demographic profile in Essex and Kent is family orientated, compared to a youthful London.
- iii. The study area is situated in the country's most economically active regions, but at the local level workplace GVA is lower than the national average.
- iv. Productivity of workers has been in decline in the study area. This is a nation-wide issue.
- v. Employment in the study area is higher or on par with the national average, except for Medway and Southend on Sea where it is lower than average.
- vi. Total employment is rising in most parts of the sub region, but the working age population is increasing more rapidly than new jobs.
- vii. The unemployment rate is higher in Thurrock and Medway than the national average. The rate is declining after a long period of high unemployment, except in Thurrock where it is still growing.
- viii. Workplace earnings are lower than the national average. Resident earnings however, are higher than the national average, implying a

- high dependency of the resident population on London for employment.
- ix. Lower than average education levels in the unitary authorities.
 - x. Occupational levels are lower than the national average in Essex, Kent and the unitary authorities. The growth of professional occupations has, however, been higher than the national average.
 - xi. Deprivation is relatively low in Essex and much of Kent compared to the rest of the study area.
 - xii. There are clusters of economic activity, particularly transport, distribution and logistics in Thurrock and Medway, but these are constrained by the lack of capacity at the existing Dartford Crossing. The study area has higher than average GVA in the distribution, transport accommodation and food sectors, and also in construction. GVA forecasts indicate producer services is forecast to grow the fastest and will outpace manufacturing except in Thurrock where manufacturing will maintain its largest share.
 - xiii. Structural changes to the local economy have significantly negatively impacted key traditional industries such as manufacturing with the service economy growing in its place. In the study area there has been a notable decline across the county and unitary authorities in manufacturing and a growth in the service sectors, including finance and business services.
 - xiv. Almost half of the districts have lower than average housing prices. Prices in Thurrock and Southend on Sea unitary authorities are lower than the national average. Across most of the study area properties are more affordable than the national average.

7.4.38 **Table 7.6** provides a summary of socio-economic indicators within the county and unitary authorities in the Study Area compared to London.

TABLE 7.6 - SUMMARY OF KEY ECONOMIC AND SOCIAL INDICATORS TO SHOW PERFORMANCE OF THE STUDY AREA COMPARED TO THE UK AVERAGE

Report Chapter	Indicator	Measure/Unit/Date	Essex	Thurrock	Southend	Kent	Medway	London	Source
Demographics	Working age population	Year on year % increase, 2004-14							ONS Annual Population Survey
	Workplace GVA per head	2013 (provisional)							ONS Regional GVA per head NUTS3
Economic Indicators	GVA per hour worked	Index, 2012							ONS Nominal GVA per Hour Worked NUTS3
	Employment Rate	% 2013-14							ONS Annual Population Survey
	Change in employment rate	% 2004-14							ONS Annual Population Survey
	Unemployment rate	% 2014							ONS Annual Population Survey
Labour Force	Education	NVQ2+, 2011							ONS 2011 Census
	Employment by occupation	% in professional occupations							ONS 2011 Census
Wealth & Deprivation	Workplace earnings	Median £ per week, 2014							ONS Annual Population Survey
	Resident earnings	Median £ per week, 2014							ONS Annual Survey of Hours and Earnings
	Deprivation	% most deprived LSOAs by area, 2010							ONS Annual Survey of Hours and Earnings
Business Demography	Growth rate of active enterprises	2012-13							Department for Communities and Local Government, 2010 Indices of Multiple Deprivation
	Growth rate of enterprise births	2012-13							ONS Business Demography
	Growth rate of enterprise deaths	2012-13							ONS Business Demography
	Business survival rates	2008-13							ONS Business Demography

Key		above the national average
		same as national average
		below the national average

8 Future Development and Economic Growth

- 8.1.1 There are significant development plans for new housing and employment in the area, as summarised in **Table 8.1**. Key strategic developments include London Gateway Port (DP World), Port of Tilbury, Ebbsfleet Garden City, Paramount London and Lakeside and Bluewater Shopping Centres. These developments will have a significant impact on future traffic growth in the area.
- 8.1.2 These developments will lead to an increase of around 120,000 new homes and 130,000 new jobs, which will have a significant impact on future traffic growth in the area. Section 4.3 of Volume 5 of the SAR describes future development proposals included in the different traffic growth scenarios of the traffic model. **Figure 8.1** shows the location of these developments.
- 8.1.3 Engagement with business stakeholders on the scheme has demonstrated a consistent demand for a new crossing from across industry. A business survey in October 2015 received over 800 responses from businesses of varying sizes and from a number of different sectors which showed a similar demand for a new crossing. The key findings showed:
- 87% felt there need to be changes to the Dartford Crossing
 - 73% considered that the traffic flow on the Dartford Crossing has an impact on business
 - 66% thought their business would grow if improvements were made to the crossing.
- 8.1.4 Typical examples of business stakeholder views are given in **Table 8.2**.

TABLE 8.1 - PLANNED DEVELOPMENTS AFFECTING TRAFFIC AT DARTFORD

Development	Details
London Gateway Port (DP World)	London Gateway Port is a development on the north bank of the River Thames in Thurrock. It comprises a new deep-water port, as well as one of Europe's largest logistics parks. Once fully operational, the port could handle around 3.5 million containers a year, with 6 deep water berths. 9 million ft ² of logistics park. 12,000 new jobs planned
Port of Tilbury	The port is a significant multi modal distribution centre covering 850 acres. Adjacent to the Port of Tilbury is the London Distribution Park (LDP), a 70-acre development of warehousing and haulage which is underway. 1,100 new jobs planned
Port of Dover	New development at Western Docks
RWE npower	Proposed redevelopment of the Tilbury and Littlebrook power station sites.
Ebbsfleet Garden City	New Development Corporation established in April 2015. 15,000 new homes planned
Local Authorities in the Area	Local authorities have increased demand for new homes through their objectively assessed needs and this has led to significant plans for housing development over the next 15 years across all local authorities in the area. High levels of

Development	Details
	development are likely to be planned for the following 15 year plan period.
Paramount London	London Paramount Entertainment Resort (Paramount London) is a proposed theme park and entertainment resort on the Swanscombe peninsula in Kent, which would become the UK's largest entertainment resort. It is a Nationally Significant Infrastructure Project and would lead to up to 40,000 visitors per day and up to 10,000 jobs.
Lakeside Shopping Centre	Lakeside opened in 1990 and is the eleventh largest shopping centre in the UK. Lakeside has plans to increase development by 33% with a further 2,600 jobs.
Bluewater Shopping Centre	Bluewater opened in 1999 and is the fourth-largest shopping centre in the UK. Bluewater has plans to increase development by 20% with a further 1,500 jobs

TABLE 8.2 - BUSINESS STAKEHOLDER VIEWS

Stakeholder	Views
The Confederation of British Industry (CBI)	CBI ranked the Lower Thames Crossing as one of the Top Ten London's future infrastructure needs in their CBI/ KPMG London Business Survey (October 2013)
Essex Chamber of Commerce	A crossing is most definitely needed. ECC welcomed the LTC scheme as important for connectivity and growth (July 2015)
Kent Invicta Chamber of Commerce	Without extra capacity the existing crossing will not cope and we will all suffer from lengthy delays. This comes at a cost and could hinder economic growth (January 2014)
London First	We want a new Lower Thames Crossing (March 2015)
October 2015 Business Survey comments	<ul style="list-style-type: none"> Routine rush hour delays is a loss to the country's efficiency. But what is worse are regular delays due to accidents and poor weather conditions which compounds the problem. The current crossing is an incredibly weak point in our transport system. Currently the crossing causes us so many problems as we cannot predict how long we will be held in traffic. We are almost prevented from being able to offer urgent services as we cannot guarantee response times. An additional crossing point is essential to Kent businesses. Disruption at The Dartford Crossing prevents me from taking any work located in Essex, as an entire day has to be allocated to make allowances for the crossing, especially northbound.

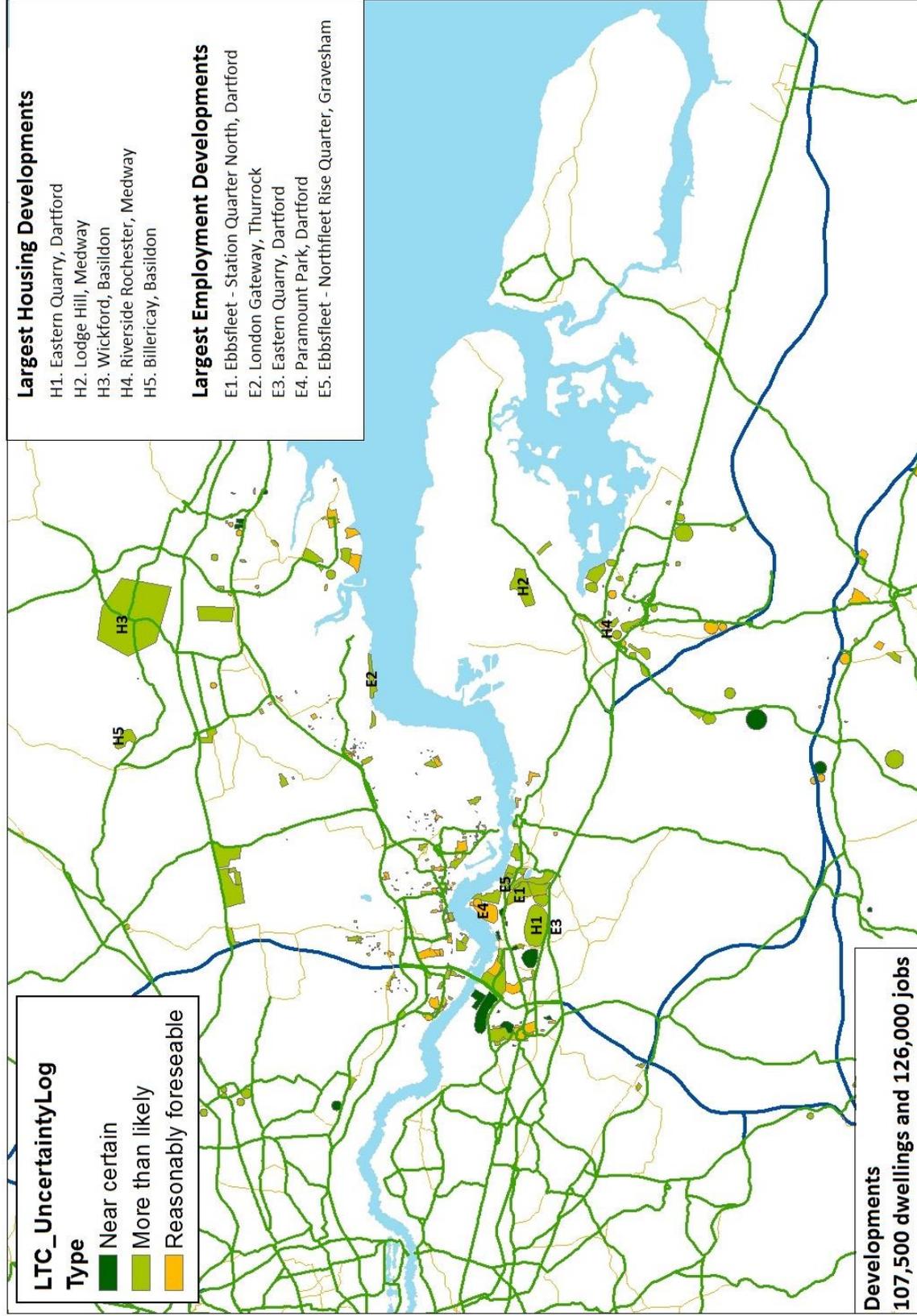


FIGURE 8.1 - FUTURE DEVELOPMENT FROM UNCERTAINTY LOG

9 Future Conditions at Dartford

9.1 Without Scheme Scenario

9.1.1 This section discusses the future conditions at Dartford crossing without any further improvements; this is described as the Without Scheme scenario.

9.2 Future Traffic Conditions

9.2.1 **Figure 9.1** shows the future predicted hourly traffic flows at Dartford Crossing on the northbound and southbound carriageways, for the AM Peak, PM Peak and Inter-peak periods, in 2025 and 2041.

9.2.2 The crossing will operate at capacity for more hours in the future, increasing congestion and the likelihood of incidents that will lead to greater unreliability. In 2025, the northbound crossing will be operating at capacity during the peaks and inter-peak, and southbound this will be the case by 2041.

9.2.3 Whilst providing some improvement in journey times, Dart Charge will not provide a long term solution to the congestion problems at Dartford. It will not provide a significant increase in crossing capacity, nor address the constraints both at the crossing and along the A282 corridor. The crossing is likely to have similar or worse traffic conditions in 2025 to those observed before Dart Charge was implemented.

9.2.4 The Annual Average Daily Traffic flow is forecast to reach around 159,000 vehicles per day in 2025 and 163,000 vehicles per day by 2041, compared to the existing base year flow (2009) of 140,000 vehicles.

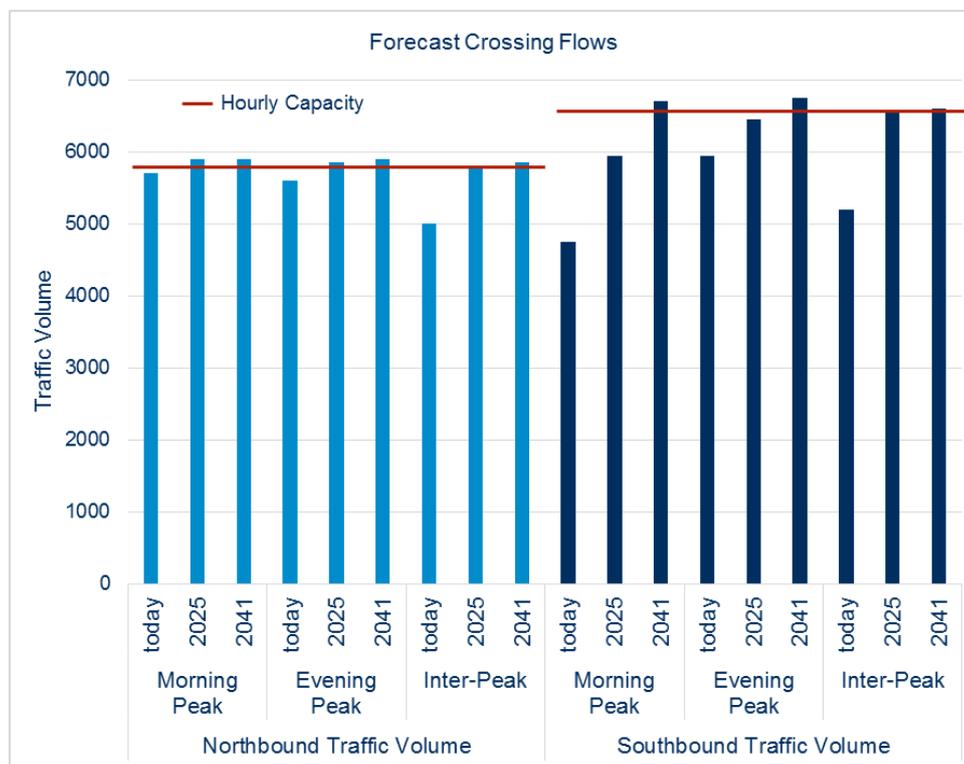


FIGURE 9.1 - FORECAST HOURLY TRAFFIC FLOWS

- 9.2.5 **Figure 9.2** shows how congestion at the crossing and the surrounding road network is predicted to increase in the future. The figure shows the volume/capacity ratios on the crossing and the adjacent network in the morning peak in the Base Year (2009) and in 2041. It can be seen that the volume/capacity ratios are predicted to exceed 90% on a large part of the network in 2041. At these volume/capacity ratios, congestion will be widespread and any incidents will have a correspondingly greater impact on a larger number of road users.
- 9.2.6 The average daily traffic speeds across the Dartford Crossing between M25 Junction 2 and Junction 29 are predicted to deteriorate to 41mph in 2025 and 36mph in 2041.
- 9.2.7 Journey time reliability at the crossing will worsen. Loss of capacity at the crossing or along the A282 corridor will lead to higher levels of congestion with increasing traffic growth. Problems of congestion on the local road network around Dartford will also worsen.

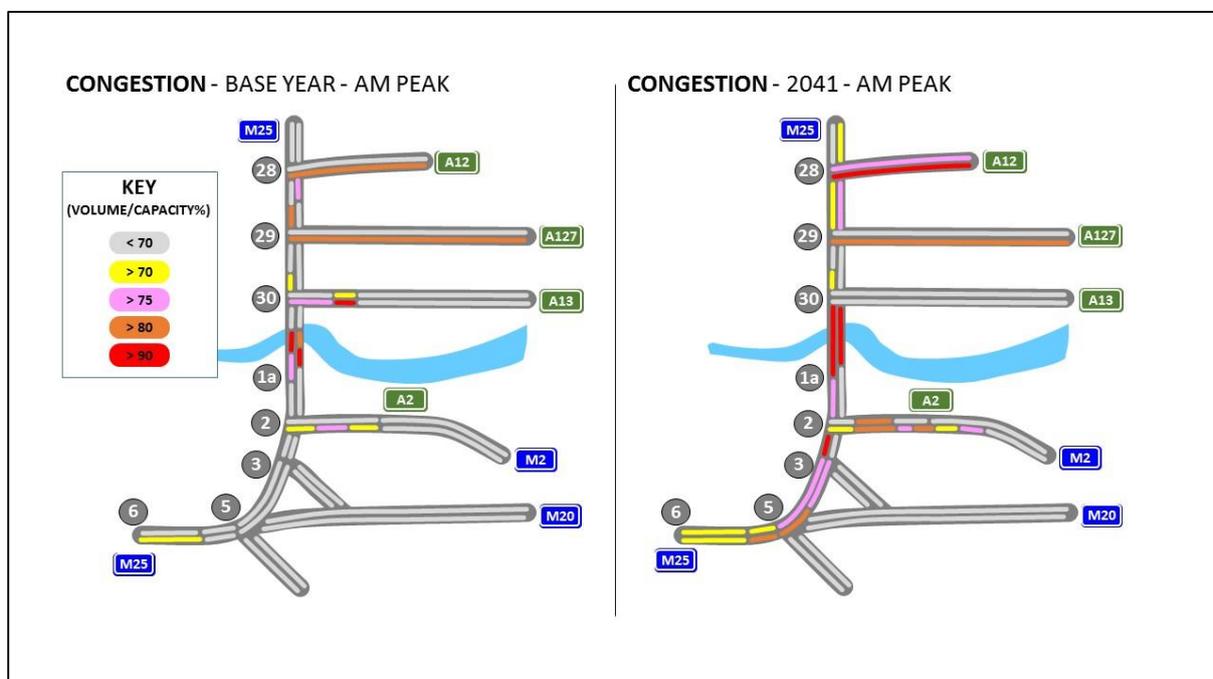


FIGURE 9.2 - FUTURE WORSENING OF CONGESTION

9.3 Future Development Plans

- 9.3.1 Future development plans for new housing and employment in the area are described in Section 8. These developments will lead to an increase of around 120,000 new homes and 130,000 new jobs, which will have a significant impact on future traffic growth in the area.

9.4 Future Environmental and Road Safety Conditions

Air Quality

- 9.4.1 With increasing congestion at Dartford Crossing and on the local road network around Dartford, it is expected that air quality will continue to deteriorate, in spite of improvements in vehicle emissions. There will still be significant air quality problems in 2025, with predicted exceedances of EU

standards for (NO₂) at properties in Dartford. This is demonstrated in **Table 9.1**; the location of receptors is shown in **Figure 4.2**.

TABLE 9.1 - PREDICTED NO₂ CONCENTRATIONS AT DARTFORD IN 2025

Receptor ID	Without Scheme 2025	Approximate Number of Potentially Influenced Receptors
R4	43.0ug/m ³	<10
R12	43.7ug/m ³	<50
Note: The Air Quality Strategic Objective (AQSO) level for NO ₂ is 40 ug/m ³		

Noise

- 9.4.2 Properties along the A282 south of the existing crossing at Dartford experience very high noise levels. The combination of increased traffic flows and reduced traffic speeds in an already congested situation for a future Without Scheme scenario means that noise levels are likely to increase in areas where excessive noise levels already occur. However, roads in this area including the A282 are designated as Noise Important Areas and the Highways England Strategic Business Plan identifies the need for interventions such as low noise surfacing and use of barriers to combat the disturbance experienced in locations where noise levels are at their highest.

Road safety

- 9.4.3 The existing road safety record for the M25/ A282 corridor is poor, with the accident rate based on fatal and weighted injuries per billion vehicle kilometres being between 70% and 320% higher than the national average, and Junctions 1a and Junction 2 being ranked amongst the worst performing junctions in the country. As a result of the projected national reduction in casualties, it is forecast that the accident rate will be lower than the existing rate, although it is likely to continue to perform poorly compared with national average rates.

10 The Need for Improvement

10.1 Summary of Existing Problems at Dartford

10.1.1 The Dartford Crossing is one of the most strategically important pieces of road network in the UK, carrying traffic of international and national importance, as well as catering for regional and local movements. The previous sections have explained the transport, economic, and environmental problems encountered today and that are forecast in the future at the crossing. This section provides a summary of these problems.

Congestion

10.1.2 There is insufficient capacity to cater for demand and this has been the case since 1999 once the additional capacity of the QEII Bridge was reached. This is a result of a number of existing constraints both at the crossing and the approaches to the crossing:

- Existing horizontal geometry of the tunnels and approaches.
- Closely spaced junctions leading to extensive weaving of traffic.
- The movement of restricted and dangerous goods vehicles through the tunnels, which are managed through a TMC and require to be escorted through the tunnels safely.

10.1.3 The crossing is heavily congested today and is predicted to become increasingly congested for larger parts of the day in the future. By 2025, the northbound crossing will be operating at capacity during the peak and inter-peak periods, and southbound will be the same by 2041.

10.1.4 Whilst providing some improvement in journey times, Dart Charge will not provide a long term solution to the congestion problems at Dartford. It will not provide a significant increase in crossing capacity, nor address the constraints both at the crossing and along the A282 corridor. The crossing is likely to have similar or worse traffic conditions in 2025 to those observed before Dart Charge was implemented.

Resilience and reliability

10.1.5 Operational resilience is poor and incidents have a disproportionate effect on reliability of the strategic and local road networks. The poor quality of the northbound infrastructure and the incremental development of the road network in the corridor have led to a network prone to frequent incidents which increase the likelihood of congestion, not only at the crossing but also on the wider road network.

10.1.6 There are over 300 unplanned closures per annum with an average duration of around 30 minutes. In the event of closures, the local network becomes very badly congested and users have no suitable alternative routes.

10.1.7 The Dartford Crossing is one of the least reliable sections for users of the SRN. With increasing congestion in the future, the likelihood of incidents will lead to greater unreliability.

Development and Economic Growth

- 10.1.8 Congestion at the crossing leads to wasted time for people and industry, and affects economic productivity, whilst constrained capacity limits growth in productivity, output, investment and employment. The local economies have a comparatively low productivity as measured by gross value added. This has impacted on local house prices and the willingness of developers and businesses to invest.
- 10.1.9 Regional and local development plans are focussed on economic growth with targets for new jobs and new homes. There are significant development plans for new housing and employment in the area, which include London Gateway Port (DP World), Port of Tilbury, Ebbsfleet Garden City, Paramount London and Lakeside and Bluewater Shopping Centres. Further development will generate more demand for cross-Thames travel.
- 10.1.10 Congestion, lack of capacity, lack of network resilience, poor connectivity between Kent and Essex and unreliability of journey times act as constraints on economic growth and will slow down the rate of investment; this is confirmed through engagement with business stakeholders, including a recent business survey.

Environment and Safety

- 10.1.11 The existing environmental problems at Dartford have an adverse impact on the local community. The traffic congestion at the crossing and on the surrounding road network affects both air quality and noise experienced by local residents. The A282 south of the crossing is both an Air Quality Management Area and a Noise Important Area with people close to the road exposed to high levels of air pollution and noise.
- 10.1.12 With increasing congestion at Dartford Crossing and on the local road network around Dartford, there will continue to be problems with air quality, despite improvements in vehicle emission standards. Noise levels are also likely to increase with increasing congestion.
- 10.1.13 The existing road safety record for the A282 corridor is poor, with the fatal and weighted injury index per billion vehicle kilometres being between 70% and 320% higher than the national average, and Junction 1a and Junction 2 ranked amongst the worst performing junctions in the country.

10.2 Scheme Objectives for a new Crossing

- 10.2.1 Client Scheme Requirements (CSR) have been agreed between DfT and Highways England for the delivery of the scheme. CSR are the formal means by which the DfT instruct Highways England to develop a scheme and define the scope of a project.
- 10.2.2 The CSR were used to develop a single set of scheme objectives and requirements for the Lower Thames Crossing scheme, which are shown in **Table 10.1**.

TABLE 10.1 - SCHEME OBJECTIVES AND REQUIREMENTS

Scheme Objectives	
Economic	<ul style="list-style-type: none"> To support sustainable local development, regional economic growth in medium to long term. To be affordable to government and users To achieve value for money.
Environment and Community	<ul style="list-style-type: none"> To minimise adverse impacts on health and the environment.
Transport	<ul style="list-style-type: none"> 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 major road network. To improve safety.
Scheme Requirements	
<ul style="list-style-type: none"> Increase road capacity across the Thames Estuary, east of London, between Essex and Kent, with additional infrastructure and operational arrangements to provide additional capacity, journey time reliability and improved resilience, which is fully integrated with the initiatives to regenerate the area. 	
<ul style="list-style-type: none"> Funding to be provided in part/full by user charges 	
<ul style="list-style-type: none"> Be part of an integrated asset strategy for the existing crossing, taking particular account of the operational characteristics of the Dartford Thurrock crossing. 	
<ul style="list-style-type: none"> Ensure compatibility with TfL's proposed river crossings 	
<ul style="list-style-type: none"> Conform to relevant UK legislation and EU Directives 	
<ul style="list-style-type: none"> Include provision for non-motorised users 	
<ul style="list-style-type: none"> Avoid unacceptable impacts on committed developments 	

10.2.3 The appraisal of route options is described in Volumes 4 to 7 of the SAR. All route and river crossing options are appraised against the above scheme objectives and requirements.

11 References

Title	Document number
Conservation of Habitats and Species Regulations 2010	2010 No. 490
DCLG National Planning Policy Framework	2015
DfT Action for Roads: A network for the 21st century	ISBN 9780101 867924
EA Groundwater Protection: Principles and Practice	GP3
EA Thames Estuary 2100	TE2100
EU Ambient Air Quality Directive	2008/50/EC
EU Habitats Directive	92/43/EEC
EU White Paper: Roadmap to a single European transport area - Towards a competitive and Resource Efficient transport system	SEC(2011)
Historic England – Thames Gateway Historic Environment Characterisation Study	1 June 2005
HM Treasury National Infrastructure Plan	2014
Inner Thames Estuary geological map	BGS 1997
Inner Thames Estuary - Pre-Quaternary and Quaternary Geology	1997
London Infrastructure Plan 2050 + Transport Supporting Paper	Mayor of London 2015
Planning Act 2008	2008 c.29
Water Framework Directive of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy	2000/60/EC
Brentwood BC Corporate Plan	2014-2016
Brentwood BC Replacement Local Plan	2005
Dartford BC Core Strategy	2026
Dartford BC Corporate Plan	2013-2016
Essex CC Transport Strategy	2011
GLA Adopted London Local Plan	January 2015
Gravesham BC Adopted Core Strategy	2014
Gravesham BC Corporate Business Plan	2011-15
London Borough of Havering Adopted Core Strategy and Development Control Policies Development Plan	2008
London Borough of Havering Corporate Plan	2014-2015
London Borough of Havering Local Implementation Plan	2007
Kent and Medway Structure Plan	2006
Kent CC Strategic Policy Statement	2014-2015
Kent CC Transport Delivery Plan for Kent	2010
London Borough of Bexley Adopted Core Strategy	2012
London Borough of Bexley Local Implementation Plan	2014/15-2016/17
Medway Council Local Plan	2003
Medway Council Plan	2014-2015
Thurrock Council Corporate Plan and Medium Term Financial Strategy	2013-2016
Thurrock Council Adopted Core Strategy and Policies for Management of Development	2011

Thurrock Council Transport Strategy	2013-2026
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12 Abbreviations and Glossary

Abbreviation	Description
2025 Opening year	A modelled year in the LTC traffic model in which flows are estimated for each option
2041 Design year	A modelled year in the LTC traffic model. The design year is typically 15 years after opening, but for LTC 2041, 16 years after opening, was assessed as it is the maximum horizon year for current growth assumptions. Traffic flows are estimated for each option.
AADT	Average Annual Daily Traffic
AECOM	AECOM Technology Corporation
Affected Road Network	This comprises the area within which roads could be considered within the air quality model (selection of the roads within the model depends upon a number of criteria such as changes in Heavy Duty Vehicle flows).
Alignment	The alignment is the horizontal and vertical route of a road, defined as a series of horizontal tangents and curves or vertical crest and sag curves, and the gradients connecting them.
AM	07:00 to 10:00
AMCB	Analysis of monetary costs and benefits
AMI	Advanced Motorway Indicator, with optical feedback for enforcement.
ANPR	Automated Number Plate Recognition
AOD	Above ordnance datum, vertical datum used by an ordnance survey as the basis for delivering altitudes on maps.
AONB	Area of Outstanding Natural Beauty: Statutory designation intended to conserve and enhance the ecology, natural heritage and landscape value of an area of countryside.
APS	Annual Population Survey
APTR	All-purpose trunk road
AQMA	Air Quality Management Area: an area, declared by a local authority, where air quality monitoring does not meet Defra's national air quality objectives.
AQSO	Air Quality Strategy Objective: Objective set by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland to improve air quality in the UK in the medium term. Objectives are focused on the main air pollutants to protect health.
Armour	Riprap - also known as rip rap, rip-rap, shot rock, rock armour or rubble - is rock or other material used to armour shorelines, streambeds, bridge abutments, pilings and other shoreline structures against scour, water or ice erosion.
ASC	Asset Support Contract(or)
AST	Appraisal Summary Table; a summary of impacts of introducing new infrastructure, setting out impacts using a structured set of economic, social and environmental measures.
AURN	Defra's Automatic Rural and Urban Network: the UK's largest automatic monitoring network and the main network used for compliance reporting against the Ambient Air Quality Directives.
BAP	Biodiversity Action Plan: National, local and sector-specific plans established under the UK Biodiversity Action Plan, with the intention of securing the conservation and sustainable use of biodiversity.
Batter slope	In construction is a receding slope of a wall, structure, or earthwork. The term is used with buildings and non-building structures to identify when a wall is intentionally built with an inward slope.

BCR	Benefit-Cost Ratio, the net benefit of a scheme divided by the net cost to Government. The ratio of present value of benefits (PVB) to present value of costs (PVC), an indication of value for money.
BGS	British Geological Survey: a partly publicly funded body which aims to advance geoscientific knowledge of the United Kingdom landmass and its continental shelf by means of systematic surveying, monitoring and research.
Bluewater	Bluewater Shopping Centre, an out of town shopping centre in Stone, Kent, outside the M25 Orbital motorway, 17.8 miles (28.6 km) east south east of London's centre.
BMS	Bridge Management System
BR	Bridge (when used as part of a LTC shortlist route reference) Bridleway
BT	Bored tunnel
BTO	British Trust for Ornithology: an organisation founded in 1932 for the study of birds in the British Isles.
Capex	Capital expenditure, the cost of developing or providing non-consumable parts of the product or system.
Catchpit chamber	Catchpits are a precast concrete drainage product that are recommended for use as a filter and collector in land drainage systems that do not make use of any sort of geo-membrane. A catchpit is essentially an empty chamber with an inlet pipe and an outlet pipe set at a level above the floor of the pit. Any sediment carried by the system settles out whilst in the catchpit, from where it can be periodically pumped out or removed
CCTV	Closed-circuit television. Highways England CCTV cameras are used to monitor traffic flows on the English motorway and trunk road network primarily for the purposes of traffic management.
CDA	Critical Drainage Area(s): As defined in the Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006 a Critical Drainage Area is "an area within Flood Zone 1 which has critical drainage problems and which has been notified... [to]...the local planning authority by the Environment Agency".
CESS	Highways England Commercial Services Division Cost Estimation Summary Spreadsheet
CFMP	Catchment Flood Management Plan: A strategic planning tool through which the Environment Agency works with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.
Chart Datum	The level of water from which charted depths displayed on a nautical chart are measured.
CKD	Combined kerb drain(s): a combined kerb and drainage system.
CO2e	Carbon dioxide equivalent; a standard unit for measuring carbon footprints. The idea is to express the impact of each different greenhouse gas in terms of the amount of CO2 that would create the same amount of warming.
COBALT	New 'light touch' version of COBA, COst Benefit Analysis computer program, DfT's tool for estimating accident benefits. The COBA program compares the costs of providing road schemes with the benefits derived by road users
Connect Plus	Connect Plus (M25) Ltd, management company for the Dartford-Thurrock Crossing.
CRM	Customer relationship management
C.RO Ports	C.RO is the brand name for the subsidiaries of C.RO Ports SA that operate ro-ro terminals in the UK, the Netherlands and Belgium.
CSR	Client Scheme Requirements
D2AP	Dual two-lane all-purpose road
Dart Charge	The Dartford Crossing free-flow electronic number plate recognition charging system (operates between 0600 and 2200).
Dartford Cable Tunnel	An £11m tunnel upstream of the Dartford Crossing, built in 2003-4, whose diameter is ~3m. It is designed to carry and allow for maintenance of 380kV National Grid electrical cable beneath the River Thames.

DBFO	Design, build, finance, operate: a way of creating "public-private partnerships" (PPPs) by funding public infrastructure projects with private capital.
DCC	Dartford Crossing Control Centre
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs: the government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities in the United Kingdom of Great Britain and Northern Ireland.
Deneholes	An underground structure consisting of a number of small chalk caves entered by a vertical shaft.
DFFC	Dartford Free Flow Crossing (tollbooths removed)
DfT	Department for Transport: the government department responsible for the English transport network and a limited number of transport matters in Scotland, Wales and Northern Ireland that have not been devolved.
DGV	Dangerous goods vehicle
DI	Distributional Impact
Disbenefit	A disadvantage or loss resulting from something.
DMRB	Design Manual for Roads and Bridges: A comprehensive manual (comprising 15 volumes) which contains requirements, advice and other published documents relating to works on motorway and all-purpose trunk roads for which one of the Overseeing Organisations (Highways England, Transport Scotland, The Welsh Government or the Department for Regional Development (Northern Ireland)) is highway authority. The DMRB has been developed as a series of documents published by the Overseeing Organisations of England, Scotland, Wales and Northern Ireland. For the Lower Thames Crossing the Overseeing Organisation is Highways England.
DP World	Dubai Ports World, London Gateway Port
DRCC	Dartford River Crossing Control Centre
DVS	DVS Property Specialists, the specialist property arm of the Valuation Office Agency (VOA).
DWT	Deadweight tonnage, a measure of how much weight a ship is carrying or can safely carry.
EA	Environment Agency: The Environment Agency was established under the Environment Act 1995, and is a Non-Departmental Public Body of Defra. The Environment Agency is the leading public body for protecting and improving the environment in England and Wales. The organisation is responsible for wide-ranging matters, including the management of all forms of flood risk, water resources, water quality, waste regulation, pollution control, inland fisheries, recreation, conservation and navigation of inland waterways.
EB	eastbound
ELHAM	TfL's East London Highway Assignment Model
EMME	Equilibre Multimodal, Multimodal Equilibrium, a complete travel demand modelling system for urban, regional and national transportation forecasting.
EMMEBANK	Neue Emme Bank Vorm.Amtersparniskasse Burgdorf
ERA	Emergency Refuge Area: on roads for use in emergency or breakdown only, located approximately every 800 metres and separated from the main carriageway.
ERT	Emergency roadside telephone(s)
ESL - Eastern Southern Link	The Eastern Southern Link (ESL) is an alternative for shortlist Routes 2, 3 and 4 to the south of the River Thames. The route would connect into Junction 1 of the M2 and would pass to the east of Shorne and then northwest towards Church Lane and Lower Higham Road. This route could connect into any of the Routes 2, 3 and 4 north of the river utilising all of the crossing options for these route options.
EU	European Union: A politico-economic union of 28 member states that are located primarily in Europe.

Fastrack	A bus rapid transit scheme operating in the Thames Gateway area of Kent, operated by Arriva Southern Counties.
FP	Footpath
FSA	Flood Storage Area: a natural or man-made area basin that temporarily fills with water during periods of high river levels.
FWI	Fatalities and Weighted Injuries: a statistical measurement of all non-fatal injuries added-up using a weighting factor to produce a total number of 'fatality equivalents'.
GDP	Gross Domestic Product
GIS	Geographic information system: an integrated collection of computer software and data used to view and manage information about geographic places, analyse spatial relationships, and model spatial processes.
GVA	Gross Value Added
Ha	Hectares
HADECS	Highways England Digital Enforcement Camera System
HAGDMS	Highways England Geotechnical Data Management System
HAM	TfL's Highway Assignment Model
Hanson	Hanson UK, part of the HeidelbergCement Group.
HATO	Highways Agency Traffic Officer
HATRIS	Highways England journey time database
HGV	Heavy Goods Vehicle
HHJV	Halcrow Hyder Joint Venture: a joint venture between Halcrow Group Limited and Hyder Consulting Limited.
HRA	Habitats Regulations Assessment: A tool developed by the European Commission to help competent authorities (as defined in the Habitats Regulations) to carry out assessment to ensure that a project, plan or policy will not have an adverse effect on the integrity of any Natura 2000 or European sites (Special Areas of Conservation, Special Protection Areas and Ramsar sites), (either in isolation or in combination with other plans and projects), and to begin to identify appropriate mitigation strategies where such effects were identified.
HS1	High Speed 1 rail line (formerly Channel Tunnel Rail Link (CTRL))
IAN	Interim Advice Notice: Issued by Highways England from time to time. They contain specific guidance, which should only be used in connection with works on motorways and trunk roads in England.
Inter-peak	10:00 to 16:00
IP	Internet Protocol
IT	Immersed tunnel
ITS	Intelligent Transportation System
Jacked box tunnelling	Jacked box tunnelling is a method of construction that enables engineers to create underground space at shallow depth in a manner that avoids disruption of valuable infrastructure and reduces impact on the human environment.
KMEP	Kent and Medway Economic Partnership
Lafarge Tarmac	Lafarge Tarmac Limited is a British building materials company headquartered in Solihull, Birmingham.
Lakeside	Lakeside Shopping Centre, branded as Intu Lakeside, is a large out-of-town shopping centre located in West Thurrock, in the borough of Thurrock, Essex just beyond the eastern boundary of Greater London.
LATS	London Area Transport Surveys
LCS	Lane Control Signs
LDP	London Distribution Park: offers 70 acres (28Ha) of land for industrial and logistics development 6.5 miles from the M25, adjacent to Port of Tilbury, London.

LGV	Light Goods Vehicle
Location A	The location for LTC route options close to the existing Dartford crossing.
Location C	The location for LTC route options connecting the A2/ M2 east of Gravesend with the A13 and M25 (between Junctions 29 and 30) north of the River Thames.
Location C Variant	As for options at Locations C and A with additional widening of the A229 between the M2 and the M20.
London Gateway	A new deep-water port, able to handle the biggest container ships in the world, and part the London Gateway development on the north bank of the River Thames in Thurrock, Essex, 20 miles (32 km) east of central London.
LPER	see Paramount London
LTC	Lower Thames Crossing: a proposed new crossing of the Thames estuary linking the county of Kent with the county of Essex, at or east of the existing Dartford Crossing.
LTS railway	London Tilbury Southend railway
LWS	Local wildlife site
Mainline	The through carriageway of a road as opposed to a slip road or a link road at a junction
Mardyke	A small river, mainly in Thurrock, that flows into the River Thames at Purfleet, close to the QEII Bridge.
MIDAS	Motorway Incident Detection and Automatic Signalling
MMO	Marine Management Organisation: An executive non-departmental public body in the UK established under the Marine and Coastal Access Act 2009. The MMO exists to make a significant contribution to sustainable development in the marine area, and to promote the UK government's vision for clean, healthy, safe, productive and biologically diverse oceans and seas.
MS4	The latest generation of Variable Message Signs designed to display both pictograms and text; uses internationally recognised warning symbols and provides a dual colour display matrix for amber and red coloured characters or symbols.
MTM	Medway Traffic Model
NB	northbound
NCR	National Cycle Route: a cycle route part of the National Cycle Network created by Sustrans to encourage cycling throughout Britain.
NDD	Highways England Network Development Directorate
NIA	Noise-important area(s): Defra published noise maps for England's roads in 2008, with the noise action plans following 2 years later in 2010. The action plans set out a framework for managing noise, rather than propose specific mitigation measures, and were designed to identify 'Important Areas' that are impacted by noise from major sources and therefore must be investigated. NIAs are where the 1% of the population that are affected by the highest noise levels from major roads are located, according to the results of Defra's strategic noise maps.
NMU	Non-motorised user, e.g. pedestrians, cyclists, equestrians.
NO2/ NO ₂	Nitrogen dioxide
NPPF	National Planning Policy Framework: published in March 2012 by the UK's Department of Communities and Local Government, consolidating over two dozen previously issued documents called Planning Policy Statements (PPS) and Planning Policy Guidance Notes (PPG) for use in England.
NPS	National Policy Statement (see NPSNN)
NPSNN	National Policy Statement for National Networks: The NPSNN sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks in England. It provides planning guidance for promoters of nationally significant infrastructure projects on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the Secretary of State.

NSIP	Nationally significant infrastructure project: major infrastructure developments in England and Wales, such as proposals for power plants, large renewable energy projects, new airports and airport extensions, major road projects etc.
NPV	Net present value, a measure of the total impact of a scheme upon society, in monetary terms, expressed in 2010 prices.
NRTS	National Roads Telecommunications Services
NTCC	National Technology Control Centre: based in the West Midlands, the NTCC is an ambitious telematics project aimed at providing free, real-time information on England's network of motorways and trunk roads to road users, allowing them to plan routes and avoid congested areas.
NTEM	DfT's National Trip End Model
NTS	National Transport Survey
O&M	Operations and Maintenance
OD	Origin-destination: origin-destination data (also known as flow data) includes the travel-to-work and migration patterns of individuals, cross-tabulated by variables of interest (for example occupation).
ONS	Office for National Statistics: the executive office of the UK Statistics Authority, a non-ministerial department which reports directly to the UK Parliament.
Opex	An operating expense or operating expenditure or operational expense or operational expenditure: an ongoing cost for running a product, business or system.
Orifice plate	A device used for measuring flow rate, for reducing pressure or for restricting flow (in the latter two cases it is often called a restriction plate). Either a volumetric or mass flow rate may be determined, depending on the calculation associated with the orifice plate.
Orthotropic steel deck plate	An orthotropic bridge or orthotropic deck is one whose deck typically comprises a structural steel deck plate stiffened either longitudinally or transversely, or in both directions. This allows the deck both to directly bear vehicular loads and to contribute to the bridge structure's overall load-bearing behaviour. The orthotropic deck may be integral with or supported on a grid of deck framing members such as floor beams and girders.
PA	Public accounts Public address
FACTS	Parliamentary Advisory Council for Transport Safety: a registered charity and an All-party parliamentary group of the UK parliament. Its charitable objective is to protect human life through the promotion of transport safety for the public benefit.
PA metrics	Production and attraction metrics
Paramount Park, London	London Paramount Entertainment Resort (LPER). A proposed theme park and entertainment precinct on the Swanscombe peninsula, Kent. Construction could begin in autumn 2016 with the opening estimated for Easter 2021.
PCF	Highways England Project Control Framework process.
PCM	Pollution Climate Model
pcu	passenger car units. This is a metric to allow different vehicle types within traffic flows in a traffic model to be assessed in a consistent manner. Typical pcu factors are: 1 for a car or light goods vehicle; 2 for a bus or heavy goods vehicle; 0.4 for a motorcycle; and 0.2 for a pedal cycle.
Peel Ports	Britain's second largest group of ports, part of the Peel Group.
Penstock	A sluice or gate or intake structure that controls water flow, or an enclosed pipe that delivers water to hydro turbines and sewerage systems. It is a term that has been inherited from the earlier technology of mill ponds and watermills.
PIA	Personal Injury(ies) Accident(s)
PLA	Port of London Authority: a self-funding public trust established by The Port of London Act 1908 to govern the Port of London. Its responsibility extends over the Tideway of the River Thames and its continuation (the Kent/ Essex strait). It maintains and supervises navigation, and protects the river's environment.
PM	16:00 to 19:00

PM ₁₀	Particulate matter (in this example, particulates smaller than 10µm that can cause health problems).
PRoW	Public Right of Way: A right possessed by the public, to pass along routes over land at all times. Although the land may be owned by a private individual, the public may still gain access across that land along a specific route. The mode of transport allowed differs according to the type of public right of way which consist of footpaths, bridleways and open and restricted byways.
pSPA	Potential Special Protection Area: Sites which are approved by Government that are in the process of being classified as Special Protection Areas.
PSSR	Preliminary Sources Study Report
PTSD	Highways England Professional and Technical Services Division
PV	Present Values
PVB	Present value of benefits: PVBs less PVCs provide estimates of Net Present Values (NPVs) and the ratio of the PVB to the PVC constitutes the BCR.
PVC	Present value of costs: a measure of the monetary cost of a scheme, less revenues, discounted to and expressed in 2010 prices.
QEII Bridge	Queen Elizabeth II Bridge, part of the Dartford-Thurrock crossing.
QUADRO	QUeues And Delays at ROadworks computer program: a Highways England sponsored computer program maintained and distributed by TRL Software; its primary use is in rural areas. It estimates the effects of roadworks in terms of time, vehicle operating and accident costs on the users of the road. Individual roadworks jobs can be combined to produce the total cost of maintaining the road over time.
RADAR	Radar is an object-detection system that uses radio waves to determine the range, angle, or velocity of objects, including motor vehicles.
Ramsar site	A wetland of international importance, designated under the Ramsar convention.
RCC	Regional Control Centre
RET	Range Estimation Tool
RFID	Radio-frequency identification, the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information.
rMCZ	Recommended Marine Conservation Zone: A site put forward for designation under the Marine and Coastal Access Act 2009 to conserve the diversity of nationally rare, threatened and representative habitats and species.
RSPB	Royal Society for the Protection of Birds: A charitable organisation that works to promote conservation and protection of birds and the wider environment through public awareness campaigns, petitions and through the operation of nature reserves throughout the United Kingdom.
RTMC	Regional Technology Maintenance Contract(or)
RTC	Road traffic collision
RWE npower	A leading integrated UK energy company.
SAC	Special Area of Conservation: defined in the European Union's Habitats Directive (92/43/EEC), also known as the <i>Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora</i> . SACs are to protect the 220 habitats and approximately 1000 species listed in annex I and II of the directive which are considered to be of European interest following criteria given in the directive.
SANEF	Société des Autoroutes du Nord et de l'Est de la France, a motorway operator company.
SAP	LTC Stakeholder Advisory Panel: comprises key local authority stakeholders to share local knowledge, their needs, priorities and opinions with respect to LTC. SAP meetings have been held at key stages of the LTC scheme; bi-lateral meetings with SAP members have also been held.
SAR	HHJV's Pre-Consultation Scheme Assessment Report of the Lower Thames Crossing.
SATURN	Simulation and Assignment of Traffic to Urban Road Networks, Transport Model

SCADA	Supervisory Control and Data Acquisition
S-CGE	Spatial Compatible General Equilibrium
SEB(s)	Statutory Environmental Body(ies): Any principal council as defined in subsection (1) of section 270 of the Local Government Act 1982 for the area where the land is situated. Where the land is situated in England; Natural England, Historic England, the Environment Agency, Natural Resources Wales and the National Assembly for Wales where, in the opinion of the Secretary of State, the land is sufficiently near to Wales to be of interest to them and any other public authority which has environmental responsibilities and which the Secretary of State considers likely to have an interest in the scheme.
SELEP	South East Local Enterprise Partnership: the business-led, public/ private body established to drive economic growth across East Sussex, Essex, Kent, Medway, Southend and Thurrock.
Setting	This is defined in the National Planning Policy Framework as 'The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of the asset, may affect the ability to appreciate that significance or may be neutral.'
SGAR	Stage Gateway Assessment Review: part of Highways England Project Control Framework (PCF) process.
Shortlist Route 1	A new trunk road connecting M25 Junction 2 to M25 Junction 30, with a new 4 lane bridge crossing or a 4 lane twin-bored tunnel to the west of Dartford crossing, with significant improvements to Junctions 30 and 31. Smart Motorway Technology is to be implemented from Junction 2 to 1b (with no widening) and Junction 1b to 1a (with widening to dual 5 lanes).
Shortlist Route 2	A new trunk road connecting A2 (2 km east of Gravesend) to M25 between Junctions 29 and 30, using A1089 (upgrading), with dual 2 lane crossing option of a bridge / twin-bored tunnel / immersed tunnel. See also Eastern Southern Link and Western Southern Link.
Shortlist Route 3	A new trunk road connecting the A2 (2 km east of Gravesend) to the M25 (between Junctions 29 and 30), with dual 2 lane crossing option of a bridge / twin-bored tunnel / immersed tunnel. Junction with the A13 at the existing junction with the A13 and A1089 and a junction with Brentwood Road, with Brentwood Road upgraded to dual 2 lane to Orsett Cock interchange. See also Eastern Southern Link and Western Southern Link.
Shortlist Route 4	A new trunk road connecting A2 (2 km east of Gravesend) to M25 at Junction 29, using A127 (upgrading), with dual 2 lane crossing option of a bridge / twin-bored tunnel / immersed tunnel. Single carriageway road provided from B186 to A128 parallel with the A127. See also Eastern Southern Link and Western Southern Link.
SIA	Social Impact Appraisal
Skills Level 4	Equates to a Certificate of Higher Education, Key Skills Level 4, NVQ Level 4, BTEC Professional award, certificate and diploma Level 4, and HNC.
Smart motorway	Term for a range of types of actively controlled motorway, using technology to optimise use of the carriageway including the hard shoulder.
SPA	Special Protection Area: A designation under the European Union Directive on the Conservation of Wild Birds.
SPECS	Average Speed Enforcement Camera System
SPZ	Source protection zone: EA-defined groundwater sources (2000) such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area.
SRN	Strategic Road Network, the core road network, managed in England by Highways England.
SSSI	Site of Special Scientific Interest: A conservation designation denoting an area of particular ecological or geological importance.
SuDS	A sustainable drainage system designed to reduce the potential impact of new and existing developments with respect to surface water drainage discharges.
SWMP	Surface Water Management Plan: Plan to provide sufficient information to support the development of an agreed strategic approach to the management of surface water flood

	risk within a given geographical area by ensuring the most sustainable measures are identified.
TAG	Transport Analysis Guidance: national guidance document produced by the Department for Transport.
TAR	HHJV's Technical Appraisal Report of the Lower Thames Crossing.
TBM	Tunnel boring machine, machine used to excavate tunnels with a circular cross section.
TDSCG	Tunnel Design and Safety Consultation Group: formed to ensure effective design, construction and operation within the context of safety.
TE2100	EA's Thames Estuary 2100 project (formed November 2012) to develop a comprehensive action plan to manage flood risk for the Tidal Thames from Teddington in West London, through to Sheerness and Shoeburyness in Kent and Essex.
TEE	Transport Economic Efficiency (economic efficiency of the transport system)
TfL	Transport for London: created in 2000, the integrated body responsible for London's transport system.
TM	Highways England's Traffic Management (directorate)
TMC	Traffic Management Cell
TRADS	Traffic Flow Data System (holds information on traffic flows at sites on the network)
TRRL	Transport and Road Research Laboratory (now TRL Ltd): a fully independent private company offering a transport consultancy and research service to the public and private sector. Originally established in 1933 by the UK Government as the Road Research Laboratory (RRL), it was privatised in 1996.
TTMS	Temporary Traffic Management Signs
TUBA	Transport Users Benefit Appraisal (DfT economic appraisal software tool)
UPS	Uninterruptible power supply
Urban All Purpose	A road in an urban area designed for all types of traffic in accordance to the relevant DMRB Standards.
V/C	Volume over Capacity (volume/capacity)
VMS	Variable Message Sign, typically mounted on a portal gantry.
VMSL	Variable Mandatory Speed Limits
Vopak	Royal Vopak N.V. is a Dutch company that stores and handles various oil and natural gas-related products.
Vortex separator/ device	A vortex separator is a device for effective removal of sediment, litter and oil from surface water runoff.
vpd	Vehicles per day
WASHMS	Wind and Structural Health Monitoring System: the process of implementing a damage detection and characterisation strategy for engineering structures.
WB	westbound
WEBs	Wider economic benefits
WebTAG	Department for Transport's web-based multi-modal guidance on appraising transport projects and proposals.
WFD	Water Framework Directive: A European Community Directive (2000/60/EC) of the European Parliament and council designed to integrate the way water bodies are managed across Europe.
WI	Wider Impacts, land use-related economic consequences of transport interventions, not directly related to impacts on users of the transport network, such as increased productivity.
Without Scheme/ With Scheme	Without Scheme: The scenario where government takes the minimum amount of action necessary and is used as a benchmark in the appraisal of options.

	<p>With Scheme: An option that provides enhanced services by comparison to the benchmark Without Scheme scenario.</p>
<p>WSL - Western Southern Link</p>	<p>The Western Southern Link (WSL) is an alternative for shortlist Routes 2, 3 and 4 to the south of the River Thames. The route would connect into the A2 to the east of Gravesend and would go to the west of Thong and Shorne and east of Chalk towards Church Lane and Lower Higham Road. This route could connect into any of the Routes 2, 3 and 4 north of the river utilising all of the crossing options for these route options.</p>

13 Appendices

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The Pre-Consultation Scheme Assessment Report details the assessment of options leading up to consultation. A final Scheme Assessment Report will be published post consultation.