

Lower Thames Crossing

Post-Consultation Scheme Assessment Report

Volume 2: Introduction and Existing Conditions

Volume 2

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The designs shown and described in this Post-Consultation Scheme Assessment Report have been developed for the detailed appraisal of options as part of the options phase, and may be subject to change in later stages of the scheme development.

1 Introduction

1.1 Structure of Post-Consultation Scheme Assessment Report

1.1.1 The Post-Consultation Scheme Assessment Report (SAR):

- Reports on the appraisal of the route options for a new Lower Thames Crossing (LTC), including the engineering, safety, operational, traffic, economic, social and environmental appraisals.
- Reports on the public consultation of options.
- Presents a Recommended Preferred Route.

1.1.2 Highways England is making a recommendation to the Secretary of State (SoS), following consideration and analysis of the consultation feedback, on which route option Highways England considers should be selected as the Preferred Route. The SoS will consider the recommendation and then decide which route option will form the Preferred Route. That decision will be published in a 'preferred route announcement'. The Preferred Route will then be developed in more detail, with further consultation, before an application is made for a Development Consent Order (DCO).

1.1.3 A Pre-Consultation SAR was published in January 2016 and was made available at public consultation; the Pre-Consultation SAR was made up of seven volumes. Each volume has been updated in the Post-Consultation SAR to include revised and additional information where required. The Post-Consultation SAR also reports on the consultation, response to consultation findings and the Recommended Preferred Route.

1.1.4 An outline of what is included in each volume of the Post-Consultation SAR is set out below:

- Volume 1 – provides an Executive Summary of the SAR.
- **Volume 2 (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 – describes the option identification and selection process. It summarises the consultation process, the consultation findings and the Highways England response to those findings. It describes the routes reported in the Post-Consultation SAR (the Post-Consultation Appraisal Routes).
- Volume 4 – describes the engineering, safety and cost appraisal of the Post-Consultation Appraisal Routes.
- Volume 5 – describes the traffic and economic appraisal of the Post-Consultation Appraisal Routes.
- Volume 6 – describes the environmental appraisal of the Post-Consultation Appraisal Routes.

- Volume 7 – summarises the appraisal of the Post-Consultation Appraisal Routes against the scheme objectives and describes the Recommended Preferred Route. It also describes the next steps including further work that will be undertaken in the development of the scheme.

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.
- Section 11 lists other documentation referred to in this report.

2 Scheme Background

2.1 Introduction

2.1.1 The A282 Dartford-Thurrock crossing 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.

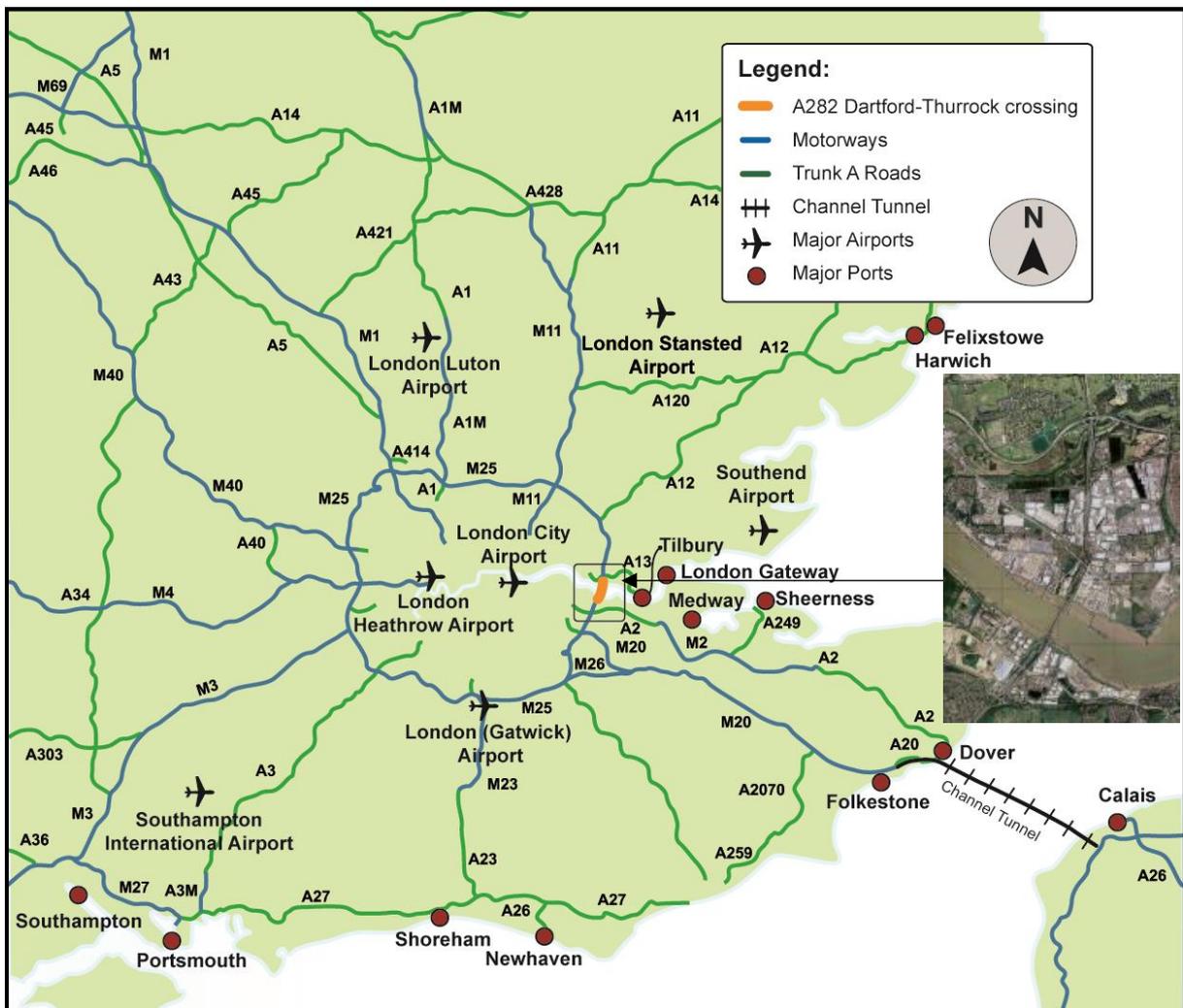


FIGURE 2.1 - LOCATION OF THE DARTFORD CROSSING IN RELATION TO THE STRATEGIC ROAD NETWORK

- 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 54 million vehicle trips are made at the Dartford Crossing each year. Currently almost 155,000 vehicles per day (vpd) use the crossing paying a user charge, via an electronic collection system (Dart Charge). Peak daily throughputs vary typically between 165,000 and 181,000 vehicles; a maximum flow of about 197,000 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) since 2008. The key studies carried out for the DfT are discussed in the following paragraphs and brief details of all the 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 (May 2013), 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 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.

2.2.6 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.

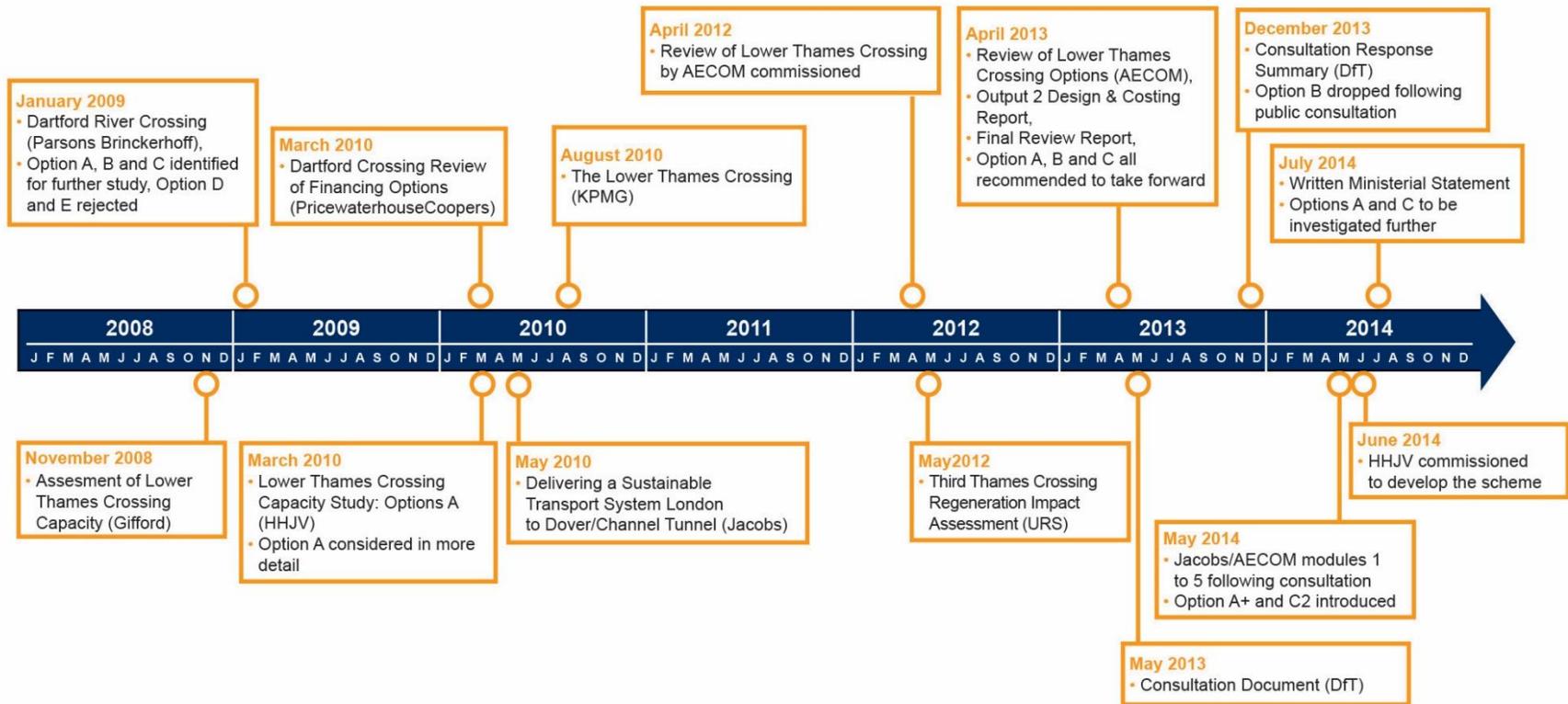


FIGURE 2.3 - TIMELINE OF PREVIOUS STUDIES

2.2.7 **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.

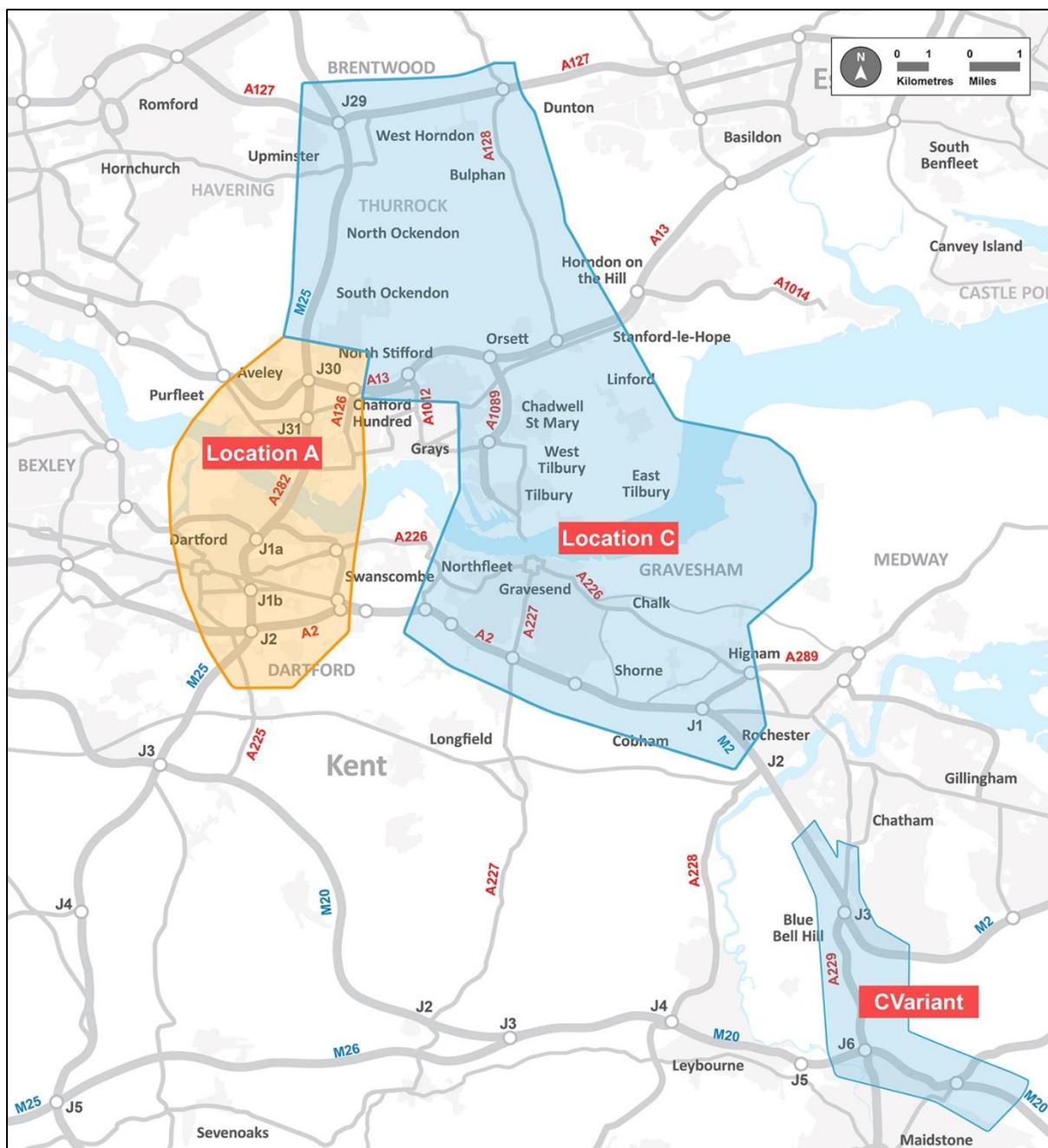


FIGURE 2.4 - STUDY AREA

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

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 less than the standard headroom of 5.3m for a new structure and minimum maintained headroom of 5.03m for existing structures and therefore too small to accept higher 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 high vehicles (refer to paragraph 3.2.1) and vehicles with dangerous loads is restricted. This is managed through a Traffic Management Cell (TMC) as described in Section 3.4. The restrictions in respect of vehicles with dangerous loads is part of the combination of mitigations and safety upgrades that are in place to ensure the Dartford Tunnels reach the levels of safety required by the Road Tunnel Safety Regulations, 2009.
- 3.2.4 On the A282 northbound there are three lanes and a hard shoulder running through Junction 2, one lane from the Junction 2 roundabout northbound on-slip merges with the left hand lane 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 after the tunnel exits merge and continue as four lanes 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**.

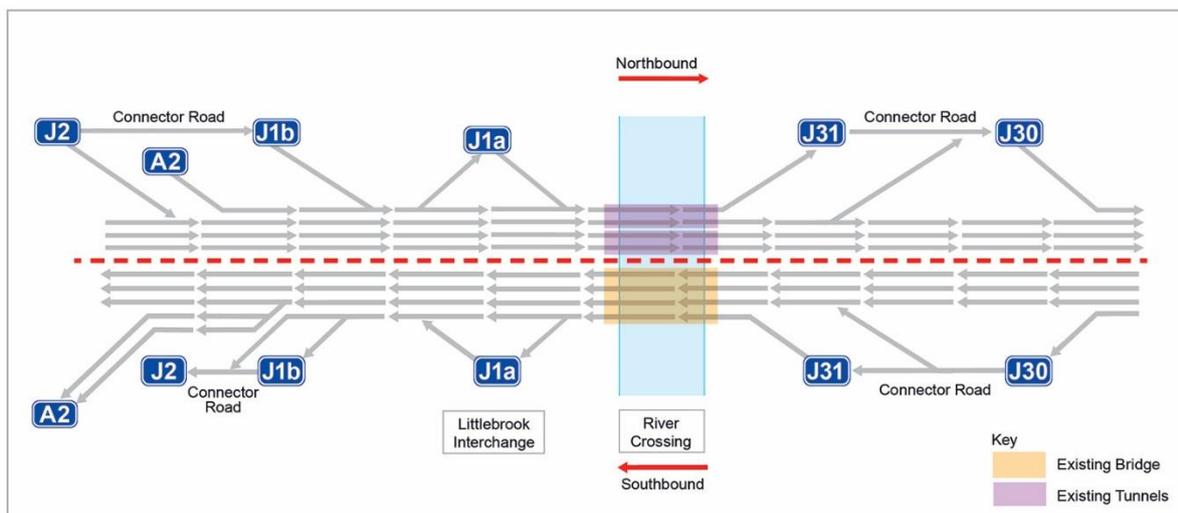


FIGURE 3.2 - EXISTING ROAD LAYOUT ALONG M25/ A282 CORRIDOR

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. 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.

- 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:
- a) Reduction in journey times southbound and northbound. The reduction in journey times southbound has been greater than the reduction northbound.
 - b) Traffic flows have increased by up to 11% 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 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 Following detection of a restricted vehicle there are three possible courses of action:
- Banned vehicles (i.e. vehicles carrying certain highly hazardous goods and those too high to go through either tunnel) are intercepted and directed to find an alternative route.
 - Restricted hazardous goods vehicles are held until they can be escorted through the tunnel in convoy.
 - Vehicles too high to go through the west tunnel but low enough to go through the east tunnel are redirected to approach the tunnels again in the correct lanes.
- 3.4.3 Hazardous goods vehicles that need to be escorted through the tunnels are marshalled into convoys off-line (refer to **Photo 3.1**) and then escorted back onto the mainline and through the tunnel. This adds to traffic movements off and back onto the mainline.



PHOTO 3.1 - TRAFFIC MANAGEMENT CELL IN OPERATION (NORTHBOUND)

- 3.4.4 In addition to the segregation of restricted vehicles the TMC also stops traffic in the event of an incident in the tunnels.
- 3.4.5 The high usage of the tunnels by goods vehicles, including foreign registered vehicles, means that vehicles need to be frequently intercepted and escorted. This is very disruptive to free flowing traffic, and acts as a constraint on capacity. The number of restricted vehicles detected at the crossing is approximately 400 per day leading to 70 escorts per day which occur every 15 minutes throughout the day including peak periods. When an escort takes place the west tunnel must be shut to general traffic for 2 to 3 minutes. With four escorts per hour this effectively requires the west tunnel to be shut for up to 12 minutes in every 60 minutes reducing capacity by 20%.
- 3.4.6 In addition to the capacity reductions resulting from the escort of restricted vehicles, the extraction of restricted vehicles incorrectly approaching the tunnels occurs on average 30 times per day and equates to 1 to 2 hours of lost capacity each day. Whilst the TMC is designed to optimise traffic flow the requirement for extractions, escorts and metering of traffic means that 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 six 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 (reduction to three lanes), to its junction with the A229 (Junction 3). The M2 then continues south east towards Canterbury, 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 The A229 is a dual carriageway connecting Junction 6 of the M20 to Junction 3 of the M2. It is generally a dual two lane carriageway but has an additional southbound climbing lane approaching M2 Junction 3. Other roads connecting the M20 and M2 include the A249 a dual carriageway connecting M20 Junction 7 to M2 Junction 5 and the A228 a single carriageway connecting M20 Junction 4 to M2 Junction 2.
- 3.6.3 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.
- M25 Junction 30/ A13 Congestion Relief. The scheme involved an online widening of the A13 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. Opened in early 2017.

3.10 Future Highway Schemes

3.10.1 Transport for London (TfL) consulted on three new river crossings. One at Silvertown for which consultation ended in November 2015 and a DCO application was submitted in spring 2016. This application is currently subject to public examination which started in October 2016. The other two crossings were at Gallions Reach and Belvedere. Consultation for these crossings ended in February 2016. The crossings are west of the Dartford Crossing as shown in **Figure 3.3**.

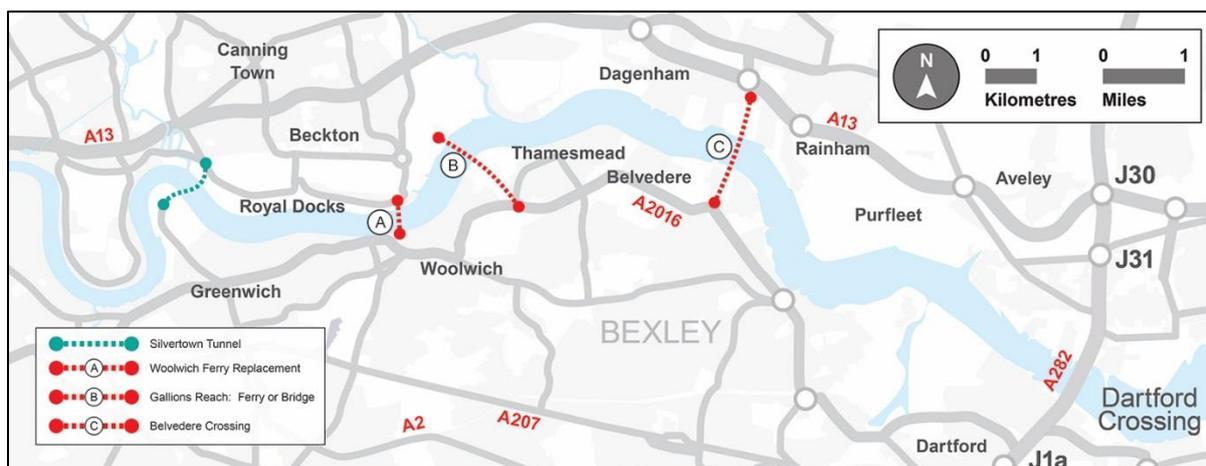


FIGURE 3.3 - TRANSPORT FOR LONDON (TFL) RIVER CROSSINGS

3.10.2 In October 2016 the Mayor of London announced changes to the proposed crossings. The Silvertown crossing has been retained, the Gallions Reach crossing has been changed to a Docklands Light Railway crossing and the Belvedere crossing has been dropped. Three new non-highway crossings have been proposed as follows:

- A pedestrian/ cycle crossing from Rotherhithe to Canary Wharf

- A ferry from North Greenwich to Canary Wharf
- An extension of London Overground (rail) from Barking Riverside

3.10.3 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.

3.10.4 Highways England is developing proposals for improvements to A2 Bean and A2 Ebbsfleet junctions. Refer also to Volume 5 of the SAR, which describes future schemes included in the traffic model.

3.11 Improvements at Dartford Crossing

3.11.1 A number of improvements and management measures have been implemented at or near to the existing Dartford Crossing to improve the flow of traffic, including Dart Charge (refer to Section 3.3) and the M25 Junction 30/ A13 Congestion Relief Scheme (refer to Section 3.10). Further improvements have been committed to and are due to be completed by 2019. All the schemes and measures are summarised in **Table 3.2** together with the strategic and local network improvement provided.

TABLE 3.2 - IMPROVEMENT AND MANAGEMENT SCHEMES AT EXISTING DARTFORD CROSSING

| Project/Improvement | Current Project Stage | On-site Completion | Strategic Network Improvement | Local Network Improvement |
|---|-----------------------|--------------------|------------------------------------|---------------------------|
| Dart Charge | Complete | 2015 | Maximising existing capacity | |
| M25 Junction 30/ A13 Congestion Relief Scheme | Complete | 2017 | Improved junction capacity | |
| Tunnel Upgrade to EUD Standards | Delivery | 2017 | Resilience | |
| DGV Check and Allow Online Registration | Delivery | 2017 | Fewer HGV movements at Junction 1a | |
| Dartford Collaborative Traffic Management | Delivery | 2018 | Improved local/ SRN integration | |
| Improved HGV signing on northbound approach | Delivery | 2018 | Improved HGV management | N/A |
| Dartford Northern Crossovers | Delivery | 2019 | Reduced traffic disruption | |
| A282 Oversized Vehicle Detection and Management | Delivery | 2018 | Reduced extractions | N/A |

3.12 Existing Traffic Conditions

3.12.1 The transport problems today can be considered under the following headings:

- Traffic flows
- Congestion at Dartford
- Journey Time Reliability
- Network Resilience
- Road Safety

3.12.2 Future conditions without any improvements being undertaken, the Without Scheme scenario, are described in Section 9.

3.13 Traffic Flows

3.13.1 At the Dartford-Thurrock River Crossing daily two-way traffic flows are typically almost 155,000 vehicles per day (vpd), 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 vpd. Peak daily throughputs varied between 165,000 and 181,000 vpd between 1998 and 2014. This can be seen in **Figure 3.4** which also shows the growth in traffic since the crossing first opened in 1963. 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 local roads. In November 2015 a peak daily flow of about 197,000 vpd was recorded.

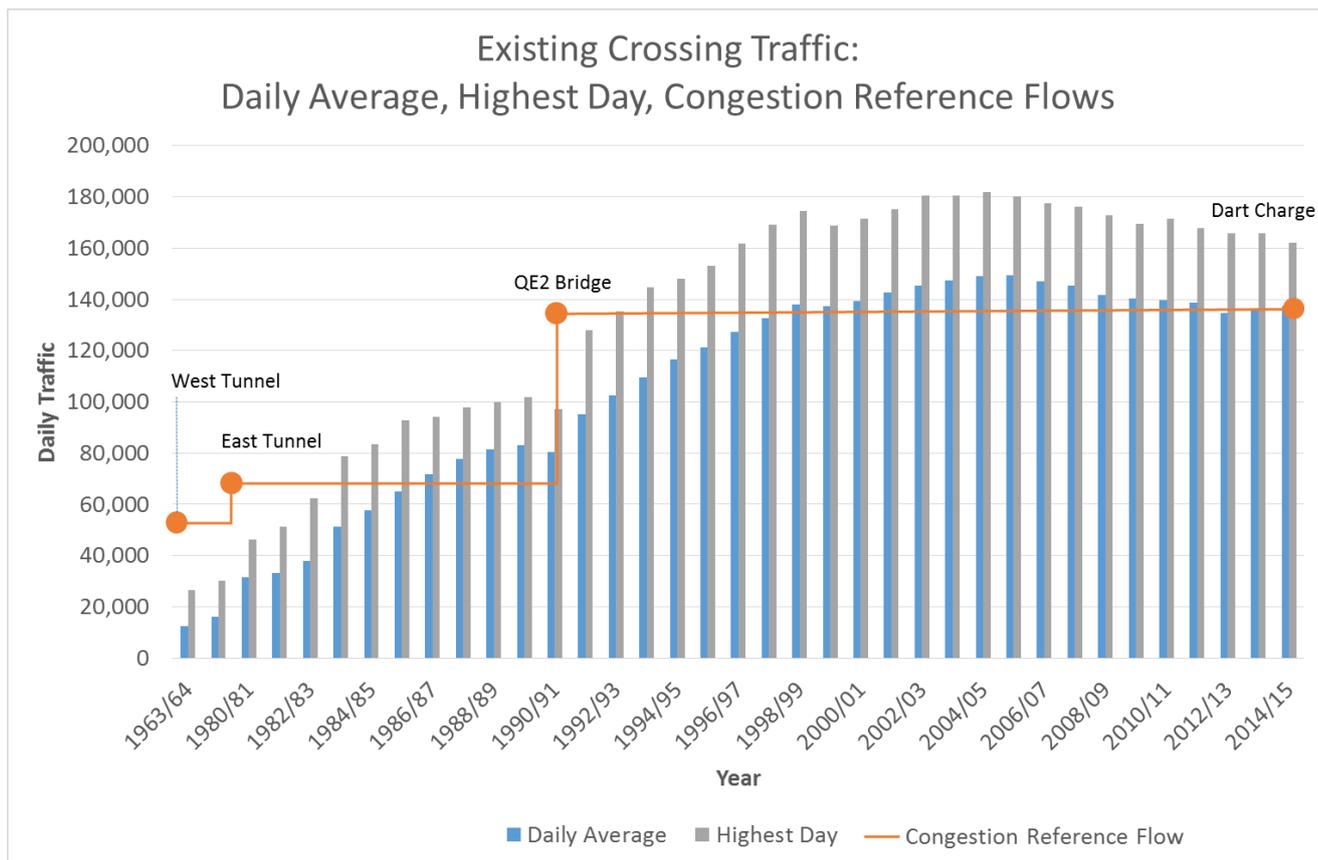


FIGURE 3.4 - DAILY AVERAGE AND HIGHEST DAILY TRAFFIC FLOW ACROSS THE DARTFORD CROSSING SINCE OPENING IN 1963 (2-WAY TRAFFIC)

- 3.13.2 Dartford Crossing traffic fell sharply between 2008 and 2013 and is recovering more slowly than the districts surrounding it as capacity is constrained in the peaks.
- 3.13.3 More recent tolling data for the 2015/ 16 financial year indicates that just over 54 million vehicle trips were made at the Dartford Crossing in the last year to April 2016. This represents an increase of around 8% on Highways England usage figures for 2014/ 15 before the implementation of Dart Charge. By late 2016 the average daily flow had increased further to about 155,000 vpd representing an increase of about 11% on pre-Dart Charge flows.
- 3.13.4 Based on traffic count data approximately 18% of the traffic on the Dartford Crossing is made up of HGVs equating to 28,000 HGVs per day. The percentage increases to 31% if 2-axle goods vehicles are included. These vehicles include those connecting ports and distribution centres in the south east and the midlands/ north. This compares to around 11% of traffic on all motorways being HGVs.
- 3.13.5 The use of the crossing has been analysed according to where customers start and finish their journeys during peak times. **Figure 3.5** below indicates where the boundaries between the national (the north and the south), regional and local designations have been drawn and the sub-divisions for Kent and Essex.

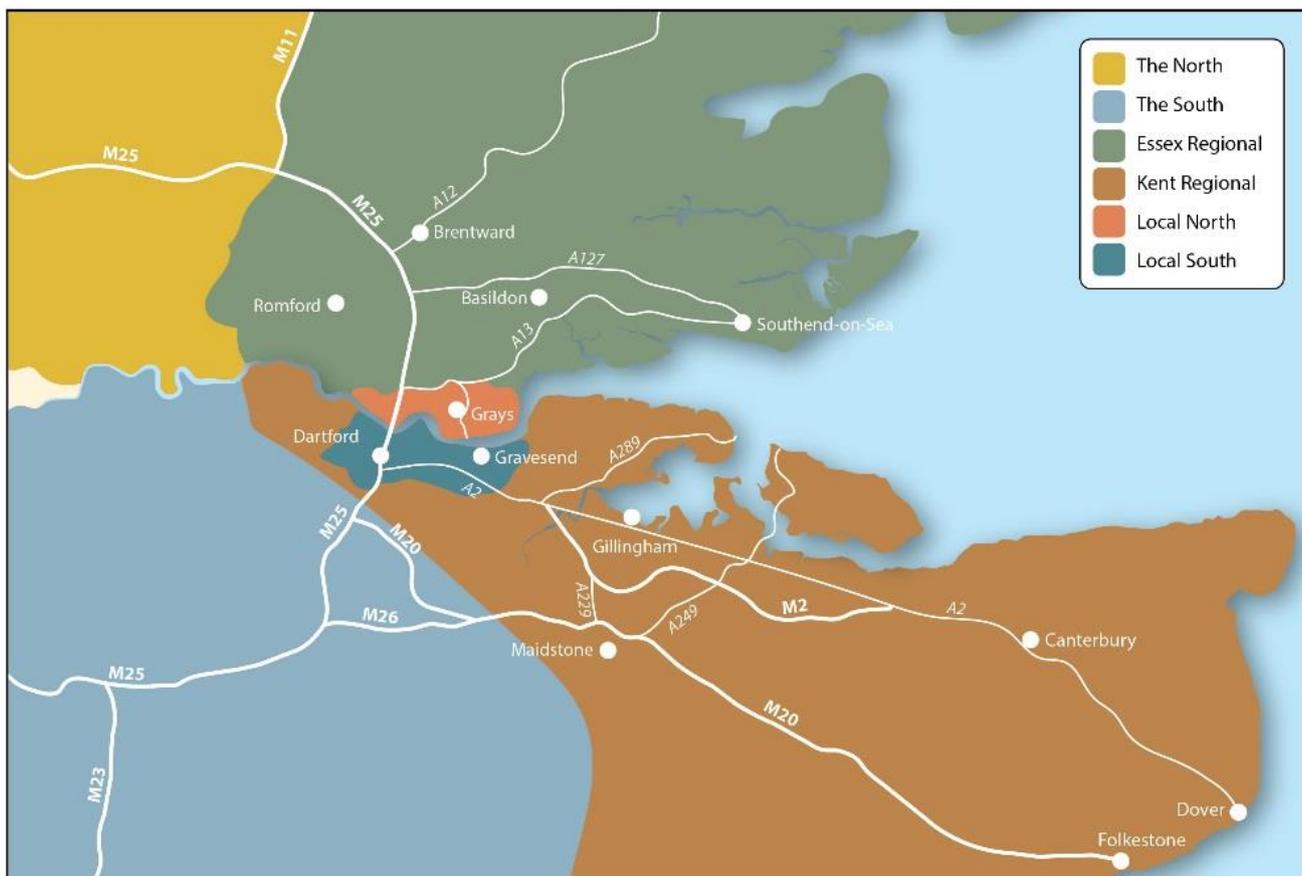


FIGURE 3.5 - NATIONAL, REGIONAL AND LOCAL DESIGNATIONS FOR JOURNEYS ACROSS DARTFORD CROSSING

3.13.6 **Table 3.3** presents the analysis segregated into local, regional and national journeys, north and south of the river as a percentage of the total number of peak journeys over the crossing.

TABLE 3.3 - ANALYSIS OF PEAK JOURNEYS OVER THE CROSSING

| | Local North (J31) | Essex Regional (A13, A127 & A12) | National The North; M25 beyond J27 | Total |
|-----------------------------------|-------------------|----------------------------------|------------------------------------|-------------|
| Local South (J1A/J1B) | 6% | 8% | 6% | 20% |
| Kent Regional (M2/A2 and M20) | 12% | 16% | 16% | 44% |
| National The South, M25 Beyond J3 | 6% | 18% | 12% | 36% |
| Total | 24% | 42% | 34% | 100% |

Peak Traffic Flows (% of journeys)

3.13.7 The analysis shows that the key features of the current usage of the Dartford Crossing in the peak hours are:

- Nearly 40% of journeys over the crossing start or finish in the local area; only 6% start and finish locally (green shading in **Table 3.3**)
- 50% of all journeys over the crossing are between Kent, Essex and national destinations. Kent and Essex represent a significant customer base for the crossing (yellow shading in **Table 3.3**)
- Only 12% of journeys over the crossing are national, north to south, south to north trips (blue shading in **Table 3.3**)

3.14 Congestion at Dartford Crossing

3.14.1 The high level of 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, including high levels of heavy goods vehicles, which present additional challenges for flows in the northbound direction given the geometry of the original tunnel.

3.14.2 **Figure 3.6** shows the existing daily profile of traffic in each direction in April 2016. This demonstrates that the morning peak is between 7am and 8am. The evening peak is between 3pm and 7pm. However, there is high demand throughout the day with a drop of only about 25% between the peaks. It also demonstrates that flows in both the northbound and southbound directions are similar. 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).

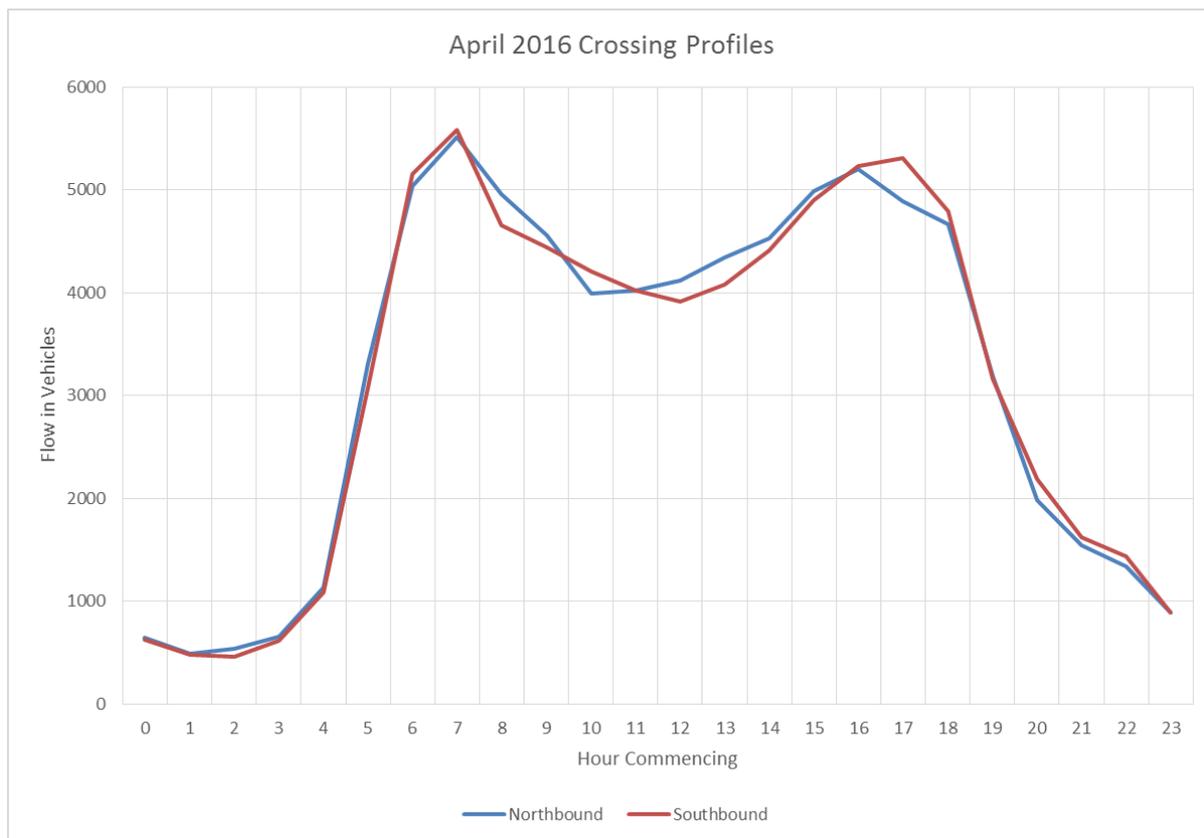


FIGURE 3.6 - DAILY PROFILE OF TRAFFIC FLOW AT THE DARTFORD CROSSING APRIL 2016

3.14.3 **Figure 3.7** shows the relative annual traffic volumes year-on-year compared with 2003 for the crossing and local authority areas adjacent to the crossing. Growth was relatively stagnant during the recession years from 2008 to 2012, but it can be seen that traffic in Essex, Kent, Medway, and Thurrock has been rising at between 2% to 4% per annum since 2012. **Figure 3.8** shows the trend analysis by road type for the country as a whole. This highlights the continued growth in motorway traffic, which now exceeds the pre-recession peak.

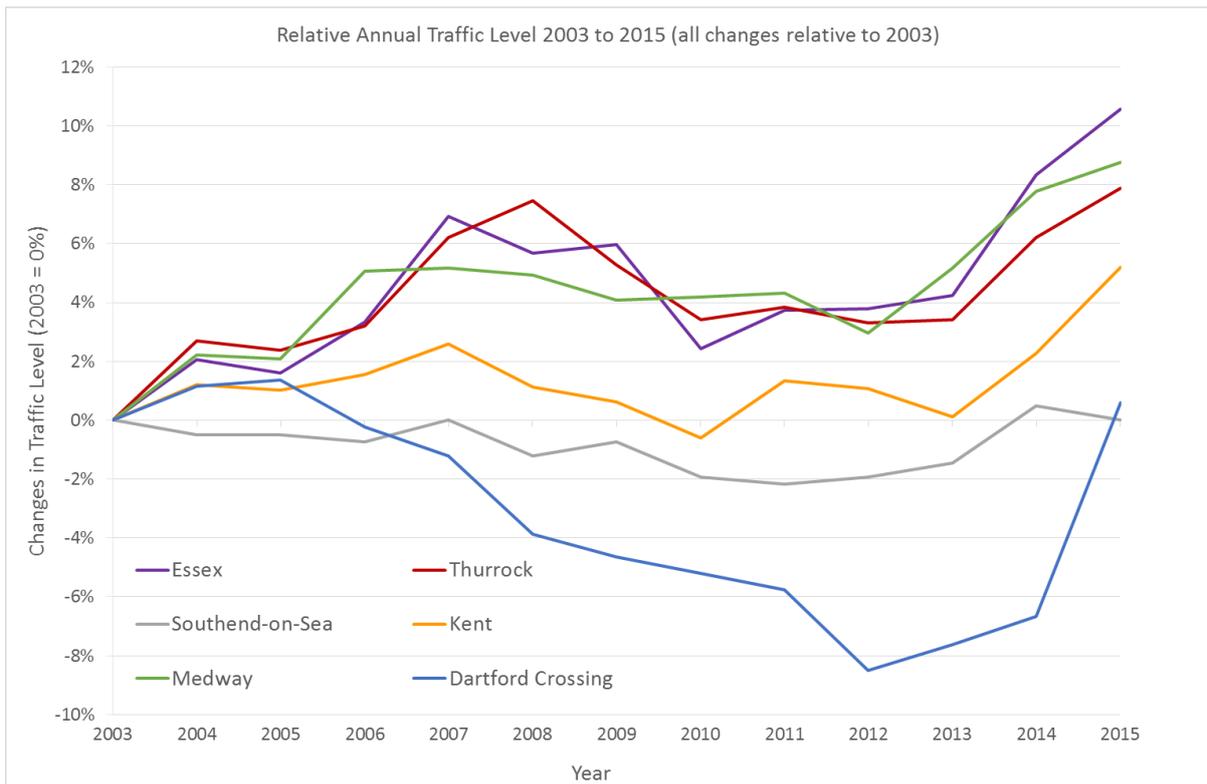


FIGURE 3.7 - RELATIVE ANNUAL TRAFFIC LEVEL CHANGES COMPARING DARTFORD CROSSING WITH ADJACENT AREAS

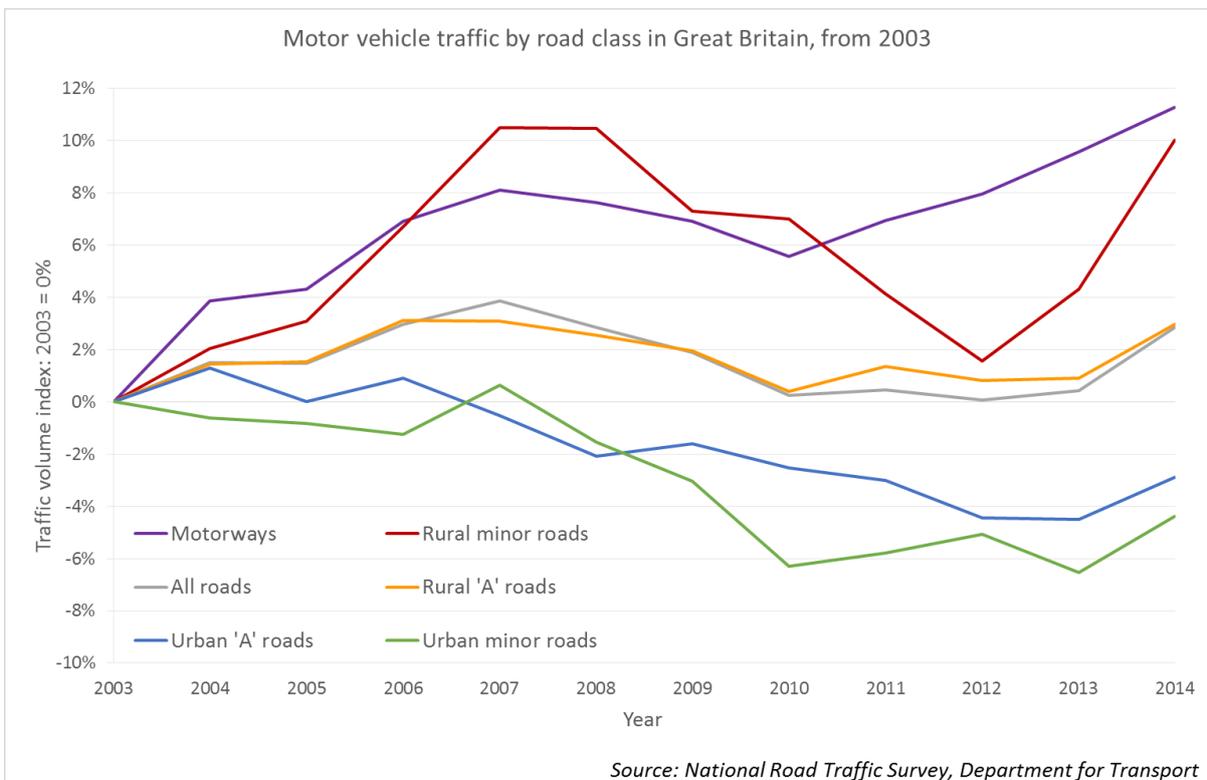


FIGURE 3.8 - RELATIVE NATIONAL TRAFFIC LEVEL CHANGES FROM 2003

3.14.4 Traffic flows at the existing crossing are restricted and cannot increase in the peak periods as there is no spare capacity. Opportunities for regional growth will therefore be suppressed because of the capacity limitations of the existing crossing.

- 3.14.5 Congestion is made worse by additional traffic joining the tunnel approaches at Junction 1a, Junction 1b and Junction 2 as well as traffic weaving to position itself in the correct lanes at the crossing. The resultant queues can extend beyond Junction 2 of the M25 three miles south of the crossing, as well as blocking back along the slip roads of Junctions 1a, 1b and 2. This has the knock-on effect of causing congestion on the local road network in Dartford on the approaches to Junctions 1a and 1b as well as affecting the A2 on the approaches to Junction 2 of the M25.
- 3.14.6 Queues on the northbound approach to the crossing can subsequently consist of around 1,000 vehicles moving slowly towards the tunnels on both the strategic and local road networks. Delays of over 20 minutes on the crossing approach are common and can be even longer for users joining from the local road network.
- 3.14.7 A further consequence of the congestion is that drivers familiar with the local area often try to jump the queues on the main approach roads by leaving the M25 or A282, using local roads and then re-joining the approaches closer to the crossing e.g. re-joining the head of the queue at Junction 1a or using parallel routes between Junction 2 and Junction 1b rather than the congested A282. This increases traffic on the local roads and junctions and leads to increased delays across the network.

3.15 Journey Time Reliability

- 3.15.1 The congestion coupled with the increased likelihood of incidents because of the configuration constraints, gives rise to extremely unreliable journey times. Considering only the section between Junction 2 and Junction 30 of the M25, journey time both northbound and southbound should be about 6 minutes which equates to an average speed of about 50mph. In reality, journey times are extremely unpredictable and during peak periods northbound speeds can drop as low as 10mph on sections of the crossing approaches with travel times more than doubling between Junction 2 and Junction 30.
- 3.15.2 As a result, the Dartford Crossing has historically been one of the least reliable section for users of the SRN.
- 3.15.3 Recent analysis of trends for journeys in 2014 (prior to introduction of the Dart Charge) is shown in **Figures 3.9** (northbound) and **3.10** (southbound) to illustrate this. This shows how weekday speeds between Junctions 2 and 31 are distributed (percent of vehicle kilometres travelled at each speed) for each direction.

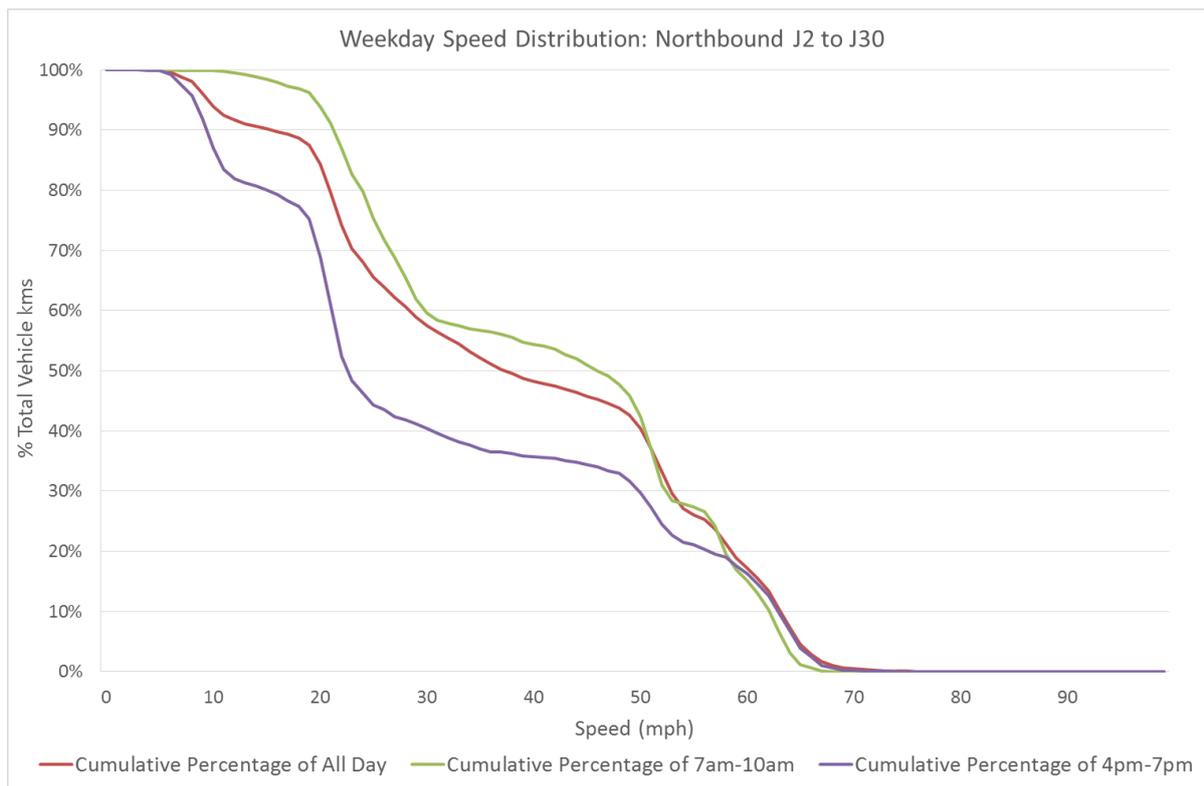


FIGURE 3.9 - NORTHBOUND SPEED DISTRIBUTION

3.15.4 In the northbound direction, over 40% of weekday vehicle kilometres are travelled at speeds below 30 mph. Speeds drop significantly in the PM peak, with over 60% of PM peak (4pm-7pm) travel taking place at speeds below 30 mph.

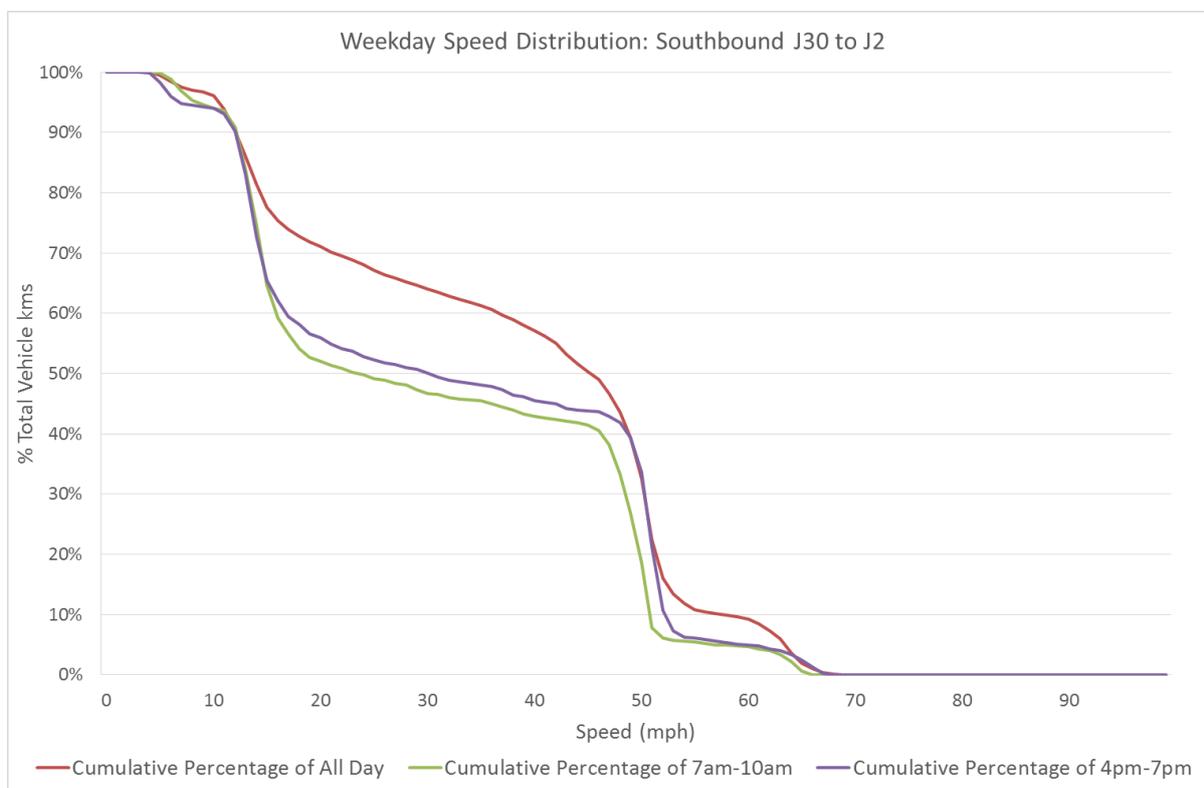


FIGURE 3.10 - SOUTHBOUND SPEED DISTRIBUTION

- 3.15.5 Speeds are slightly higher in the southbound direction, over 35% of daily vehicle kilometres are at speeds below 30 mph. Speeds drop in the AM and PM peaks, with around 50% of travel at speeds below 30 mph during these periods.
- 3.15.6 Equivalent data is not currently available on performance following introduction of the Dart Charge. Illustrative analysis based on blue-tooth monitoring indicates that average speeds in the southbound direction have improved during the peaks, but that northbound speeds remain close to previous levels.
- 3.15.7 Analysis of National Traffic Information Service data for 2015/ 16 confirms that northbound speeds drop from the start of the AM peak and remain low until the end of the PM peak, while southbound speeds show reductions during both peaks, but recover during the inter-peak period. These trends are expected to worsen with time as the traffic flows increase.
- 3.15.8 Average speed data from March 2016 for the northbound carriageway demonstrates that the crossing is sensitive to traffic volumes. On days with lower flow the average journey times between Junction 4 and Junction 29 are up to 5 minutes (20%) faster than the average flow day. On the other hand, days with higher flow levels are around 4 minutes (15%) slower than the average.
- 3.15.9 Whilst the fundamental problem at the crossing is that traffic demand at certain periods of the day exceeds capacity and this is predicted to get worse, the configuration and incremental way that the adjacent network and crossing capacity has evolved over more than 50 years exacerbates the capacity problem.
- 3.15.10 The road network near the crossing results in incidents occurring at a greater frequency in this location than other parts of the SRN. A main cause of the incidents is the complex road layout close to the crossing, with junctions closely spaced, resulting in traffic weaving over relatively short distances.
- 3.15.11 Incidents at the crossing are attributable to a range of issues, most importantly vehicle collisions and breakdowns. Obstruction events are also a significant category, although significant management and education efforts have been undertaken to reduce the number of obstruction related incidents, since introduction of the Dart Charge.
- 3.15.12 **Figure 3.11** shows the recorded level of lane closures (minutes of lane closure per month) for the first eight months of 2016.

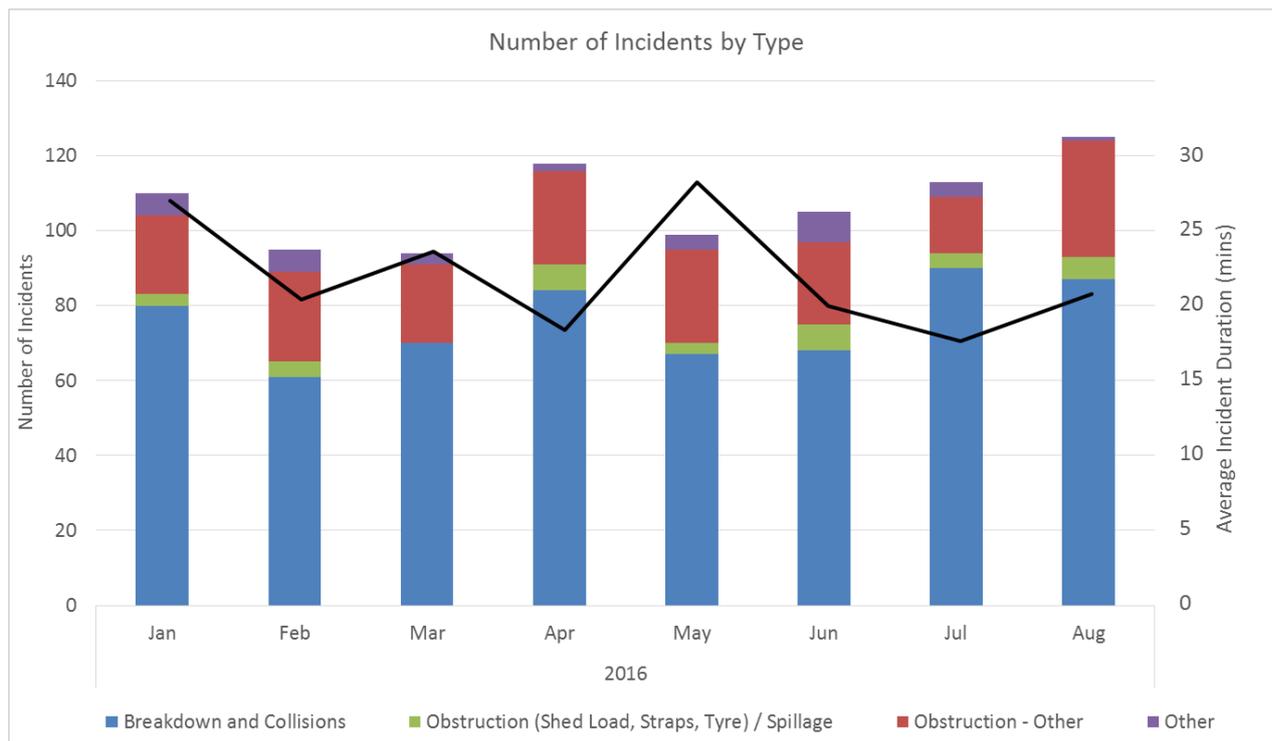


FIGURE 3.11 - 2016 CLOSURE INCIDENT DURATIONS BY INCIDENT TYPE

3.15.13 This shows that average duration of lane closures was approximately 20 minutes. There are, on average, four lane closures each day and therefore lane closures total nearly 1.5 hours per day. Due to the high traffic volumes a lane being closed for a relatively short time usually leads to significant additional congestion which can take between 3 and 5 hours to clear. Congestion of this magnitude results in thousands of lost hours for drivers caught in the delays.

3.15.14 Furthermore, on average once a week, there is a larger incident which takes over an hour to clear. During these events journeys on all roads are severely disrupted and average speeds drop below 10mph on the A282. When an incident of this type occurs slow moving traffic extends back as far as Junction 4 in the case of a northbound incident and Junction 29 with a southbound incident.

3.15.15 Vehicles carrying dangerous substances require vehicle escorts each of which can hold up traffic for 2 minutes (full closures of up to 10 minutes are sometimes required for clear tunnel transits of certain more hazardous loads but these take place overnight). These delays are caused by vehicles being held back to enable the convoys to proceed (refer to Section 3.4). During the period July 2015 to June 2016, the average number of escorting trips (these can involve multiple vehicles) was just under 2,800 per month. The significant majority of escorting trips use the west tunnel, which is less disruptive to access from the vehicle holding area.

3.16 Network Resilience

- 3.16.1 In the event of closures of the Dartford Crossing, the local network is very badly affected and users wanting to cross the River Thames have no real alternatives resulting in gridlock.
- 3.16.2 In the event of partial or full closure, traffic has to be re-routed through the unaffected sections of the crossing or in the worst case, via the Blackwall Tunnel (approximately a 30 mile detour and minimum travel time of 40 minutes). This latter option is only accessible to vehicles under 4m in height and those not carrying dangerous goods, which forces many lorry drivers to drive clockwise around the M25 which, dependent on their destination, could involve an additional journey of up to 100 miles.
- 3.16.3 When incidents and accidents occur, the fact that the crossing is often operating at, or above, capacity means that the crossing has virtually no resilience and users experience greater delays.
- 3.16.4 Due to the three crossing arrangement of two tunnels and one bridge, different operational measures can be put in place to maintain network resilience if a single crossing is closed. However, these measures require time to implement and reduce the total crossing capacity, therefore leading to substantial delays to users.
- 3.16.5 Incidents trap traffic between Junction 2 (northbound) and Junction 30 (southbound) with very limited capacity to turn-back or escape via local roads. Because there are no alternatives, the crossing cannot be restricted to motorway traffic only. The section between Junction 1a and Junction 31 of the M25 (still designated as the A282) is therefore open to non-motorway traffic. Significant demand between the junctions introduces additional weaving movements as other traffic tries to enter or exit at these two junctions.
- 3.16.6 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 3.12** shows the resulting congestion on the network between 1pm and 2pm and between 5pm and 6pm 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. Approximately 40,000 vehicles were delayed for more than 30 minutes resulting in 20,000 lost hours on a single afternoon (>10 person years of lost working time). 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.
- 3.16.7 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, poor tunnel geometry and in the case of the northbound direction the need for traffic management to control restricted vehicles. 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 could 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.

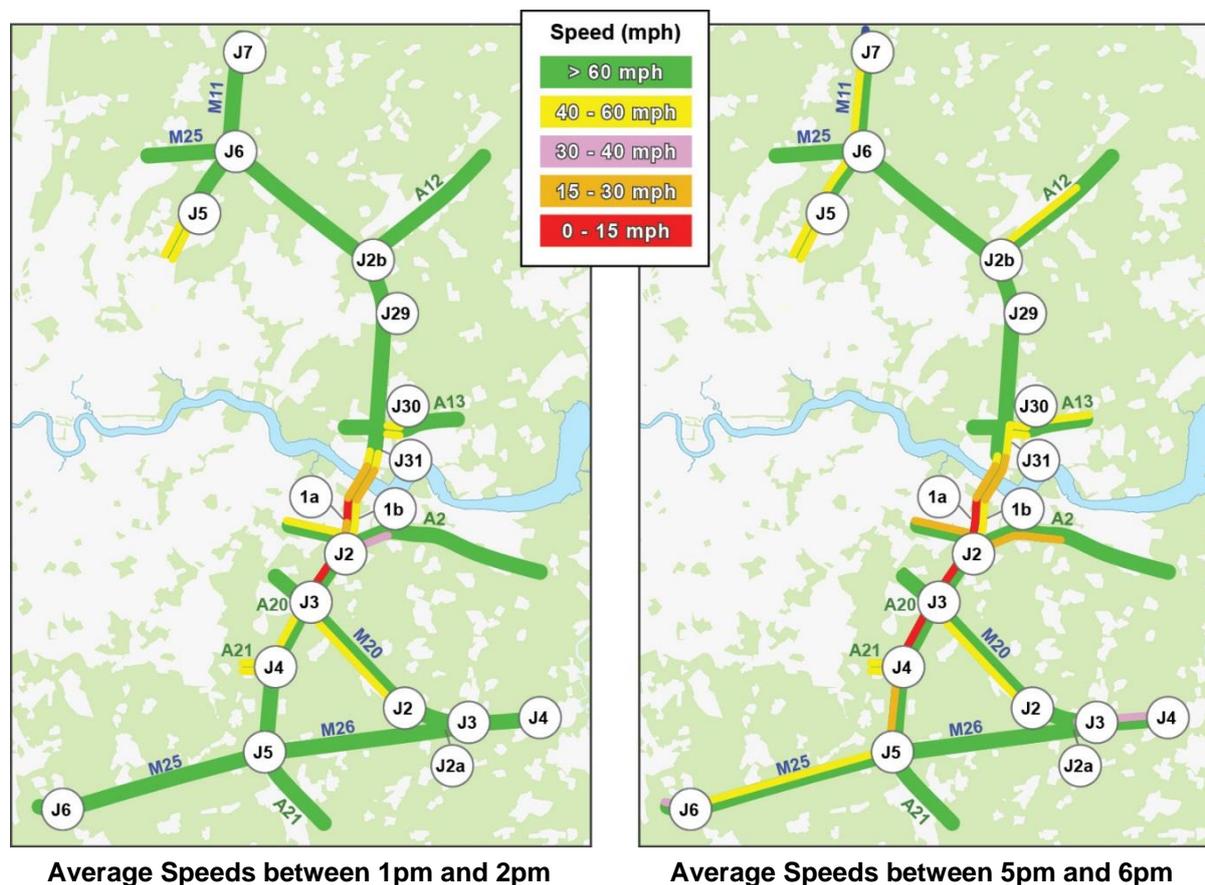


FIGURE 3.12 - ILLUSTRATION OF AVERAGE TRAVEL SPEEDS ON CROSSING AND ADJACENT NETWORK AFTER INCIDENT IN JULY 2014

3.17 Road Safety

3.17.1 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.

3.17.2 These features affect the road safety characteristics of the route. **Figure 3.13** 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.

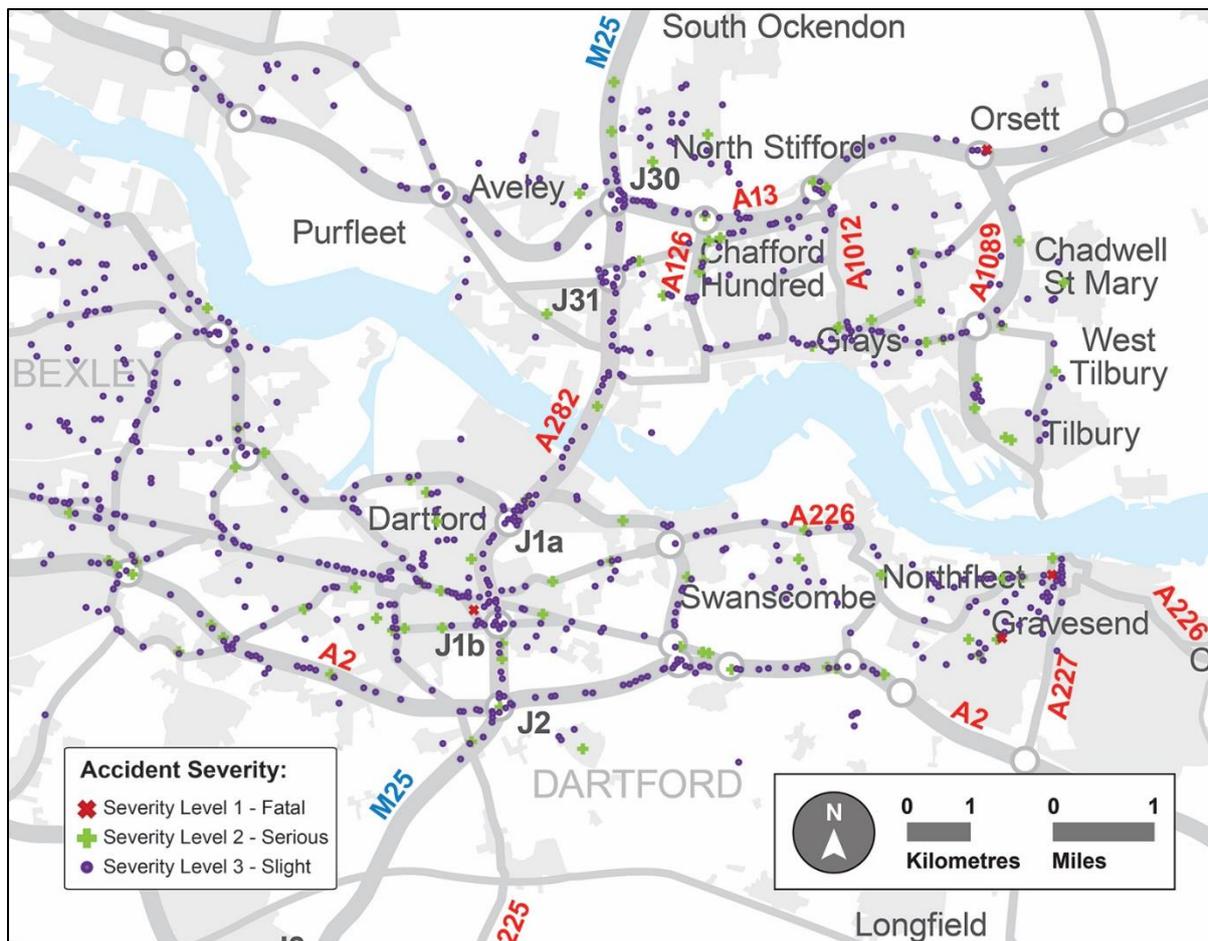


FIGURE 3.13 - LOCATION OF ACCIDENTS IN THE AREA OF THE CROSSING IN 2014

3.17.3 **Figure 3.14** 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. For the A282 between M25 Junctions 2 and 30 the national average rate for motorways has been used as this section of road is part of the M25 ring.

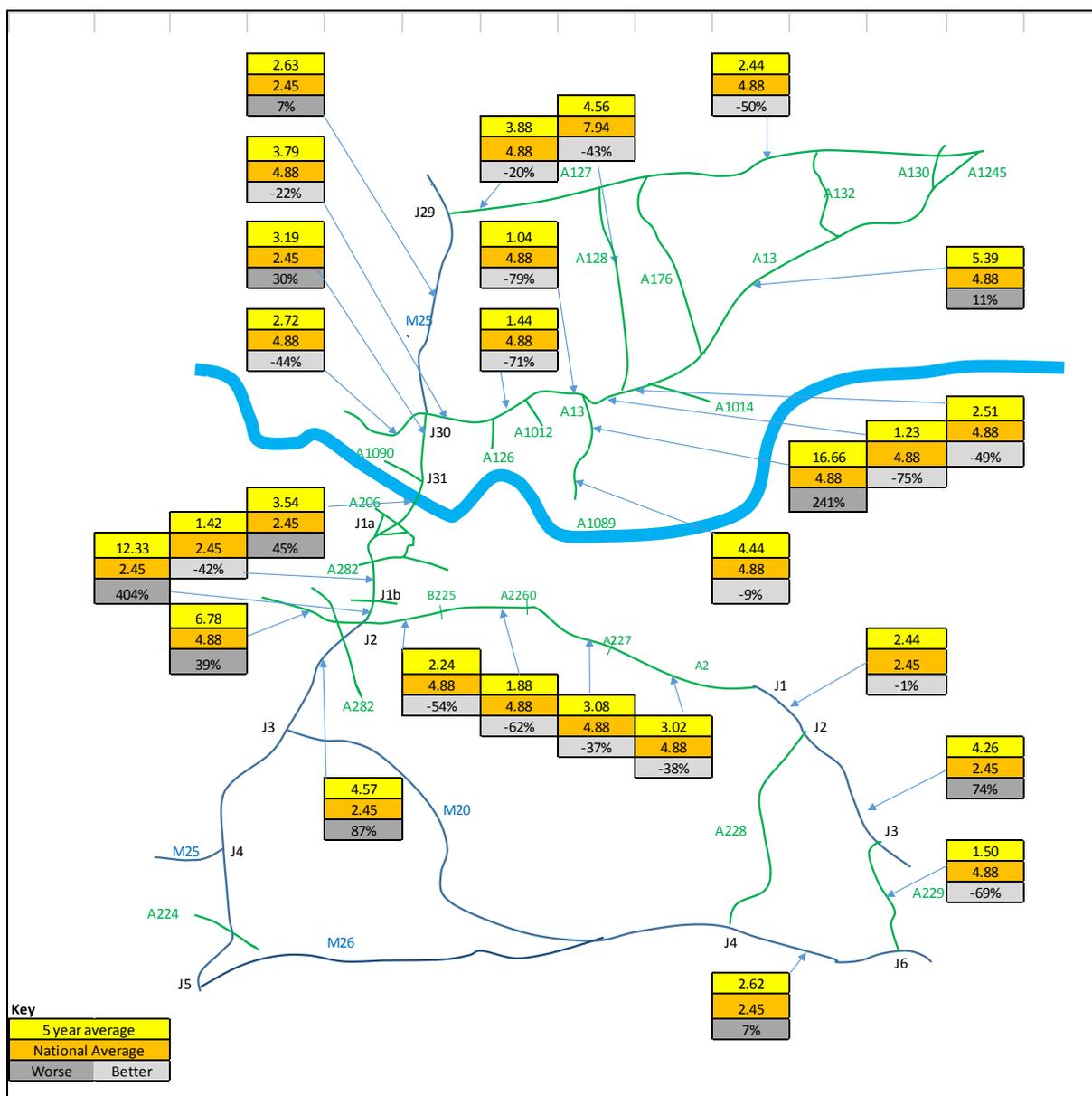


FIGURE 3.14 - 5 YEAR AVERAGE FWI COLLISIONS PER BILLION VEH KM

3.17.4 Figure 3.14 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 45% 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 404% higher than the national average.
- On the A282 Junction 1a - Junction 1b, the existing FWI rate is 42% lower than the national average.
- On the M25 Junction 31 - Junction 30, the existing FWI rate is 30% higher than the national average.

- On the M25 Junction 30 - Junction 29, the existing FWI rate is 7% higher than the national average.

3.17.5 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.

3.17.6 **Table 3.4** below has been compiled from the latest DfT national accident database (<https://data.gov.uk/dataset/road-accidents-safety-data>) for the A282.

TABLE 3.4 - CASUALTY DATA ON A282 BEFORE AND AFTER DART CHARGE

| A282 between M25 Junction 2 and Junction 31 | | | | | |
|---|-----------------|------------------------|--------------------------|-------------------------|--|
| Year | No of Accidents | No of Fatal Casualties | No of Serious Casualties | No of Slight Casualties | Comments |
| 2010 | 63 | 0 | 6 | 84 | Toll booths in operation |
| 2011 | 64 | 0 | 7 | 86 | |
| 2012 | 63 | 2 | 3 | 92 | |
| 2013 | 69 | 0 | 6 | 92 | |
| 2014 | 69 | 0 | 5 | 99 | |
| 2010 – 2014 Average | 65.6 | 0.4 | 5.4 | 90.6 | |
| Jan – Jul 2015 | 33 | 0 | 5 | 36 | Automated tolls introduced but ongoing works to remove toll booths |
| Aug – Dec 2015 | 20 | 0 | 2 | 26 | Toll booths removed |
| Total 2015 | 53 | 0 | 7 | 62 | |
| % change | -19% | - | +30% | -32% | |

3.17.7 Dart Charge was introduced at the end of November 2014 but the works to remove the toll booths were not completed until July 2015. The data for the 7 months to end of July 2015 could therefore be affected by the ongoing works.

3.17.8 Using the full year's data for 2015, the number of accidents post Dart Charge has reduced by 19%; serious casualties have increased by 30% and the slight casualties have fallen by 32%.

3.17.9 Data will continue to be monitored on the road network over a 3 year period which will provide a statistically more reliable comparison to determine the road-user safety impact in relation to the introduction of Dart Charge. This data will be assessed as part of the next phase of the scheme.

3.17.10 From **Figure 3.14**, 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)

3.17.11 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).

3.17.12 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.

3.18 Non-Motorised Users

3.18.1 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.

3.18.2 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.

3.19 Geology and Mining

3.19.1 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**.

3.20 Existing Utilities

3.20.1 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**.

3.21 Operation and Maintenance

Highway operations and maintenance

- 3.21.1 There are two Highways England maintenance areas within the Study Area – Area 5 (M25) and Area 4 (refer to Figure 1 in **Appendix 2.6**). 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 A-one+ Integrated Highway Services (Colas/ Costain/ CH2MHill).
- 3.21.2 The existing tunnel and bridge systems are operated from the Dartford River Crossing Control Centre located at the southern end of Dartford Crossing.
- 3.21.3 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 QEII 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.
- 3.21.4 A Traffic Management Cell manages the passage of restricted vehicles in the tunnels, as described in Section 3.4.
- 3.21.5 Further details on highways operation and maintenance are provided in **Appendix 2.6**.

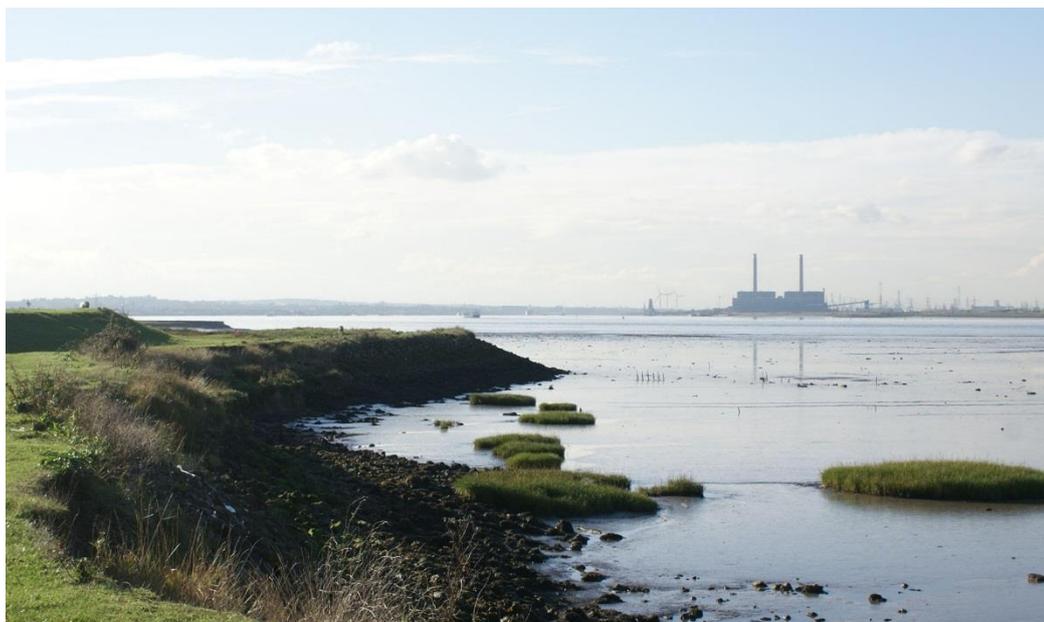
River Operations

- 3.21.6 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.
- 3.21.7 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 the Study Area.
- 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).

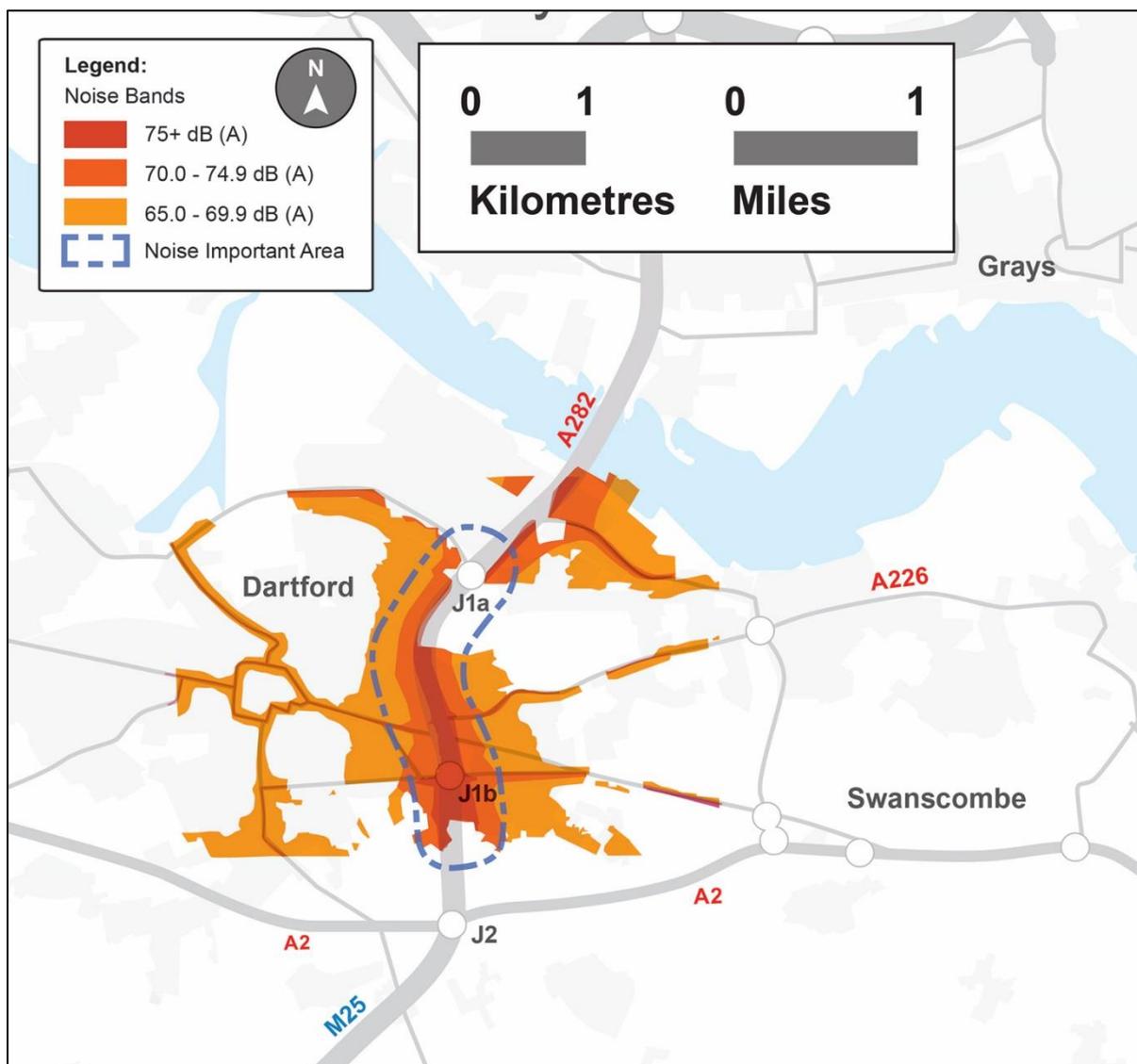


FIGURE 4.1 - EXISTING NOISE LEVELS ALONG THE A282 CORRIDOR AT DARTFORD

- 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.

- 4.2.7 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.
- 4.2.8 There are four NIAs within the northern section of the Study Area, along the A13 and A1089, north of Grays and Chadwell St Mary.
- 4.2.9 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

- 4.2.10 The presence of NIAs 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 Urban and Rural 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 µg /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 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.

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.

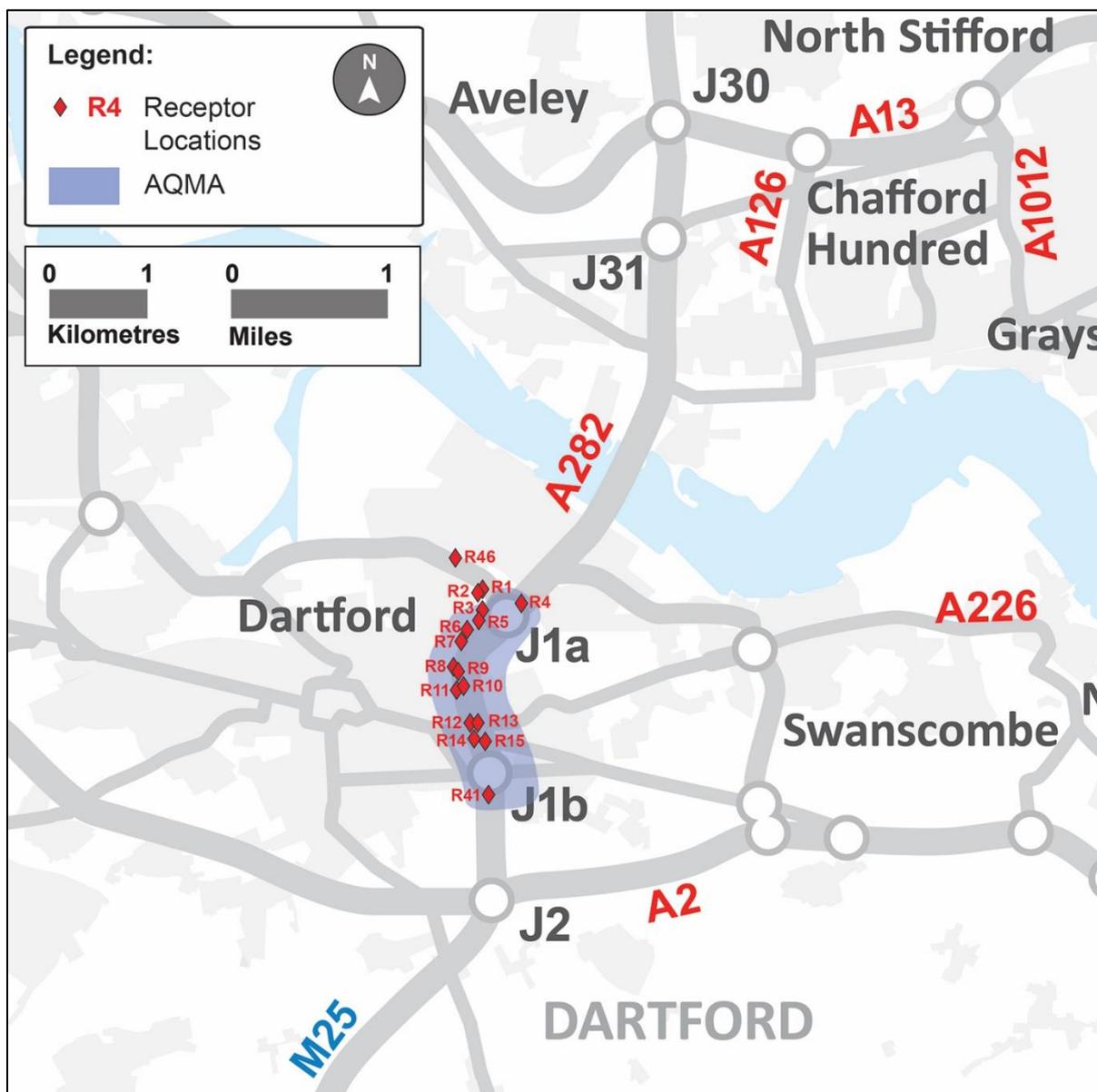


FIGURE 4.2 - AIR QUALITY RECEPTORS SOUTH OF EXISTING CROSSING, JUNCTIONS 1A-1B

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**).
- 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*¹.

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

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.

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 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.

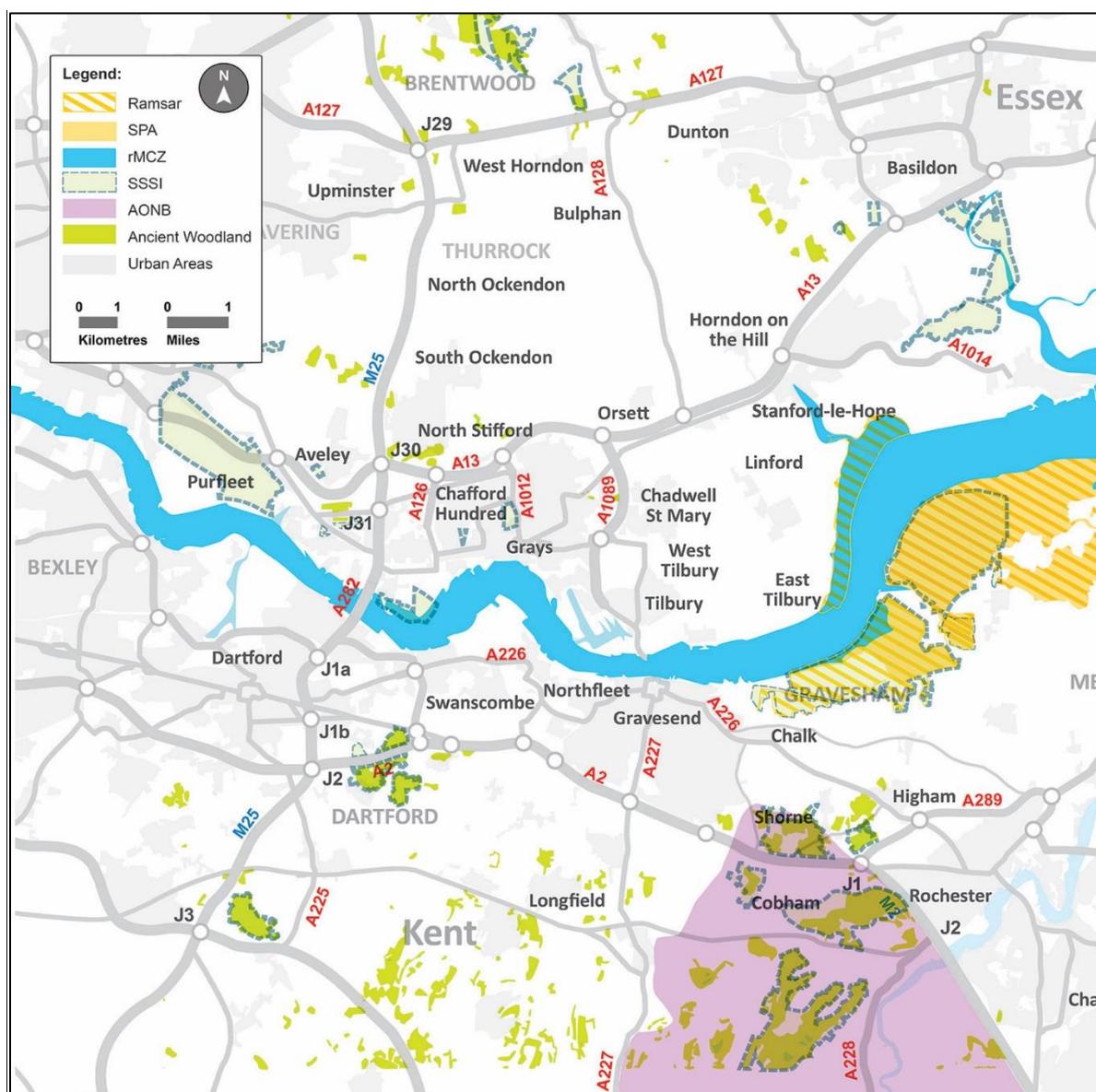


FIGURE 4.3 - KEY LANDSCAPE AND BIODIVERSITY CONSTRAINTS

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 settlements. 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 Area 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 to the west and South Ockendon to the east 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

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

(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 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 (in particular 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 known 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 4.4 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 designation of 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 north west 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 parkland 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 long-eared 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 and 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 rise 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 Introduction

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. Traffic problems at the existing crossing and the need for improvements have been recognised, and the need for a new crossing is included in the *National Infrastructure Delivery Plan 2016-2021*. (March 2016).

5.2 European Policy

5.2.1 The EU white paper *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.

5.2.2 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.

5.2.3 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. It is not yet clear how the UK's decision to leave the European Union will impact on the TEN-T network and funding.

Habitats Regulations

5.2.4 The Thames Estuary and Marshes SPA and Ramsar sites as well as other European designated sites lie within the Study Area. 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), and
- 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.

- 5.2.5 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.
- 5.2.6 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

- 5.2.7 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 were submitted to the European Commission in December 2015.

Water Framework Directive

- 5.2.8 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.

5.3 National Policy

National Infrastructure Delivery Plan (2016) (NIDP)

- 5.3.1 The NIDP (Infrastructure and Projects Authority) updates and replaces the previous *National Infrastructure Plan (2014)*, setting out infrastructure spend by sector over the next 5 years to 2010/ 21. This is being undertaken through the newly established IPA, tasked with delivering the Government's infrastructure priorities. In addition to the Top 40 priority projects, the Plan identifies a number of other priority projects, including Lower Thames Crossing which are currently in development with further scoping work

required before construction work can commence, noting that in some instances this may be post 2020/ 21.

National Policy Statement for National Networks (NPSNN) (December 2014)

- 5.3.2 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.
- 5.3.3 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 network.
- 5.3.4 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.
- 5.3.5 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.
- 5.3.6 The NPSNN has and will continue to 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)

- 5.3.7 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 that estimates show that traffic levels on strategic roads will be higher in 2040 than today. The 2015 National Road Traffic Forecasts show growth on the SRN of 29% to 60% between 2010 and 2040, with 12% to 51% growth on other principal roads and 10% to 54% on minor roads. The Action for Roads document also says 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

- 5.3.8 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.
- 5.3.9 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 Single Departmental Plan 2015 to 2020

- 5.3.10 Key objectives of the Department for Transport's Single Departmental Plan are improving journeys and in boosting economic growth and opportunity, recognising that the reliability of the transport system is crucial for business confidence and that better transport provides opportunity and increases productivity. The Plan notes that future investment decisions include delivering transport schemes in the National Infrastructure Plan, implementing the first Road Investment Strategy and maintaining and renewing the strategic road network.

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

- 5.3.11 The DfT published '*The Strategic Road Network and the Delivery of Sustainable Development,*' (2013) in which it advises that the former 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.

House of Commons Transport Committee "Strategic River Crossings"

- 5.3.12 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.*

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

- 5.3.13 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.

5.4 Regional Policy

- 5.4.1 The South East Local Economic Partnership (SELEP) 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 SELEP recognises that these national network improvements are fundamental to the future prosperity of the SELEP area and the nation as a whole.

5.5 Local Planning and Transport Policy

- 5.5.1 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.
- 5.5.2 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 Statement</i> (2015-2020) supports business growth with improved transport. <i>The Local Transport Plan for Kent 2011-16 (April 2011)</i> recognises the Dartford Crossing as one of the most strategic connections and worst bottlenecks and that the Council has identified a clear and pressing need for LTC. <i>Kent and Medway Structure Plan</i> (2006) seeks Government support for LTC and protection of Marine Conservation Zone. |
| Greater London Authority (Locations A and C) |
| Adopted <i>London Local Plan - consolidated with options since 2011</i> (March 2016) 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. A new London Plan is being developed for the new Mayor elected in May 2016 |

| |
|--|
| Brentwood Borough Council (Location C) |
| <i>Corporate Plan, 'Vision for Brentwood'</i> (2016-2019) promotes economic growth and sustainable development. <i>Replacement Local Plan</i> (2005) provides guidance on development in green belt, safeguarding of woodlands and listed buildings. The strategic objectives of the draft Local Plan (January 2016) include safeguarding the green belt from inappropriate development and securing the delivery of essential infrastructure, including transportation schemes. |
| Dartford Borough Council (Location A) |
| <i>Corporate Plan</i> (2014-2017) 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. |
| Gravesham Borough Council (Locations A and C) |
| <i>Corporate Business Plan</i> (2015-19) sets out a commitment to facilitate the regeneration of the transport network and physical infrastructure. <i>Adopted Core Strategy</i> (2014) highlights the importance of Dartford Crossing as one of UK's most important strategic connections. Policy guidance is provided on Green Belt, Kent Downs AONB, heritage assets and sites designated for biodiversity value. |
| Havering Borough Council (Location C) |
| <i>Corporate Plan</i> (2016 -2017) seeks to develop a new Local Plan which balances attractive development with protection for the green belt. <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. |
| Medway Council (Location C) |
| <i>The Council Plan</i> (2016–2017 to 2020-21) includes, as a priority, maximising regeneration and economic growth. <i>Local Plan</i> (2003) provides guidance on green belt and Kent Downs AONB. |
| Thurrock Borough Council (Locations A and C) |
| <i>Corporate Plan</i> (2016-2017) includes, as a Priority Project working with partners to identify and provide for infrastructure needs including the Lower Thames Crossing. <i>Adopted Core Strategy and Policies for Management of Development, as amended</i> (2015) provides guidance on listed buildings scheduled monuments and green belt. <i>Transport Strategy</i> (2013-2026) aims to improve air quality. |
| London Borough of Bexley (Location A) |
| <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. |

6 Existing Land Use

6.1 Introduction

- 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.

6.2 Location A

- 6.2.1 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.
- 6.2.2 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.
- 6.2.3 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.
- 6.2.4 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.
- 6.2.5 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.
- 6.2.6 Major transport infrastructure is present throughout the area including the existing M25, A282 Dartford Crossing QEII Bridge and tunnels, High Speed 1 (HS1) railway line and the A13 arterial route.

6.3 Location C

- 6.3.1 The southern bank of the River Thames in the Study Area is located within the county of Kent and the unitary authority of Medway. The area is generally open countryside with scattered urban settlements, particularly Gravesend to the west and Rochester to the east.
- 6.3.2 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.

- 6.3.3 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.
- 6.3.4 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.
- 6.3.5 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.

6.4 Community Land Use

- 6.4.1 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 recent national and regional economic trends and summarises the socio-economic characteristics of the local area impacted by the LTC options. The analysis was carried out to provide some socio-economic context for the appraisal of LTC options. The need for such analysis was highlighted in the 2014 *Transport investment and economic performance, implications for project appraisal report* for DfT which recommended that transport appraisals should include information about local economic conditions.⁵
- 7.1.2 The regional analysis covers London, the South East and East of England. The local analysis includes two counties (Kent and Essex) and three unitary authorities (Medway, Thurrock and Southend-on-Sea).
- 7.1.3 The indicators that are discussed include population, GDP growth, productivity, earnings, employment, inflation, house prices, educational attainment and deprivation. These are key inputs used in the appraisal of the range of economic and social benefits that arise from the LTC options. In addition the local section includes information on key industrial clusters and employment and housing policy targets.
- 7.1.4 The findings from the analysis of national, regional and local economic trends have been used to inform the appraisal of wider economic and social impacts (refer to Post-Consultation SAR Volume 5) and the complementary Spatial Computable General Equilibrium (S-CGE) economic modelling of LTC options.

7.2 National Economic Trends

- 7.2.1 This section summarises trends in key UK macroeconomic indicators in the period since the 2008/ 09 global financial downturn. The recovery from this downturn has largely shaped recent UK economic policy and trends.
- 7.2.2 Between 2008 and 2015 the UK's population increased by 3.3 million people from 61.8 million to 65.1 million. This 0.75% annual growth, which is almost three times higher than the 0.27% annual growth between 1971 and 2008, is a result of a higher natural increases (a higher birth rate than death rate) and higher net migration into the UK.⁶
- 7.2.3 Since the end of the downturn in 2009, economic growth has resumed, but the recovery was slow and quarterly growth has, on average, been at a lower rate (0.5%) than in the period prior to 2008 (0.7%). Growth has also

⁵ Venables A, Laird J, Overman H (2014) Department for Transport, Transport investment and economic performance, implications for project appraisal

<https://www.gov.uk/government/publications/transport-investment-and-economic-performance-tiep-report>

⁶ ONS, 2016 United Kingdom population mid-year estimate

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/timeseries/ukpop/pop>

- been more erratic, with several quarters between 2010 and 2012 recording low, or declining, GDP growth.⁷
- 7.2.4 Productivity growth has also recovered with GVA per head increasing by an average of 2.9% per annum between 2010 and 2014. London and the South East experienced the highest productivity gains with average annual growth of 3.7% and 3.2% per annum respectively. However the UK's average annual growth in GVA per head in this period was lower than the 5.1% annual average achieved in the five years prior to the downturn.⁸
- 7.2.5 Employment has grown strongly, increasing from a low employment rate of 70.1% in 2010-11 to reach a record rate of 74.5% in 2015-16. This compares to the 72.5% average annual employment rate for the five pre-recession years.⁹ Between 2009 and 2014 employment levels in most economic sectors have risen. The largest increases have been in the professional, scientific and technical sector (+18.3%) and business administration and support sector (+18.2%). Conversely the largest falls in employment have been in public administration and defence (-13.3%) and construction (-6.9%).¹⁰
- 7.2.6 Since 2011 prices have fallen sharply with monthly inflation declining to zero in 2015 and edging up only slightly to around 0.5% in 2016.¹¹
- 7.2.7 After the downturn earnings growth in the period to 2014 was somewhat static with average annual increases of around 1.5%. Whilst earnings growth since 2014 has increased to nearer 2.5%, in real terms average weekly earnings are still below 2008 levels.^{12,13}
- 7.2.8 Education levels have increased sharply since the beginning of the financial downturn, with over 7% more people nationally possessing at least NVQ1 level qualifications since 2008.¹⁴ Further, 73.1% of the population aged 16-64 have attained NVQ3 equivalent level qualifications or higher, an increase of 8.9% since 2008.

⁷ ONS, 2016 Gross domestic product, preliminary estimate: April to June 2016

<http://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/grossdomesticproductpreliminaryestimate/aprtojune2016>

⁸ ONS 2015 Regional Gross Value Added (Income Approach), 1997 to 2014

<https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedincomeapproach>

⁹ ONS, 2016, UK Labour Market: September 2016

<http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/sepember2016#employment>

¹⁰ ONS, 2015, Business Register and Employment Survey (BRES) provisional results: 2014

<http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/businessregisterandemploymentsurveybresprovisionalresults/2015-09-24#industry-comparison>

¹¹ ONS 2016 UK consumer price inflation: August 2016

<https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/consumerpriceinflation/aug2016>

¹² ONS, 2016, UK Labour Market: September 2016

<http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/sepember2016#employment>

¹³ ONS, 2016, Supplementary analysis of average weekly earnings: July 2016

<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/articles/supplementaryanalysisofaverageweeklyearnings/july2016>

¹⁴ 2011 ONS (accessed 2016) Annual Population Survey

7.3 Regional Economic Trends

- 7.3.1 The LTC Study Area stretches across three regions: London, South East and the East of England. Between 2008 and 2015 London's population grew twice as quickly in annual percentage terms as the UK total, rising from 7.8 million to 8.6 million, an increase of over 100,000 people per year. In the same period the population of the South East grew from 8.4 million to 8.8 million and the East of England population grew from 5.7 million to 6.76 million. Overall the population of the three regions increased by 2.3 million over seven years, an average annual growth rate of 1.5%.¹⁵
- 7.3.2 All key regional economic indicators show that the three regions are performing either above or close to the national average. GVA in South East grew by 22.5% from 2009 until 2014 and by 18.5% in the East of England. For the same period London experienced higher growth of 29%.¹⁶
- 7.3.3 The three regions have the highest productivity levels in England. Compared to an Index of 100 in 2014, London is the highest-performing region in the country, with a national productivity score of 129.4, whilst the South East had a score of 107.4. Prior to the downturn, productivity in the East of England was in line with the national average, but has since declined to 96.8 in 2014.¹⁷
- 7.3.4 Employment rates in the South East (77.2%) and East of England (77.0%) are higher than the national average (73.6%). The employment rate in London is slightly lower than average at 73.2% (April 2015-May 2016).¹⁸ 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 compared to those in their local area.
- 7.3.5 Despite the national decline in the construction sector, the sector experienced 24% growth in GVA across the three regions since 2009. Construction employment also remained strong in many of the non-London LTC districts between 2009 and 2014.¹⁹
- 7.3.6 In the South East, 12% of regional GVA comes from the wholesale and retail sectors. While construction accounts for just 6.8%, it grew by 30% in the five years since 2009. In the East of England, the largest shares of GVA in 2014 were for real estate (13%) and wholesale and retail (12%). Construction accounts for 8% of regional GVA, but grew by 25% in the period from 2009 to 2014. Construction contributes just only 4.6% to London's GVA because of the large size of the financial and insurance sectors which have an 18% share of GVA. However, the construction sector grew by 40% in the period between 2009 and 2014.²⁰

¹⁵ 2015 ONS (accessed 2016) – Population Estimates for UK, England and Wales, Scotland and Northern Ireland
<http://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland>

¹⁶ 2015 ONS (accessed 2016) –Regional Gross Value added (Income Approach)
<http://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedincomeapproach>

¹⁷ Based on analysis of ONS (2016) Nominal (smoothed) GVA per hour worked indices, 2004 – 2014

¹⁸ Apr 15 – Mar 16 ONS (accessed 2016) Annual Population Survey
<https://www.nomisweb.co.uk/query/construct/components/date.asp?menuopt=13&subcomp>

¹⁹ Refer to footnote 24

²⁰ 2015 ONS (accessed 2016) - Regional Gross Value Added (Income Approach)
<http://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedincomeapproach>

7.3.7 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 below.

7.4 Local Economic Trends

Kent

7.4.1 A summary of Kent's socio-economic indicators is provided in **Table 7.1**. GVA in Kent was £20,096 per annum in 2014, which was lower than the national average (£24,616 per annum), although this is partly skewed by the significantly higher value in London at £42,666 per annum.²¹ Resident wages in Kent were above the UK average of £627 in 2015 at £668 per week, whereas workplace earnings were lower than the UK average at £588 per week.²² This indicates that many people commute to higher paid jobs in London.

7.4.2 In terms of industrial structure the transport distribution, real estate and public administration sectors have the largest shares of GVA in the county. Transport distribution and logistics is also a key cluster based on location quotient and business count data.²³

7.4.3 Kent and Medway are often considered together in terms of policy and indicators because Medway was historically part of Kent until it became a unitary authority in 1998. For example, their employment and housing targets are combined. The latest estimates for these 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 that a total of 47,500 new jobs and 23,000 new homes are projected for Kent and Medway between 2013 and 2020. 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.²⁴

TABLE 7.1 - SOCIO-ECONOMIC INDICATORS - KENT

| Key indicators | Kent | UK | Source |
|---|---------|------------|---|
| Working Age Population (Apr 2015- Mar 16) | 924,900 | 40,904,500 | ONS (2016) Annual Population Survey (APS) |
| GVA per Head (2014) | £20,096 | £24,616 | ONS (2016) Regional Gross Value Added |

²¹ ONS (2014) Regional Gross Value Added (Income Approach) NUTS3 Tables

<http://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2015>

²² 2014-2015 estimate, ONS (accessed 2016) Annual Survey of Hours and Earnings (resident & workplace)

<https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?theme=25>

²³ A location quotient is a way of quantifying how concentrated a particular industry, cluster, occupation, or demographic group is in a region as compared to the national average.

²⁴ South East Local Enterprise Partnership (2014) Kent and Medway Growth Deal

http://www.southeastlep.com/images/uploads/resources/KENT_AND_MEDWAY_South_East_LEP_-_Growth_Deal_and_Strategic_Economic_Plan_WEB-6.pdf

| Key indicators | Kent | UK | Source |
|--|--|--|--|
| | | | (Income Approach) NUTS3 Tables |
| Employment & rate (Apr 2015-Mar 16) | 690,800 (74.7%) | 30,093,100 (73.6%) | ONS (2016) 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 (2015) | £668 | £627 | ONS (2016) Annual Survey of Hours and Earnings |
| Average workplace weekly earnings (2015) | £588 | £627 | NOMIS (2016) Annual Survey of Hours and Earnings |
| Proportion of LSOAs in Kent that are in the top 20% most deprived in the UK (2010) ²⁵ | 11% | N/A | Communities & Local Government (2010) Indices of Multiple Deprivation |
| Median house sale price (2014) | £243,500* | £192,000** | *ONS (2014) House Price Statistics for Small Areas, 1995–2014 **ONS (2016) Explaining the impact of the new UK house price index:2016 |
| Key industrial clusters in Kent | Transport distribution and logistics | | HHJV 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) Medway target is 17,930 (by 2028) | | |

Essex

7.4.4 A summary of socio-economic indicators in Essex is given in **Table 7.2**. Like Kent, there is a notable difference between the earnings of the resident based population and workplace population in Essex. Local residents enjoyed above average mean weekly incomes of £689 in 2015 compared to the UK average of £627, possibly due to high levels of commuting to London and a higher than national average employment rate at 76.2% in 2013 compared to the UK average of 73.6%.^{26,27} In comparison local workplace based workers have lower than average incomes. GVA per head in 2014 based on the workplace population at £20,224 per annum was lower than

²⁵ Lower Super Output Areas (LSOAs) are areas, defined by the Office for National Statistics, used to produce local area statistics for populations of between 1,000 and 3,000 people.

²⁶ 2014-2015 estimate, ONS (accessed 2016) Annual Survey of Hours and Earnings (resident & workplace)
<https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?theme=25>

²⁷ Apr 2015 – Mar 2016 ONS (accessed 2016) Annual Population Survey (resident based)
<https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?theme=28>

the UK average of £24,616 per annum.²⁸ The statistics paint a picture of a county that has varied wealth with a dependency on commuting to London for higher value jobs.

- 7.4.5 Despite income levels being higher than the national average, education levels of the resident-based population are lower than the UK average with just 23% achieving a Level 4 qualification or above compared to 27% nationally.²⁹
- 7.4.6 The industrial structure of Essex is also relatively similar to that in Kent. Key industries include distribution transport and logistics, construction and real estate, all of which have a higher share of local GVA than the national average. An analysis of industry clusters based on employment shares relative to the national average and business counts supports the GVA data, indicating that there are clusters of activity in the distribution transport and logistics, manufacturing and construction sectors. When industry size is measured by the total number of employees rather than employment share, the economic structure of Essex is 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.³⁰
- 7.4.7 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 LTC Study Area.

TABLE 7.2 - SOCIO-ECONOMIC INDICATORS - ESSEX

| Key indicators | Essex | UK | Source |
|---|--|--|--|
| Working Age Population (Apr 2015- Mar 16) | 880,700 | 40,904,500 | ONS (2016) Annual Population Survey (APS) |
| GVA per Head (2014) | £20,224 | £24,616 | ONS (2016) Regional Gross Value Added (Income Approach) NUTS3 Tables |
| Employment & rate (Apr 2015- Mar 16) | 671,300 (76.2%) | 30,093,100 (73.6%) | ONS (2016) 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 (2015) | £689 | £627 | ONS (2016) Annual Survey of Hours and Earnings |
| Average workplace weekly earnings (2015) | £612 | £627 | ONS (2016) Annual Survey of Hours and Earnings |

²⁸ 2015 estimate, ONS (2016) Regional Gross Value Added (Income Approach) NUTS3 Tables

<http://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2015>

²⁹ A Level 4 qualification would be a Certificate of Higher Education, Key Skills Level 4, NVQ Level 4, BTEC Professional award, certificate and diploma Level 4, and HNC.

³⁰ Essex County Council (2012) Strategic Economic Plan

<http://www.essex.gov.uk/Your-Council/Strategies-Policies/Pages/Economic-Plan-for-Essex.aspx>

| Key indicators | Essex | UK | Source |
|---|--|------------|--|
| Proportion of LSOAs in Essex that are in the top 20% most deprived in the UK (2010) | 6.0% | N/A | Communities & Local Government (2010) Indices of Multiple Deprivation |
| Median house sale price (2014) | £195,000* | £192,000** | *ONS (2014) House Price Statistics for Small Areas, 1995–2014 **ONS (2016) Explaining the impact of the new UK house price index:2016 |
| Key industrial clusters in Essex | Distribution, logistics and transport; Manufacturing; construction | | HHJV 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 | | |

Medway

- 7.4.8 Medway is a unitary authority south of the Thames which was originally part of the County of Kent. A summary of Medway's socio-economic indicators is given in **Table 7.3**. Similar to Kent, workplace earnings at £576 per week in 2015 were lower than the national average, although resident earnings at £613 per week are closer to the UK average.³¹ Medway experienced a 6% drop in productivity from 2004 to 2012. This is in part due to the recession and partly due to the gradual decline of manufacturing in the area. Medway is still struggling to recover from the downturn with an unemployment rate of 9.1% in 2015-16 that is much higher than rates in the rest of the Study Area, which range between 5.3% in Kent to 6.2% in Thurrock.³² Skills are also in short supply with just 19% of Medway's resident population educated to Level 4 or above. As a result 14% of Medway's Lower Super Output Areas (LSOAs) are in the top 20 most deprived in the country.
- 7.4.9 In terms of industrial structure, Medway has a larger than average share of GVA in the transport and distribution, production and public administration, education and health sectors. The transport and distribution sector is a key cluster for Medway with both a high location quotient and a high number of businesses.
- 7.4.10 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

³¹ 2014-2015 estimate, ONS (accessed 2016) Annual Survey of Hours and Earnings (resident & workplace)
<https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?theme=25>

³² 2015-2016 estimate, ONS (accessed 2016) Annual Population Survey
<https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?theme=28>

new homes. High infrastructure costs for roads and utilities has been identified as an issue impacting on viability of housing growth.³³

TABLE 7.3 - SOCIO-ECONOMIC INDICATORS - MEDWAY

| Key indicators | Medway | UK | Source |
|--|--|--|--|
| Working Age Population (Apr 2015- Mar 16) | 177,000 | 40,904,500 | ONS (2016) Annual Population Survey (APS) |
| GVA per Head (2014) | £17,038 | £24,616 | ONS (2016) Regional Gross Value Added (Income Approach) NUTS3 Tables |
| Employment & rate (Apr 2015- Mar 16) | 125,600 (71.0%) | 30,093,100 (73.6%) | ONS (2016) 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 (2015) | £613 | £627 | ONS (2016) Annual Survey of Hours and Earnings |
| Average workplace weekly earnings (2015) | £576 | £627 | ONS (2016) Annual Survey of Hours and Earnings |
| Proportion of LSOAs in Medway that are in the top 20% most deprived in the UK (2010) | 14% | N/A | Communities & Local Government (2010) Indices of Multiple Deprivation |
| Median house sale price (2014) | £170,000* | £192,000** | *ONS (2014) House Price Statistics for Small Areas, 1995–2014 **ONS (2016) Explaining the impact of the new UK house price index:2016 |
| Key industrial clusters in Medway | Transport distribution and logistics | | HHJV 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) Medway target is 17,930 (by 2028) | | |

³³ Kent and Medway Economic Partnership (draft 2013) Unlocking the Potential: Going for Growth Kent and Medway's Growth Plan: Opportunities, Challenges and Solutions

http://kmep.org.uk/documents/Unlocking_the_Potential_-_v.3.1_19.12.13.pdf

Thurrock

- 7.4.11 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 its socio-economic indicators is provided in **Table 7.4**. Thurrock has a lower than average GVA per head at £18,056 compared to both Essex and the national average.³⁴ It also has lower than average resident and workplace wages which are almost 10% lower than the national average.³⁵ There are pockets of significant deprivation with 12.6% of its LSOAs in the top 20 most deprived in the UK (more than double that in Essex).³⁶ It also experienced a 16% drop in productivity between 2004 and 2014.³⁷
- 7.4.12 The largest industries in Thurrock by share of GVA are distribution, transportation, accommodation and food, manufacturing, and public administration. An industry clusters analysis based on employment shares found that the transport distribution and logistics, retail and wholesale sectors are key clusters. Like Medway, manufacturing, a former key source of employment, has declined by almost 10% over the last 15 years. In its place, employment in the retail and motor trade sectors has grown, although at slower rates than the decline in manufacturing. Lakeside Shopping Centre provides a high proportion of Thurrock's retail employment.
- 7.4.13 The local authority plan to support employment and business growth in key sectors such as 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 around 245 Ha at the London Gateway development site.³⁸ 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 expansion.

³⁴ 2015 estimate, ONS (accessed 2016) Regional Gross Value Added (Income Approach) NUTS3 Tables

<http://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2015>

³⁵ 2014-2015 estimate, ONS (accessed 2016) Annual Survey of Hours and Earnings (resident & workplace)

<https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?theme=25>

³⁶ 2015 Communities & Local Government (accessed 2016) Indices of Multiple Deprivation

<https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015>

³⁷ 2014 estimate, ONS (2016) Subregional Productivity

<http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/subregionalproductivityproductivityhoursandproductivityjobsbylocalenterprisepartnerships>

³⁸ Thurrock Borough Council (Proposed draft submission, May 2013) Thurrock Core Strategy Local Plan - Focused Review: consistency with National Planning Policy Framework

https://www.thurrock.gov.uk/sites/default/files/assets/documents/ex114_nppf_focused_review_proposed_main_modifications.pdf

TABLE 7.4 - SOCIO-ECONOMIC INDICATORS - THURROCK

| Key indicators | Thurrock | UK | Source |
|--|--|--|--|
| Working Age Population (Apr 2015- Mar 16) | 105,900 | 40,904,500 | ONS (2016) Annual Population Survey (APS) |
| GVA per Head (2014) | £18,056 | £24,616 | ONS (2016) Regional Gross Value Added (Income Approach) NUTS3 Tables |
| Employment & rate (Apr 2015- Mar 16) | 76,500 (72.2%) | 30,093,100 (73.6%) | ONS (2016) 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 (2015) | £624 | £627 | ONS (2016) Annual Survey of Hours and Earnings |
| Average workplace weekly earnings (2015) | £556 | £627 | ONS (2016) Annual Survey of Hours and Earnings |
| Proportion of LSOAs in Thurrock that are in the top 20% most deprived in the UK (2010) | 12.6% | N/A | Communities & Local Government (2010) Indices of Multiple Deprivation |
| Median house sale price (2014) | £192,500* | £192,000** | *ONS (2014) House Price Statistics for Small Areas, 1995–2014 **ONS (2016) Explaining the impact of the new UK house price index:2016 |
| Key industrial clusters in Thurrock | Transportation, distribution and logistics; retail and wholesale | | HHJV analysis of ONS (2014) APS |
| Employment policy target | 26,000 (2001-2026) | | 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) | | |

Southend-on-Sea

7.4.14 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 its socio-economic indicators is given in **Table 7.5**. Workplace GVA per head at £16,955 per annum is lower than the national average.³⁹ Southend's productivity index at 90.1 in 2014 is the lowest in the

³⁹ 2015 estimate, ONS (accessed 2016) Regional Gross Value Added (Income Approach) NUTS3 Tables

LTC Study Area and is much lower than the national level of 100.⁴⁰ 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.⁴¹ Average workplace weekly earnings at £528 are well below the national average and the employment rate is also below average.⁴² However average resident-based weekly earnings of £632 are well above the national average.⁴³ 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.

7.4.15 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 and high business counts in Southend-on-Sea compared to the national average. The management and health sectors also have high location quotients, but this indicator of clustering is not reflected in the business count data.

7.4.16 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 between 2001 and 2021. The Core Strategy identifies the lack of transport infrastructure as a constraint on the area's potential to develop and reach planned economic targets.⁴⁴

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

| Key indicators | Southend-on-Sea | UK | Source |
|---|--|--|--|
| Working Age Population (Apr 2015- Mar 16) | 109,900 | 40,904,500 | ONS (2016) Annual Population Survey (APS) |
| GVA per Head (2014) | £16,955 | £24,616 | ONS (2016) Regional Gross Value Added (Income Approach) NUTS3 Tables |
| Employment & rate (Apr 2015- Mar 16) | 83,500 (75.9%) | 30,093,100 (73.6%) | ONS (2016) APS |
| Average resident skills level (2011) | 22% with Level 4 or above qualifications | 27% with Level 4 or above qualifications | ONS 2011 Census |

<http://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2015>

⁴⁰ 2012 estimate, ONS (2014) Subregional Productivity

<http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/subregionalproductivityproductivityhoursandproductivityjobsbylocalenterprisepartnerships>

⁴¹ Based on Communities & Local Government (2010) Indices of Multiple Deprivation

<https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015>

⁴² 2014-2015 estimate ONS (accessed 2016) Annual Survey of Hours and Earnings (resident & workplace)

<https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?theme=25>

⁴³ 2014-2015 estimate, ONS (accessed 2016) Annual Survey of Hours and Earnings (resident & workplace)

<https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?theme=25>

⁴⁴ Southend on Sea Borough Council (2007) Core Strategy

http://www.southend.gov.uk/downloads/download/276/core_strategy

| Key indicators | Southend-on-Sea | UK | Source |
|---|----------------------------|------------|--|
| Average resident weekly earnings (2015) | £632 | £627 | ONS (2016) Annual Survey of Hours and Earnings |
| Average workplace weekly earnings (2015) | £528 | £627 | ONS (2016) Annual Survey of Hours and Earnings |
| Median house sale price (2014) | £204,000* | £192,000** | *ONS (2014) House Price Statistics for Small Areas, 1995–2014 **ONS (2016) Explaining the impact of the new UK house price index:2016 |
| Proportion of Lower Super Output Areas in Southend that are in the top 20% most deprived in the UK (2010) | 21% | N/A | Communities & Local Government (2010) Indices of Multiple Deprivation |
| Key industrial clusters in Southend | Food and beverages, retail | | HHJV 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) | | |

Summary of Findings

7.4.17 There are socio-economic differences in the local authorities across the LTC 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 UK 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.

7.4.18 The Study Area has the following key socio-economic characteristics:

- i. High population growth across the Study Area except in Medway.
- ii. The 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. The 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 regions, but the working age population is increasing more rapidly than the number of new jobs being created.
- vii. The unemployment rate is higher in Thurrock and Medway than the national average. Overall 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. There are 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 in the transport, distribution and logistics sectors 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, food and construction sectors. GVA forecasts indicate producer services are 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. Median house prices in Kent are higher, whilst those in Medway are significantly lower, than the UK average. Across the rest of the Study Area house prices are close to the UK average.

7.4.19 **Table 7.6** provides a summary of socio-economic indicators within the county and unitary authorities in the Study Area and those for London and compares these to the UK averages.

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

| Report Chapter | Indicator | Measure/Unit/Date | Essex | Thurrock | Southend | Kent | Medway | London | Source |
|---------------------------------|-----------------------------------|---------------------------------------|-------|----------|----------|-------|--------|--------|---|
| Demographics | Working age population | Year on year % increase, 2004-15 | Below | Above | Above | Above | Above | Above | ONS Annual Population Survey |
| Economic Indicators | Workplace GVA per head | 2013 (provisional) | Below | Below | Below | Below | Below | Above | ONS Regional GVA per head NUTS3 |
| | GVA per hour worked | Index, 2014 | Below | Below | Below | Below | Same | Above | ONS Nominal GVA per Hour Worked NUTS3 |
| | Employment Rate | %, 2014-15 | Above | Same | Above | Same | Below | Below | ONS Annual Population Survey |
| | Change in employment rate | % 2004-15 | Below | Same | Below | Above | Above | Above | ONS Annual Population Survey |
| | Unemployment rate | %, 2015 | Below | Above | Same | Same | Above | Above | ONS Annual Population Survey |
| Labour Force | Education | NVQ2+, 2011 | Same | Below | Below | Same | Below | Above | ONS 2011 Census |
| | Employment by occupation | % 2016 in professional occupations | Below | Below | Below | Below | Below | Above | ONS Annual Population Survey |
| Wealth & Deprivation | Workplace earnings | Median £ per week, 2015 | Below | Below | Below | Below | Below | Above | ONS Annual Survey of Hours and Earnings |
| | Resident earnings | Median £ per week, 2015 | Above | Same | Same | Above | Below | Above | ONS Annual Survey of Hours and Earnings |
| | Deprivation | 10% most deprived LSOAs by area, 2015 | Below | Below | Above | Below | Below | Below | Department for Communities and Local Government, 2015 Indices of Multiple Deprivation |
| Business Demography | Growth rate of active enterprises | 2012-13 | Same | Above | Same | Same | Same | Above | ONS Business Demography |
| | Growth rate of enterprise births | 2013-14 | Below | Above | Below | Below | Same | Above | ONS Business Demography |
| | Growth rate of enterprise deaths | 2013-14 | Below | Above | Below | Below | Above | Above | ONS Business Demography |
| | Business survival rates | 2009-14 | Above | Below | Below | Same | Below | Below | ONS Business Demography |

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

8 Future Development and Economic Growth

8.1 Introduction

8.1.1 There are significant development plans for new housing and employment in the area, as summarised in **Table 8.1**.

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 are likely to be planned for the following 15 year plan period. |
| London Resort Company Holdings | London Resort Company Holdings (LRCH) are proposing a 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 50,000 visitors per day and up to 33,000 jobs. |
| Lakeside Shopping Centre | Lakeside opened in 1990 and is the tenth largest shopping centre in the UK (by area). 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 |

8.1.2 Key strategic developments include Ebbsfleet Garden City, LRCH's proposed theme park and the expansion of the London Gateway Port (DP World), Port of Tilbury, and Lakeside and Bluewater Shopping Centres. These developments will have a significant impact on future traffic growth in the area.

8.1.3 In accordance with WebTAG guidance, an Uncertainty Log has been developed which requires that both employment and housing projections are

tested and ranked depending on their level of uncertainty within the planning process. The categorisation is shown in **Table 8.2** below.

TABLE 8.2 - DEVELOPMENT PLANNING CRITERIA FOR THE GROWTH SCENARIOS

| Development planning | | |
|------------------------|--|---|
| Level of Uncertainty | Definition | Status |
| Near Certain | The outcome will happen or there is a high probability that it will happen | Intent announced by proponent to regulatory agencies Approved development proposals Projects under construction |
| More than Likely | The outcome is likely to happen but there is some uncertainty | Submission of planning or consent application imminent Development application within the consent process |
| Reasonably Foreseeable | The outcome may happen, but there is significant uncertainty | Identified within a development plan Not directly associated with the transport strategy/ scheme but may occur if the scheme is implemented Development condition upon the transport/ scheme proceeding A committed policy goal subject to tests whose outcomes are subject to significant uncertainty |

- 8.1.4 Considering the 'near certain' developments for 2025, it is forecast that there will be approximately 8,000 new jobs and 7,000 new homes. With the 'more than likely' developments included this increases to 71,000 new jobs and 51,000 new homes and with the 'reasonably foreseeable' developments included this increases further to 97,000 new jobs and 80,000 new homes. This will have a significant impact on future traffic growth in the area.
- 8.1.5 Examining the equivalent development forecasts for 2041, it is forecast that there will 8,000 new jobs and 8,000 new homes in 'near certain' developments, increasing to 101,000 new jobs and 61,000 new homes with the inclusion of the 'more than likely category' and further increasing to 122,000 new jobs and 92,000 new homes with the inclusion of the reasonably foreseeable category.
- 8.1.6 **Figure 8.1** shows the location of the major development sites which have been considered and their categorisation into the three levels of uncertainty.
- 8.1.7 Engagement with stakeholders who represent business and transport, infrastructure or utility organisations and their responses to the consultation have demonstrated very strong support for the proposed scheme and a consistent demand for a new crossing. Further information can found in the *Ipsos MORI Lower Thames Crossing Consultation: Analysis of findings report*.
- 8.1.8 In the wider area the Government has set up the Thames Estuary 2050 Growth Commission, which will develop an ambitious vision and delivery

plan for North Kent, South Essex and East London up to 2050. The Commission will explore the development of high productivity clusters in specific locations, looking at future regeneration and planned infrastructure projects, and is expected to issue its report later in 2017.

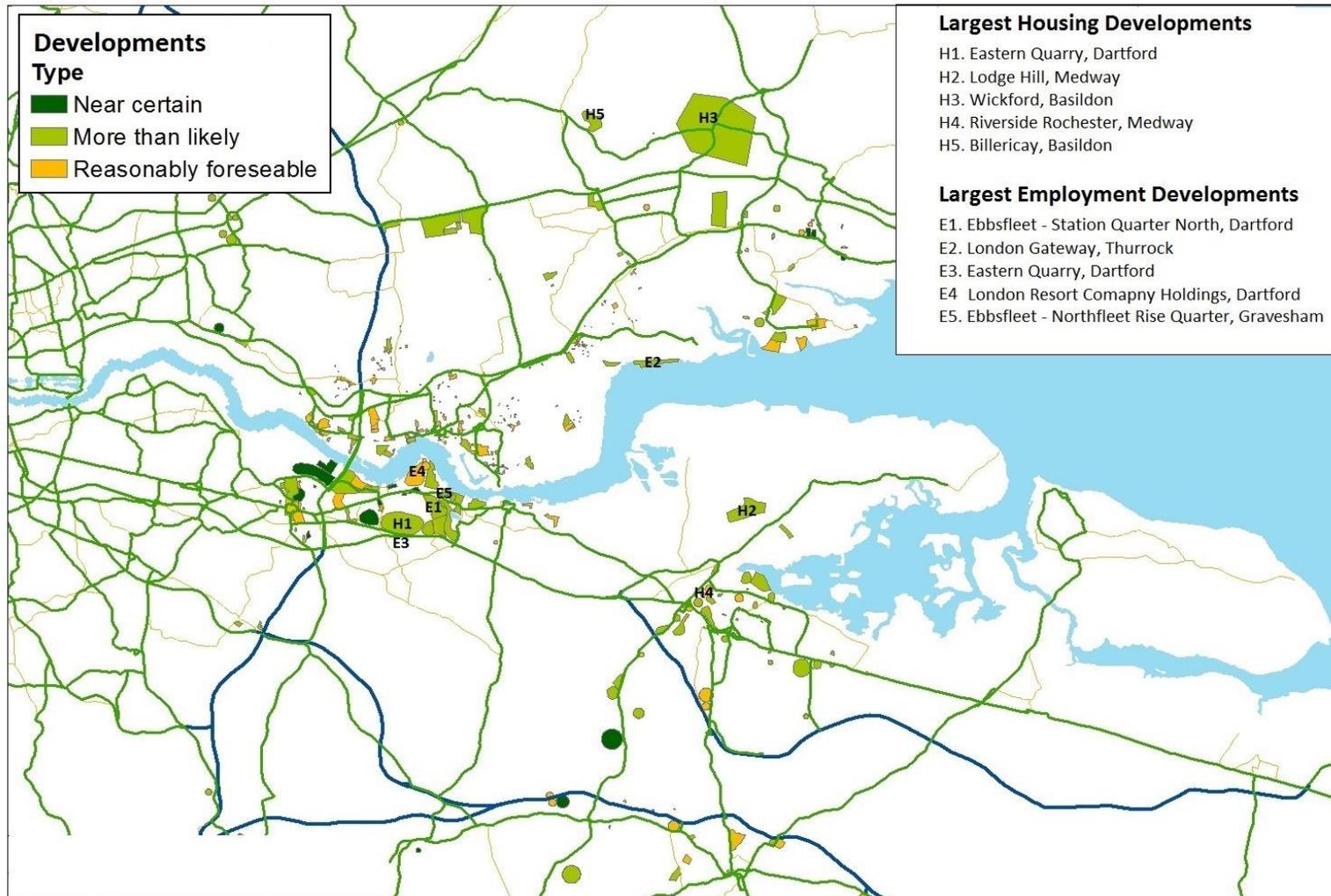


FIGURE 8.1 - FUTURE DEVELOPMENT FROM UNCERTAINTY LOG

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 The traffic modelling and forecasting indicates that the crossing will operate at capacity for longer periods in the future, increasing congestion and the likelihood of incidents that will lead to greater unreliability.

9.2.2 Despite the capacity improvements delivered by Dart Charge and the benefits of the schemes summarised in Section 3.11, the forecast levels of traffic growth are expected to result in significantly increased congestion.

9.2.3 **Figures 9.1 and 9.2** show the predicted northbound and southbound traffic flows and queued traffic from the LTC v2.1 traffic model, during the AM, PM and Inter-peak (IP) periods compared with the capacity in 2009, 2025 and 2041. These show that by 2025 the crossing will be operating at capacity in both directions during the peaks and inter-peak periods, resulting in increased levels of queuing in all modelled periods. Further growth to 2041 results in further increases in levels of queuing. This implies levels of congestion far worse than today.

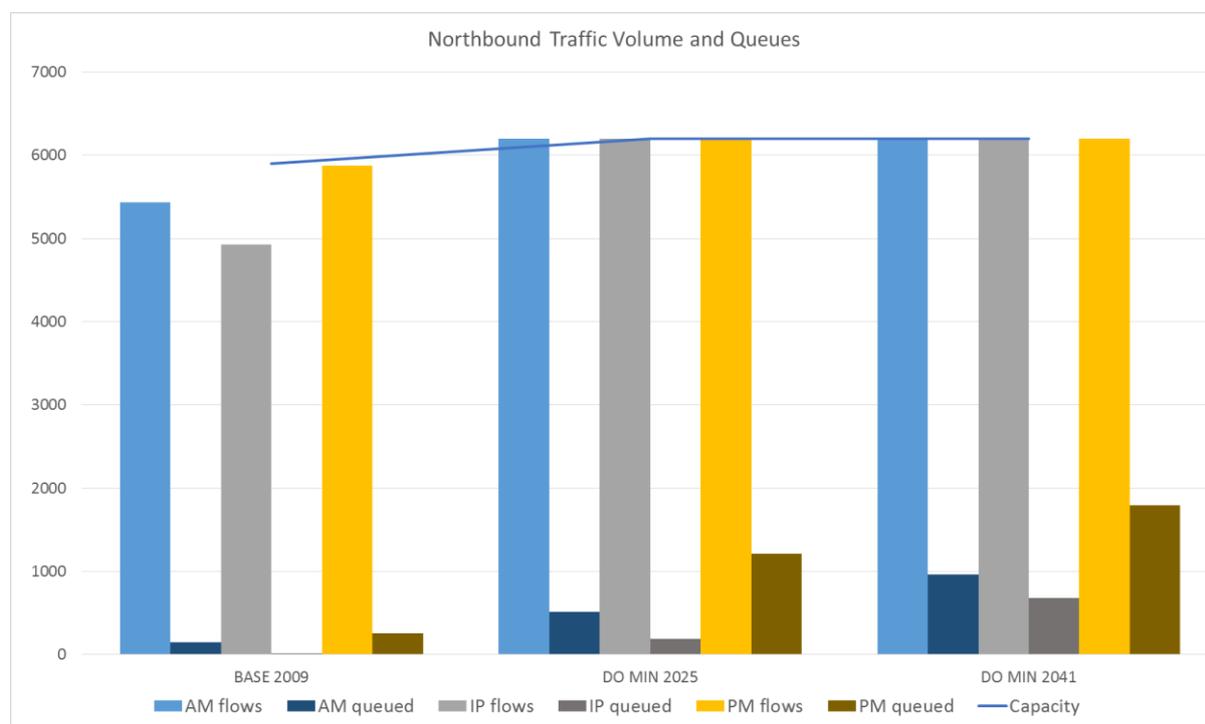


FIGURE 9.1 - FORECAST HOURLY TRAFFIC FLOWS AND QUEUES WITHOUT SCHEME NORTHBOUND

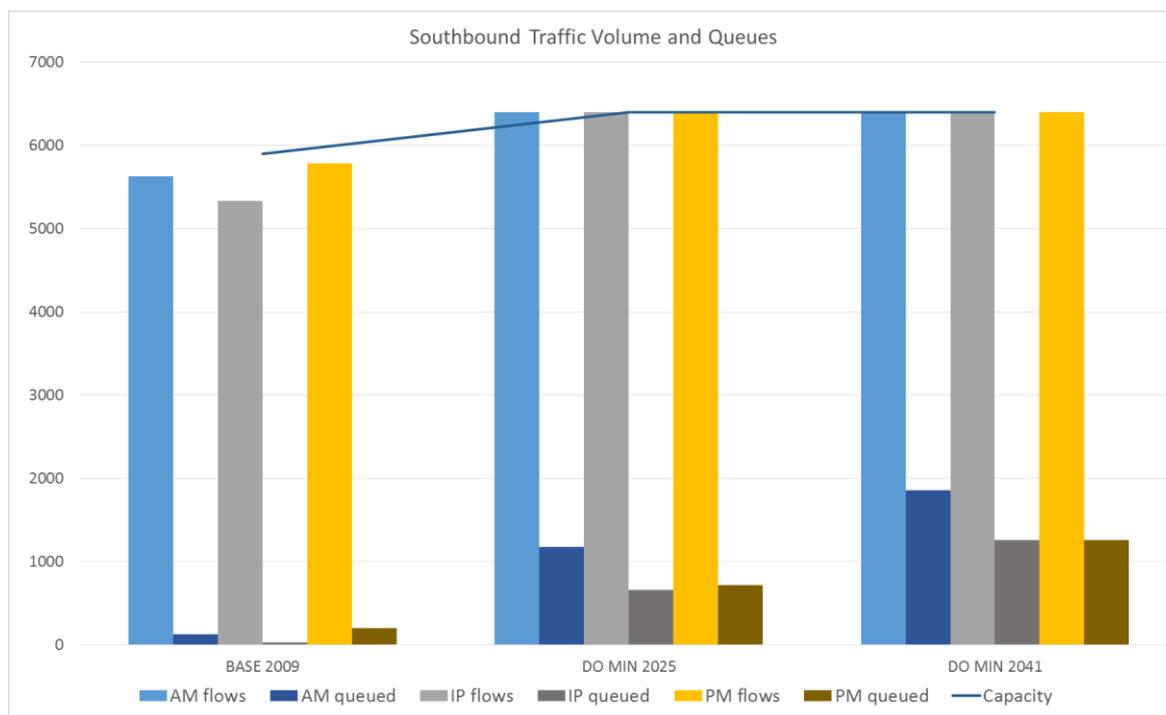


FIGURE 9.2 - FORECAST HOURLY TRAFFIC FLOWS AND QUEUES WITHOUT SCHEME SOUTHBOUND

- 9.2.4 This shows that future traffic growth is constrained by the lack of capacity. This will lead to increased queuing during the peak hours and users choosing to travel outside peak hours. In future, it is anticipated that from 2025, the crossing will operate at capacity for both directions in the morning peak, evening peak and inter-peak periods.
- 9.2.5 The LTC v2.1 model predicts that without LTC there will be greater HGV flows between 2025 and 2041. This will result in reductions in flows of cars and light vans and an overall slight reduction in the total vehicle flows.
- 9.2.6 Whilst providing some initial 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.
- 9.2.7 **Figure 9.1** and **Figure 9.2** show that the existing crossing is expected to reach capacity in 2025.
- 9.2.8 The Dartford Crossing, its approach roads and other surrounding roads suffer from some of the highest levels of traffic congestion on the SRN. Congestion occurs when traffic levels on a road increase and begin to approach (or even exceed) the capacity of the road and is characterised by slower speeds, longer trip times, increased journey time unreliability and increased levels of vehicle queueing. A proxy measure of congestion is the ratio of traffic volumes to road capacity (i.e. 'volume/ capacity' ratio).
- 9.2.9 **Figure 9.3** 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.

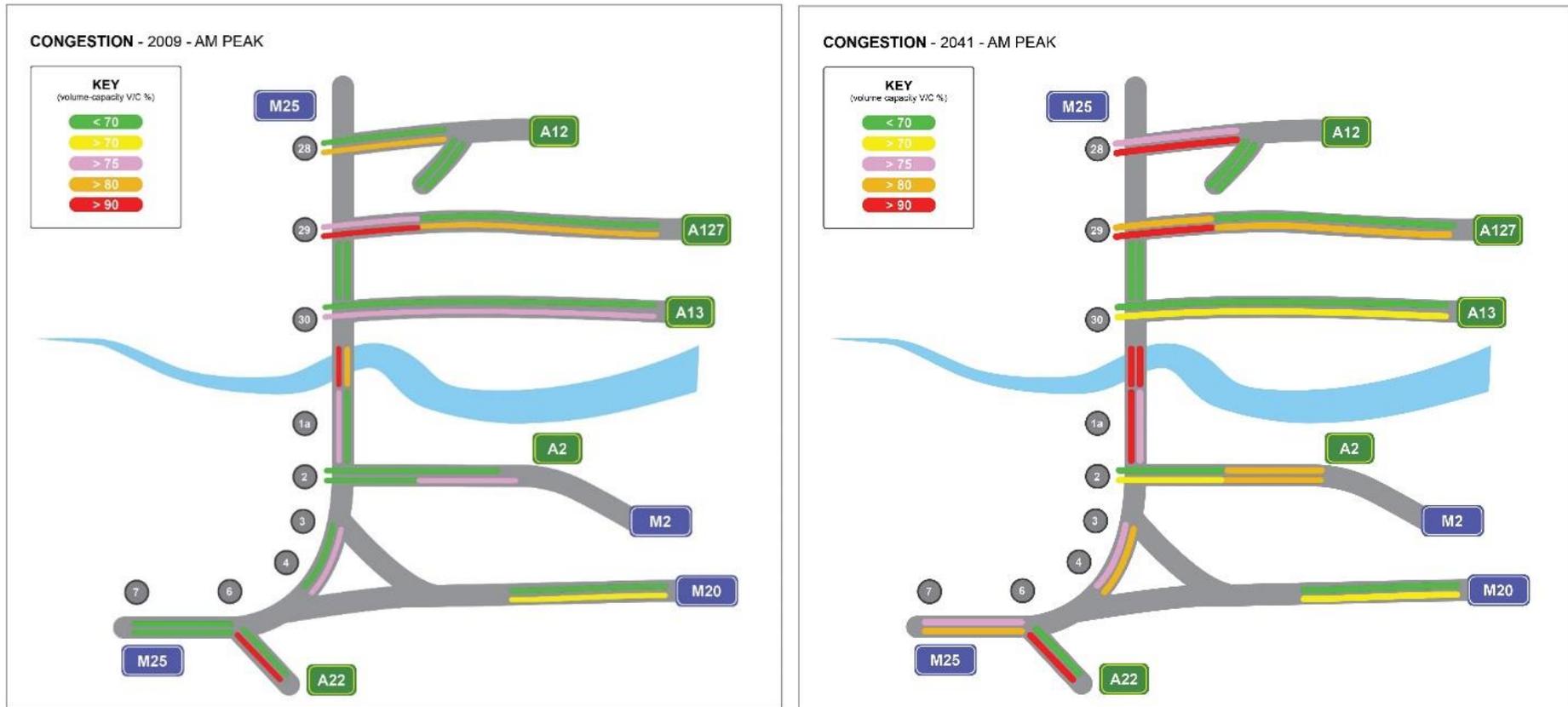


FIGURE 9.3 - FUTURE WORSENING OF CONGESTION WITHOUT SCHEME

9.2.10 This shows that volume/ capacity ratios currently exceed 90% at a number of locations on the network, including the northbound Dartford Crossing and the A127 and A22 towards the M25.

9.2.11 Apart from sections of the A13, where work has recently been completed to increase capacity, and the M20, where capacity increases are planned as part of the smart motorways programme, congestion will increase in a wide range of locations and reaches over 90% in a number of additional locations. These include:

- M25 northbound from Junction 2 to the Crossing
- The southbound Crossing
- A12 westbound

9.2.12 Other areas where increased congestion is expected include the M25, between Junction 3 and 6, and A2, A127 and A12.

9.2.13 These changes include the beneficial impact of Dart Charge which is assumed to be in place in the future year models.

9.2.14 This increased congestion is expected to result in increased journey times. Based on the LTC v2.1 model, average journey times on the M25/ A282 between Junction 2 and Junction 30 are forecast to change as follows:

- Average northbound journey times will increase by over 25% by 2025 and by over 50% by 2041.
- Average southbound journey times will increase by almost 45% by 2025 and by over 75% by 2041.

9.2.15 Based on this analysis, the key conclusions are that:

- Current traffic hotspots are the existing Dartford Crossing where both northbound and southbound links are projected to have volume/ capacity ratios above 100% in 2041.
- The A282 Junction 1a and 1b approach links are likewise heavily congested (especially northbound where the poor tunnel geometry, closely spaced junctions and need to segregate over height/ DGVs restricts effective capacity and increases potential for incidents).
- Other congested routes are the A2, A13, A127 and A12 westbound, M25 between Junctions 6 and 7, and the A12 and A127 eastbound.

9.2.16 Clearly, congestion on the existing crossing and the surrounding network will only worsen with time.

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 could lead to an increase of up to 92,000 new homes and 122,000 new jobs by 2041, which will have a significant impact on future traffic growth in the area.

9.4 Future Environmental and Road Safety Conditions

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, despite improvements in vehicle emissions. There will still be significant air quality problems in 2025, with predicted exceedances of the Air Quality Strategy Objective for nitrogen dioxide (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 µg /m ³ | Approximate Number of Potentially Influenced Receptors |
|--|---|--|
| R3 | 40.0 | <50 |
| R4 | 50.5 | <10 |
| R5 | 41.4 | <50 |
| R8 | 47.7 | <50 |
| R9 | 47.9 | <50 |
| R10 | 42.1 | <50 |
| R11 | 41.7 | <100 |
| R12 | 52.0 | <50 |
| R13 | 41.9 | <50 |
| Note: The Air Quality Strategy Objective (AQSO) level for NO ₂ is 40 µg /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 in the vicinity of the existing Dartford Crossing is poor, for both the mainline and existing junctions along the route. For many sections of this route between M25 Junction 29 and M25 Junction 3, analysis of existing collision data indicates that the Fatalities and Weighted Injury Rate is well above the national average for the type of road. Without a new river crossing, future traffic

levels are projected to increase and the existing route will continue to perform poorly compared with national average safety standards with high rates of injury accidents.

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 restricted nature 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 Approximately 300 incidents occur in the approaches or at the crossing every year; very few days are incident-free. Incidents last on average for half an hour and are cleared quickly, but it typically take 3 to 5 hours for any backlog to clear.

10.1.7 On average, once a week, there is a larger incident which takes over an hour to clear. The network doesn't recover for the rest of the day and only returns

to normal overnight. During these events journeys both on the network and local roads are severely disrupted. Average speeds drop to below 10mph.

- 10.1.8 The high frequency of incidents is caused by the physical layout of the road. The junctions are closely spaced with traffic weaving to enter or exit the road. The smaller diameter of the western tunnel and the restrictions on hazardous vehicles (requiring convoys) also places operational constraints on the northbound tunnels which disrupt the smooth flow of traffic (for example, goods vehicles needing to cross the lanes to access the larger tunnel). The higher than average number of HGVs on this section of the network also contributes to a higher incident rate.
- 10.1.9 When incidents do occur, road users have no reasonable alternatives. The choice is to 'wait it out', take a detour of about 30 miles through the Blackwall Tunnel (which can take more than an hour), provided they are permitted, or go clockwise around the M25 (which could be up to 100 miles depending on destination).
- 10.1.10 The Dartford Crossing is one of the least reliable sections of the SRN. If nothing is done, the congestion in the future will become even more severe as traffic levels and frequency of incidents increase.

Development and Economic Growth

- 10.1.11 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.
- 10.1.12 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, LRCH's proposed theme park and Lakeside and Bluewater Shopping Centres. Further development will generate more demand for cross-Thames travel.
- 10.1.13 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.

Environment and Safety

- 10.1.14 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.
- 10.1.15 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.

10.1.16 The existing road safety record for the A282 corridor is poor, with the fatal and weighted injury index per billion vehicle kilometres being up to 400% 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 (Version 2.8) (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 | |
|--|--|
| 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. |
| Economic | <ul style="list-style-type: none"> To support sustainable local development and regional economic growth in the medium to long term. To be affordable to Government and users. To achieve value for money. |
| Environment and Community | <ul style="list-style-type: none"> To minimise adverse impacts on health and the environment. |
| 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. The route and river crossing options also need to meet the above scheme requirements.

11 References

| Title | Document number |
|--|----------------------|
| Conservation of Habitats and Species Regulations 2010 | 2010 No. 490 |
| NIDP National Infrastructure Delivery Plan 2016-2021 | March 2016 |
| DfT National Policy Statement for National Networks | 2014 |
| DfT Road Investment Strategy | 2014 |
| Highways England Strategic Business Plan 2015-2020 | Undated |
| DfT: Single Departmental Plan 2015 to 2020 | 2015 |
| DfT The Strategic Road Network and the Delivery of Sustainable Development | 2013 |
| House of Commons Transport Committee Strategic River Crossings Tenth Report of Session 2014-15 | March 2015 |
| DCLG National Planning Policy Framework | 2012 |
| DfT Action for Roads: A network for the 21st century | ISBN 9780101 867924 |
| EU The Habitats Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna | May 1992 |
| 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 |
| 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 |
| DEFRA Conservation of Habitats and Species Regulations | 2010 |
| The South East Local Economic Partnership Growth Deal an Economic Plan 2014 | July 2014 |
| GLA The London Plan – consolidated with options since 2011 | March 2016 |
| Brentwood BC Corporate Plan Vision for Brentwood | 2016-2019 |
| Brentwood BC Replacement Local Plan | 2005 |
| Brentwood BC Draft Local Plan | January 2016 |
| Dartford BC Core Strategy | 2026 |
| Dartford BC Corporate Plan | 2014-2017 |
| Essex CC Transport Strategy | 2011 |
| GLA Adopted London Local Plan | January 2015 |
| Gravesham BC Adopted Core Strategy | 2014 |

| Title | Document number |
|--|----------------------------|
| Gravesham BC Corporate Business Plan | 2015-19 |
| London Borough of Havering Adopted Core Strategy and Development Control Policies Development Plan | 2008 |
| London Borough of Havering Corporate Plan | 2016-2017 |
| London Borough of Havering Local Implementation Plan | 2007 |
| Kent and Medway Structure Plan | 2006 |
| Kent CC Strategic Statement | 2015-2020 |
| Kent CC The Local Transport Plan for Kent 2011-16 | 2011 |
| 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 The Council Plan | 2016-17 to 2020-21 |
| Thurrock Council Corporate Plan | 2016-2017 |
| Thurrock Council Adopted Core Strategy and Policies for Management of Development, as amended | 2015 |
| Thurrock Council Transport Strategy | 2013-2026 |
| Lower Thames Crossing Consultation: Analysis of findings report (Final version) | Ipsos MORI - February 2017 |

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 |
| ADMS-Roads | Comprehensive software for modelling road traffic pollution. |
| 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 |
| 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. |
| AQS | Air Quality Strategy |
| AQSO | Air Quality Strategy 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. |
| 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 Urban and Rural 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. |
| Benefit Cost Ratio (BCR) | 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. |
| Birds Directive | Council Directive 2009/147/EC on the conservation of wild birds) is a European Union directive. It replaces Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds and aims to protect all European wild birds and the habitats of listed species, in particular through the designation of Special Protection Areas (SPAs). |
| 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. |
| BR | Bridge (when used as part of a LTC shortlist route reference) Bridleway |
| Bridge Management System (BMS) | A means for managing bridges throughout design, construction, operation and maintenance of the bridges. |

| Abbreviation | Description |
|-----------------------|---|
| BSL | British Sign Language |
| BT | Bored tunnel |
| BTEC | Business and Technology Education Council |
| BTO | British Trust for Ornithology: an organisation founded in 1932 for the study of birds in the British Isles. |
| C2 enquiry | An initial enquiry made to a utility company under the New Roads and Street Works Act (NRWSA) about the locations of their plant and equipment. |
| 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 |
| CCC | Highways England Customer Contact Centre |
| 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, an area which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency. |
| CEMP | Construction Environmental Management Plan |
| 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. |
| 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 |
| CoCP | Code of Construction Practice |
| Connect Plus | Connect Plus (M25) Ltd, management company for the Dartford-Thurrock Crossing. |
| 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, the formal means by which the DfT instruct Highways England to develop a scheme and define the scope of a project. |
| 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 and 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. |
| DC | Dartford Crossing |
| DCC | Dartford Crossing Control Centre |
| DCLG | Department for Communities and Local Government |
| 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. |
| 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. DGVs are subject to restrictions under the ADR Regulations (Accord Dangereux Routier, European regulations concerning the international transport of dangerous goods by road). The passage of Dangerous Goods Vehicles through the Dartford Tunnels is determined according to the procedure described in the Dartford Dangerous Goods Listing. The Dartford tunnels are a category C tunnel according to the categories defined in the ADR regulations. Vehicles with |

| Abbreviation | Description |
|-------------------------------------|--|
| | Tunnel Restriction Codes A, B, and C are prevented from using the tunnels (with some minor exceptions for vehicle Tunnel Restriction Code C). Vehicles with Tunnel Restriction Codes D and E are subject to conveying or 'check and allow' using the procedures describe in the Dartford Dangerous Goods Listing. |
| Disbenefit | A disadvantage or loss resulting from something. |
| Distributional Impact | Distributional impacts (DIs) consider the variance of transport intervention impacts across different social groups. The analysis of DIs is mandatory in the appraisal process and is a constituent of the Appraisal Summary Table (AST). |
| 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 |
| DV | District Valuer |
| 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. |
| Eastern Southern Link (ESL) | The Eastern Southern Link (ESL) is an alternative for Routes 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 either of the Routes 3 and 4 north of the river utilising all of the crossing options for these route options. |
| EB | eastbound |
| Environment Impact Assessment (EIA) | The purpose of Environmental Impact Assessment is to protect the environment by ensuring that a consenting authority, when deciding whether to grant consent for a project which is likely to have significant effects on the environment, does so in the full knowledge of the likely significant effects, and takes this into account in the decision making process. |
| ERA | Emergency Refuge Area: on roads for use in emergency or breakdown only and separated from the main carriageway. |
| 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. |
| FRA | Flood Risk Assessment. |
| 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 |
| Habitats Directive | The Habitats Directive (the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora) is a European Union directive adopted in 1992 as an EU response to the Berne Convention. It is one of the EU's two directives in relation to wildlife and nature conservation, the other being the Birds Directive; it aims to protect some 220 habitats and approximately 1,000 species listed in the directive's Annexes. |
| Habitats Regulations | The Conservation of Habitats and Species Regulations 2010 (as amended) are the principal means by which Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the "Habitats Directive") and the Birds Directives Council Directive 2009/147/EC are transposed into English law. |
| Habitats Regulations | This is a multi-stage process undertaken to determine whether a project, plan or policy will have an adverse effect on the integrity of any Natura 2000 or European sites (Special Areas of Conservation, |

| Abbreviation | Description |
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| Assessment (HRA) | Special Protection Areas and Ramsar sites), (either in isolation or in combination with other plans and projects). The outcomes of this process should inform decision-making and whether consent should be granted for a project. |
| HAGDMS | Highways England Geotechnical Data Management System |
| Hanson | Hanson UK, part of the HeidelbergCement Group. |
| HGV | Heavy Goods Vehicle |
| HHJV | Halcrow Hyder Joint Venture: a joint venture between Halcrow Group Limited and Hyder Consulting Limited appointed as technical adviser by Highways England in June 2014. |
| HMRC | HM Revenue & Customs |
| HRA | Habitats Regulations Assessment |
| 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 |
| IPA | Infrastructure and Projects Authority |
| Ipsos MORI | A UK market research organisation appointed by Highways England to analyse and report on the responses to the LTC public consultation. |
| IROPI | Imperative Reasons of Overriding Public Interest |
| IT | Immersed tunnel |
| ITS | Intelligent Transportation System |
| 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. |
| London Distribution Park (LDP) | An area, 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 B | The location for a new crossing in the vicinity of the Swanscombe peninsula. It would connect the A2 to the south in the vicinity of Dartford to the A1089 to the north in the vicinity of Tilbury Docks. This route would cross the Eastern Quarry development site and the Swanscombe Peninsular. |
| 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. |
| Locations D and E | The two most easterly of five locations originally examined by the DfT for the proposed Lower Thames Crossing, both were eliminated from further consideration. |
| LoHAM | Transport for London's Highway Assignment Model |
| London Gateway | A new deep-water port, able to handle the biggest container ships in the world, and part of the London Gateway development on the north bank of the River Thames in Thurrock, Essex, 20 miles (32 km) east of central London. |
| LRCH | London Resort Company Holdings, developer for the proposed theme park on the Swanscombe Peninsula, Kent. |
| LSOA | Lower Super Output Area; LSOAs typically contain 4 to 6 OAs (census output areas, the smallest unit for which census data is published) with a population of around 1500. |
| 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 and Southend railway |
| LVIA | Landscape and Visual Impact Assessment |
| LWS | Local wildlife site |
| Mainline | The through carriageway of a road as opposed to a slip road or a link road at a junction |

| Abbreviation | Description |
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| Mardyke | A small river, mainly in Thurrock, that flows into the River Thames at Purfleet, close to the QEII Bridge. |
| Marine Conservation Zones (MCZs) | A Marine Conservation Zone (MCZ) is a type of marine nature reserve in UK waters. They were established under the Marine and Coastal Access Act (2009) and are areas designated with the aim to protect nationally important, rare or threatened habitats and species. |
| Marine Management Organisation (MMO) | 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. |
| National Cycle Route (NCR) | A cycle route part of the National Cycle Network created by Sustrans to encourage cycling throughout Britain. |
| National Vegetation Classification (NVC) | A system of classifying natural habitat types in Great Britain according to the vegetation they contain. |
| Natura 2000 | A network of nature protection areas in the territory of the EU. It is made up of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) designated respectively under the Habitats Directive and Birds Directive. The network includes both terrestrial and marine sites (Marine Protected Areas (MPAs)). |
| NB | northbound |
| NIDP | National Infrastructure Delivery Plan |
| NMU | Non-motorised user, e.g. pedestrians, cyclists, equestrians. |
| NO ₂ | Nitrogen dioxide |
| Noise-important area (NIA) | 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. |
| 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. |
| 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 |
| NTIS | Highways England National Traffic Information Service |
| NUTS | Nomenclature of Territorial Units for Statistics |
| NVQ | National Vocational Qualification |
| O&M | Operations and Maintenance |
| 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. |
| PA | Public accounts Public address |

| Abbreviation | Description |
|---|---|
| PACTS | 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. |
| 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. |
| PIA | Personal Injury(ies) Accident(s) |
| PIE | Public Information Event. Highways England held a total of 24 PIEs in 20 locations during the six-week public consultation period between January and March 2016; almost 13,000 people attended. |
| 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). |
| Post-Consultation Appraisal Routes | The routes appraised, following the public consultation, using updated version of the LTC traffic model (v2.1), which takes account of updated data following the opening of Dart Charge, enhancements to improve highway network representation and future patterns of local development in Kent and Essex, and new values of time issued by DfT. |
| PRA | Preferred Route Announcement |
| pSPA | Potential Special Protection Area: Sites which are approved by Government that are in the process of being classified as Special Protection Areas. |
| 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. |
| R&D | Research and development. |
| Ramsar site | A wetland of international importance, designated under the Ramsar convention. |
| Recommended Preferred Route | The preferred route of the Lower Thames Crossing as recommended by Highways England in the Post-Consultation SAR. |
| RIS | DfT's Road Investment Strategy |
| 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. |
| Route 1 (Post-Consultation Appraisal Route) | A new trunk road connecting M25 Junction 2 to M25 Junction 30, with a new 4 lane bridge crossing 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). |
| Route 2 (shortlist route) | 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. |
| Route 3 (Post-Consultation Appraisal Route) | 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 of a twin-bored tunnel river crossing large enough to accommodate a future dual 3 lane carriageway. 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. |
| Route 4 (Post- | A new trunk road connecting the A2 (2 km east of Gravesend) to the M25 (between Junctions 29 and 30), with dual 2 lane twin-bored tunnel river crossing large enough to accommodate a future dual 3 lane carriageway. Junction with A13 between Orsett Cock (A128) and Manor Way (A1014) junctions. Single |

| Abbreviation | Description |
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| Consultation Appraisal Route) | carriageway road provided from B186 to A128 parallel with the A127. See also Eastern Southern Link and Western Southern Link. |
| 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. |
| 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 Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora. 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 | Scheme Assessment Report, on the Lower Thames Crossing. The Pre-Consultation SAR was issued in January 2016, prior to the public consultation; the Post-Consultation SAR is a revised report that reports on the consultation, response to consultation findings and presents Highways England's Recommended Preferred Route. |
| SATURN | Simulation and Assignment of Traffic to Urban Road Networks, Transport Model |
| SCADA | Supervisory Control and Data Acquisition |
| S-CGE | Spatial Compatible General Equilibrium economic model |
| 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.' |
| SIA | Social Impact Appraisal |
| Smart motorway | Term for a range of types of actively controlled motorway, using technology to optimise use of the carriageway including the hard shoulder. |
| SOCC | Statement of Community Consultation, sets out how local communities in the vicinity of the scheme will be consulted. Directly affected and neighbouring local authorities will be consulted on the content of the SOCC before it is finalised. |
| SoS | Secretary of State (for Transport) |
| SPA | Special Protection Area: A designation under the European Union Directive on the Conservation of Wild Birds. |
| 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. |
| STEM subjects | Science, Technology, Engineering and Mathematics |
| SuDS | A sustainable drainage system designed to reduce the potential impact of new and existing developments with respect to surface water drainage discharges. |
| Sustrans | A UK charity enabling people to travel by foot, bike or public transport for more of the journeys they make every day; their flagship project is the National Cycle Network. |
| 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. |
| TAME | Highways England's Traffic Appraisal Modelling and Economics division |

| Abbreviation | Description |
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| TBM | Tunnel boring machine, machine used to excavate tunnels with a circular cross section. |
| 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) |
| TEN-T | Trans-European transport network |
| TfL | Transport for London: created in 2000, the integrated body responsible for London's transport system. |
| TGSEP | Thames Gateway South Essex Partnership |
| Thames Estuary 2050 Growth Commission | The Thames Estuary 2050 Growth Commission, announced in March 2016, is tasked with developing an ambitious vision and delivery plan for North Kent, South Essex and East London up to 2050. |
| TM | Highways England's Traffic Management (directorate) |
| TMC | Traffic Management Cell |
| 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. |
| TUBA | Transport Users Benefit Appraisal (DfT economic appraisal software tool) |
| ULEV | Ultra Low Emission Vehicle |
| Urban All Purpose | A road in an urban area designed for all types of traffic in accordance to the relevant DMRB Standards. |
| VAT | Value Added Tax |
| VfM | Value for Money |
| VMSL | Variable Mandatory Speed Limit(s) |
| VOC | Vehicle operating cost(s) |
| 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. |
| VOSA | Vehicle and Operator Services Agency, now merged with the Driving Standards Agency into a single agency, the Driver and Vehicle Standards Agency (DVSA). |
| 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. |
| Western Southern Link | The Western Southern Link (WSL) is an alternative for Post-Consultation Appraisal Routes 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 either of the Routes 3 and 4 north of the river utilising all of the crossing options for these route options. |
| 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. |
| Wider Impacts (WI) | 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. With Scheme: An option that provides enhanced services by comparison to the benchmark Without Scheme scenario. |

13 Appendices

| | Title |
|---------------|---|
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