

Lower Thames Crossing

Post-Consultation Scheme Assessment Report

Volume 7: Appraisal Summary and Recommendations

Volume 7

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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 (ref HA540039-HHJ-ZZZ-REP-ZZZ-010) 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 – 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 (this volume)** – 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 Volume 7

1.2.1 Volume 7 summarises the appraisal of the Post-Consultation Appraisal Routes against the scheme objectives, bringing together:

- The engineering, safety and cost appraisal described in Volume 4.
- The traffic and economic appraisal described in Volume 5.
- The environmental appraisal described in Volume 6.

1.2.2 The structure of this volume is as follows:

- Section 2 sets out the scheme objectives and the Post-Consultation Appraisal Routes.
- Section 3 presents the appraisal summary of Route 1 at Location A, and explains why this route does not meet the scheme objectives and is not recommended.
- Section 4 presents the appraisal summary of the northern link options at Location C, summarises consultation responses, and recommends the northern link solution.
- Section 5 presents the appraisal summary of the crossing at Location C, summarises consultation responses, and recommends the crossing solution.
- Section 6 presents the appraisal summary of the southern link options at Location C, summarises consultation responses, describes further work undertaken since consultation, and recommends the southern link solution.
- Section 7 describes the Recommended Preferred Route, explains how the scheme meets the LTC scheme objectives, and describes the next steps in the development of the scheme.
- Section 8 is a schedule of abbreviations and a glossary of terms used in the SAR.

2 Scheme Objectives and Post-Consultation Appraisal Routes

2.1 Scheme Objectives

2.1.1 The scheme objectives against which all route options have been appraised are shown in **Table 2.1**. They are presented in three principal categories – transport, economic and environment and community. These scheme objectives were agreed between Highways England and the Department for Transport, as recorded in the Client Scheme Requirements (Version 2.8).

TABLE 2.1 - SCHEME OBJECTIVES

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

2.2 Post-Consultation Appraisal Routes

2.2.1 The Post-Consultation Appraisal Routes include one route at Location A, Route 1, and four routes at Location C, Routes 3 and 4, each of which can be combined with either the Western Southern link (WSL) or the Eastern Southern Link (ESL), as shown in **Figure 2.1**.

2.2.2 The Post-Consultation Appraisal Routes are:

- Route 1 with a bridge crossing
- Route 3 with a bored tunnel crossing and either the WSL or ESL
- Route 4 with a bored tunnel crossing and either the WSL or ESL

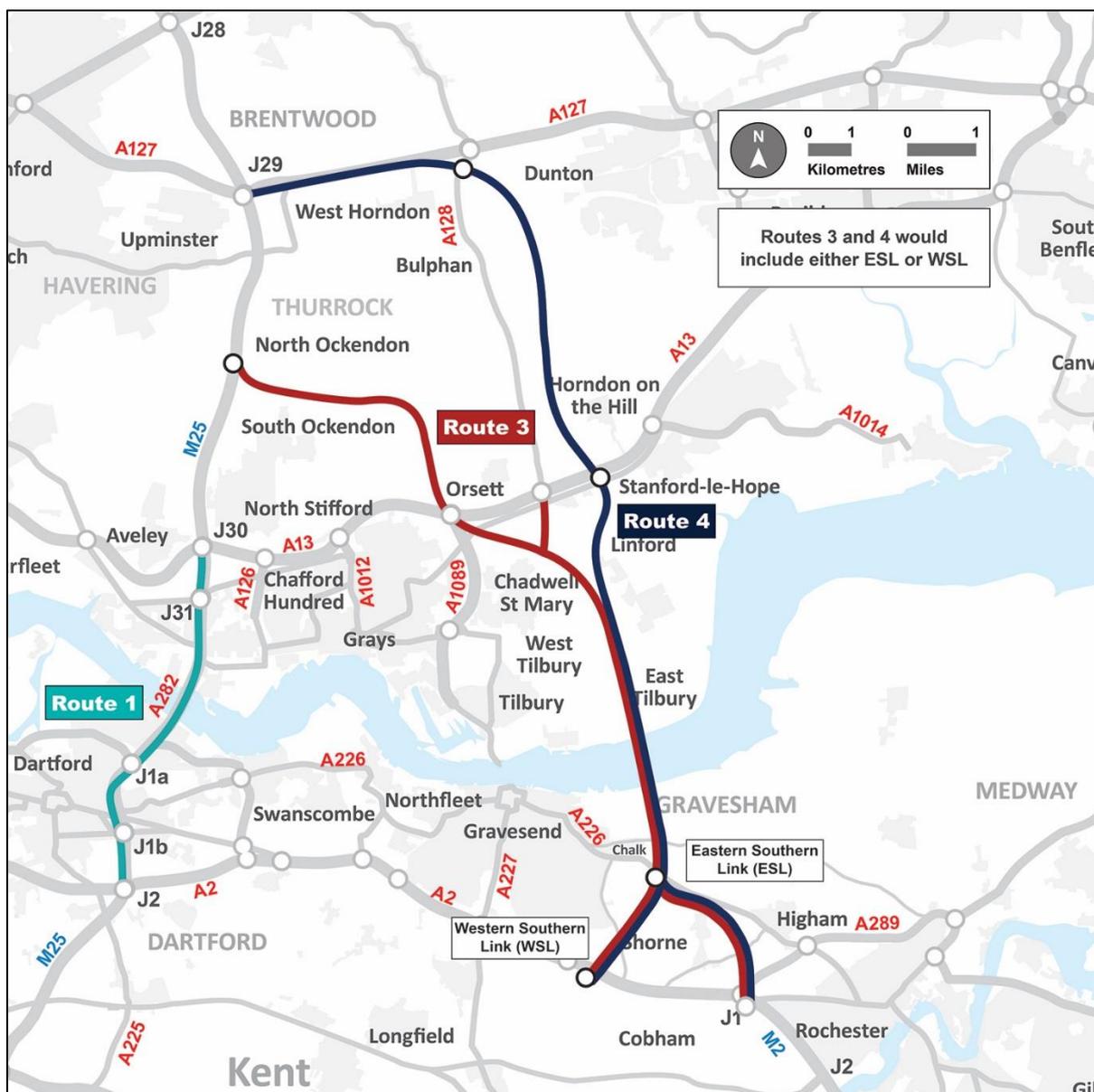


FIGURE 2.1 - POST-CONSULTATION APPRAISAL ROUTES

2.3 Route Appraisal

2.3.1 The appraisal of the shortlist routes was reported in the Pre-Consultation SAR. Following public consultation, the appraisal of the routes has been reviewed and updated taking account of the feedback from the consultation and using new or revised information. Each route has been appraised to determine the extent to which it meets the scheme objectives. Appraisal of the routes has included:

- Development of engineering designs of feasible crossing types.
- Design of horizontal and vertical alignments for highways and junctions.
- Estimating construction and operation and maintenance costs.
- Traffic forecasting using the V2.1 LTC (SATURN) traffic model, taking into account planned housing and commercial developments.

- Undertaking economic appraisal of each option in accordance with WebTAG guidance using outputs from the V2.1 LTC traffic model, using DfT's updated October 2015 consultation values of time.
- Assessing the impact on people and property.
- Appraisal of the environmental impacts both long term and during construction.

3 Location A Options

3.1 Appraisal Summary of Route 1

- 3.1.1 The options identification and selection work has looked at many options at Location A; of these options, Route 1 was selected for detailed appraisal in the shortlist routes. The Pre-Consultation SAR concluded that Route 1 would not meet the transport and economic scheme objectives, hence it was not one of the route options proposed at public consultation. However, there was still significant interest in this route at consultation and it was specifically supported by two of the directly affected local authorities, Gravesham Borough Council and the London Borough of Havering. Route 1 has therefore been included in the Post-Consultation Appraisal Routes.
- 3.1.2 In the previous appraisal of Route 1 the bridge crossing option was shown to have lower construction costs and better value for money compared to the bored tunnel crossing option at that location. It also had safety benefits compared to a tunnel option. This is because it would require northbound traffic to be segregated in three separate tunnels, leading to weaving difficulties and complex signing arrangements. The updated appraisal of Route 1 has therefore been based on the bridge crossing option only.
- 3.1.3 Route 1 would consist of a new bridge to the west of the existing tunnels, providing 4 additional traffic lanes. The new bridge together with the existing Dartford west tunnel would provide 6 lanes for northbound traffic. Traffic flow would be reversed in the existing Dartford east tunnel which, together with the QEII Bridge, would provide 6 lanes for southbound traffic. Other capacity improvements would be provided along the existing corridor between M25 Junction 2 and Junction 30, including major improvements at Junction 30. **Figure 3.1** shows Route 1 at Location A.

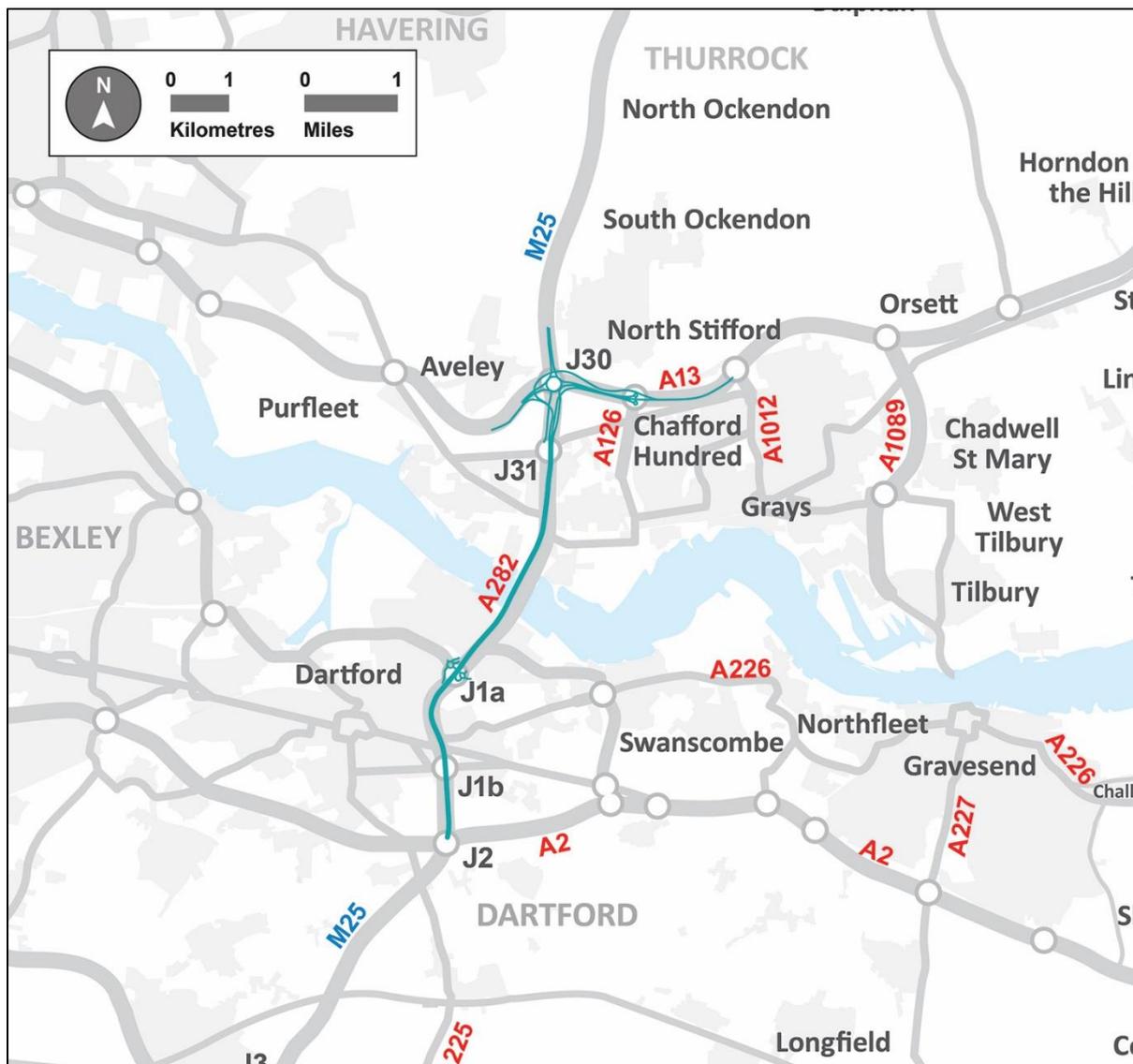


FIGURE 3.1 - LOCATION A - ROUTE 1

3.1.4 **Table 3.1** presents the summary appraisal results for Route 1 against the scheme objectives.

TABLE 3.1 - APPRAISAL OF ROUTE 1

Scheme Objective		Route 1
Transport	Relieve the congested Dartford Crossing and approach roads and improve their performance by providing free flowing north-south capacity	<ul style="list-style-type: none"> Capacity at the crossing would be increased by 53%. As a result of constructing additional capacity, traffic would be attracted to the A282 corridor, partly as a result of releasing additional suppressed traffic demand which has been constrained by the existing crossing capacity for a number of years. In 2025 traffic at the crossing would increase by 24%, with a 14% increase in HGVs. These increases would rise in 2041 to 40% and 28% respectively. There would be increased traffic flows at junctions along the M25/ A282 corridor, some of which are already close to or at capacity. Route 1 is an online improvement which does not increase the existing speed limit from the current 50mph, because of the constraints caused by the existing infrastructure. Closely spaced junctions remain, with increased weaving moves due to higher traffic flows. Free-flowing north-south capacity cannot be achieved with Route 1 and the new crossing would not change the overall experience for road users. Attracting more traffic into the existing corridor increases congestion on key east-west approach roads to the crossing, such as the A2 and A13. There would be journey time savings of 3 to 4 minutes in 2025 in the AM peak period for journeys between M25 Junction 3 and M25 Junction 28. An additional Traffic Management Cell would be required for southbound traffic to manage the movement of restricted vehicles, due to the change in traffic direction in the Dartford east tunnel.
		<ul style="list-style-type: none"> Construction of Route 1 would take approximately six and a half years. During this time traffic would be restricted to a 40mph speed limit, with complex traffic management arrangements. The capacity at the existing crossing would be reduced during construction, imposing further delays on existing users and increased unreliability of journey times.

Scheme Objective		Route 1
	Improve resilience of the Thames crossings and major road network	<ul style="list-style-type: none"> Whilst Route 1 provides additional crossing resilience, it would not improve the resilience of the wider road network. Traffic would still be funnelled through the existing M25/ A282 corridor between Junction 2 and Junction 30. There would be more capacity across the Thames and approaches, but there would also be more traffic along the route; by 2041, there would be a 40% increase in traffic at the crossing, with a 28% increase in the number of HGVs. Route 1 does not provide an independent alternative route for traffic to use. Incidents along the corridor and approach routes would still lead to long delays and severe congestion.
	Improve safety	<ul style="list-style-type: none"> It is predicted that there would be a small increase in the overall accident rate with Route 1. The existing M25/ A282 corridor has a poor safety record, and with the significant increase in traffic on the route, it is likely to continue to perform poorly compared with national average rates. There would be a more complex driving environment at the crossing with substantial weaving movements, as a result of the split of traffic between the two bridges and two tunnels, combined with the proximity of Junctions 1a and 31.
Economic	Support sustainable local development, regional economic growth in medium to long term	<ul style="list-style-type: none"> Building more capacity at Dartford would allow traffic flows to increase which would support growth. However, this would reinforce existing patterns of development rather than provide new journey opportunities and therefore new growth opportunities. The direct benefits generated by Route 1 are estimated to be £1.0bn, which are made up principally of journey time savings. The Wider Impact benefits and reliability benefits generated by Route 1 are estimated to be £0.7bn. Route 1 has limited Wider Impact benefits as it does not connect new communities or areas of business growth to the road network.
	Be affordable to government and users	<p>Estimated Construction Costs Most Likely – P90 (Nominal Costs)</p> <ul style="list-style-type: none"> £3,365m - £4,909m

Scheme Objective		Route 1
		<p>Estimated Operation and Maintenance Costs</p> <ul style="list-style-type: none"> £241m (over 60 years)
	Value for money	<ul style="list-style-type: none"> Initial Benefit Cost Ratio (BCR) of 0.7 Adjusted BCR of 1.1 (Represents low value for money)
Environment & Community	Minimise adverse impacts on health and the environment	<p>Landscape / Townscape</p> <ul style="list-style-type: none"> Effect on Mardyke Valley setting as a result of works at J30 <p>Historic Environment</p> <ul style="list-style-type: none"> No significant effects. <p>Biodiversity</p> <ul style="list-style-type: none"> Possible indirect impacts on qualifying species associated with Ramsar/ Special Protection Area (SPA) e.g. through loss of functionally linked land and collision risk with a bridge. Directly affects functionally linked land and 4 local wildlife sites. Affects 3 areas of ancient woodland as a result of works at J30. <p>Water Environment</p> <ul style="list-style-type: none"> Would affect Mardyke as a result of multiple crossings of the river valley. Direct effect on Thames recommended Marine Conservation Zone (rMCZ) as a result of bridge construction works in the river. <p>Air Quality</p> <ul style="list-style-type: none"> Modelling for air quality has indicated that existing problems would be exacerbated with Route 1, and there would be additional exceedances of the NO₂ Air Quality Strategy Objective (AQSO). During the construction period, there would be additional congestion resulting from traffic management requiring temporary speed limits and contraflow working. It is likely that air quality would worsen during the construction period, and that there would be additional exceedances of AQSOs. <p>Noise</p> <ul style="list-style-type: none"> Small overall noise disbenefit with Route 1. <p>Community Facilities</p> <ul style="list-style-type: none"> There could be direct effects due to noise and visual intrusion on small areas of Mardyke Woods and Davy Down Riverside Park, footpaths, local cycle routes and Sustrans National Cycle

Scheme Objective	Route 1
	<p>Route Networks and a small area of Open Access land.</p> <p>Impacts on property</p> <ul style="list-style-type: none"> • Potential property demolition: Residential property 17. Commercial property 12. • The bridge would impact existing businesses alongside the existing A282 corridor, and jetties as a result of significant disruption during construction.

3.2 Summary and Conclusion – Route 1

3.2.1 The performance of Route 1 against the scheme objectives is summarised below.

Transport Objectives

- 3.2.2 Route 1 does not meet the transport scheme objectives for LTC. As a result of constructing additional capacity at the existing crossing, traffic would be attracted to the M25/ A282 corridor, partly as a result of releasing additional suppressed traffic demand which has been constrained by the existing crossing capacity for a number of years. By 2025 traffic at the crossing would increase by 24%, with a 14% increase in HGVs. These increases would rise by 2041 to 40% and 28% respectively. There would be increased traffic flows at junctions along the M25/ A282 corridor, some of which are already close to or at capacity. Attracting more traffic into the existing corridor also increases congestion on key east-west approach roads to the crossing, such as the A2 and A13.
- 3.2.3 The route could not be transformed into a free-flowing 70 mph solution. The crossing and approaches would be restricted to a 50mph speed limit, due to constraints imposed by the layout of the crossing structures, junctions and existing development along the route.
- 3.2.4 It would not improve the resilience of the wider road network. Traffic would still be funnelled through the existing M25/ A282 corridor between Junction 2 and Junction 30. It does not provide an independent alternative river crossing route for traffic to use when incidents occur, which would still lead to long delays and severe congestion.
- 3.2.5 Construction of Route 1 would take approximately six and a half years. During this time traffic would be restricted to a 40mph speed limit, with complex traffic management arrangements. The capacity at the existing crossing would be reduced during construction, imposing delays on existing users and increased unreliability of journey times.
- 3.2.6 The existing M25/ A282 corridor has a poor safety record, and with the significant increase in traffic along the corridor with Route 1, it is likely to continue to perform poorly compared with national average rates. With an additional crossing point, the driving environment would be more complex requiring substantial weaving movements as a result of the split of traffic

between the two bridges and two tunnels, combined with the proximity of Junctions 1a and 31.

Economic Objectives

- 3.2.7 Building more capacity at Dartford would reinforce existing patterns of development rather than provide new journey opportunities, and would not connect new communities to the network. As a result, the economic benefits of Route 1 would be considerably lower than a solution at Location C. The estimated direct benefits generated by Route 1 are £1.0bn, with estimated Wider Impact benefits and reliability benefits of £0.7bn. In comparison, Route 3 with the WSL would generate direct and Wider Impact benefits and reliability benefits of £2.3bn and £1.5bn respectively.
- 3.2.8 It is estimated that Route 1 would require an investment in the range of £3.4bn to £4.9bn (most likely to P90 estimates). In comparison, it is estimated that Route 3 with WSL would require an investment in the range of £4.1bn to £5.8bn.
- 3.2.9 The Adjusted BCR of Route 1, including Wider Impact benefits, is estimated to be 1.1 which represents low value for money. In comparison, Route 3 with the WSL has an estimated Adjusted BCR of 2.0, which represents high value for money.

Environment and Community Objective

- 3.2.10 Existing air quality problems along the M25/ A282 corridor would be exacerbated with Route 1. Air quality would get worse for most of the route because more traffic would be attracted to the existing road corridor. In many locations this would lead to further exceedances of the NO₂ AQSO.
- 3.2.11 During the construction period, as a result of additional congestion resulting from traffic management, temporary speed limits and contraflow working, air quality would worsen and there would be additional exceedances of the AQSO.
- 3.2.12 There would be an overall noise disbenefit with Route 1 compared to the Without Scheme scenario, because of the additional traffic through the existing corridor.
- 3.2.13 Route 1 could have landscape impacts on the setting of the Mardyke Valley, and impacts on features associated with the internationally important Ramsar and Special Protection Area sites including impacts due to land take on functionally linked land. It would also require land take in local wildlife sites, ancient woodland areas and a recommended Marine Conservation Zone.

Summary

- 3.2.14 A detailed appraisal has been undertaken of Route 1 at Location A which has demonstrated that this route does not meet the following LTC scheme objectives:
- **Transport:** To relieve the congested Dartford Crossing and approach roads and improve their performance by providing free flowing north-south capacity.

- **Transport:** To improve resilience of the Thames crossings and major road network.

3.2.15 Route 1 also performs poorly against a number of other scheme objectives – supporting local development and regional economic growth, value for money, minimising adverse impacts on health and the environment and improving safety.

3.2.16 Route 1 would not meet key scheme objectives and performs poorly against other scheme objectives for a new Lower Thames Crossing. On this basis it has been concluded that Route 1 at Location A should not be taken forward.

3.3 Long Tunnel Alternative at Location A

3.3.1 Some respondents suggested that a long tunnel at Location A from south of M25 Junction 2 to north of M25 Junction 30 would be a better solution. This option was examined as part of the longlist appraisal, as Option A14, and was not taken forward for further consideration at that stage because it would not meet the traffic objectives for the scheme. There would be no connections with Junction 2, Junction 1b, Junction 1a, Junction 31, and Junction 30 along the M25/ A282 corridor. Whilst the new tunnel would have a capacity of around 8000 vehicles/hour, the maximum peak hourly two-way traffic flow predicted in 2025 would be only 3700 vehicles/ hour, as the tunnel would only carry long distance traffic. As a result, high flow levels would remain on the existing M25/ A282 corridor between Junction 2 and Junction 30. The cost of the tunnel would be twice that of Route 1, whilst the economic benefits would be 6% lower than Route 1. The Initial BCR, excluding Wider Impact benefits, would be 0.4, and therefore would provide poor value for money. Overall this option does not meet the scheme objectives and would be poor value for money, it has therefore been concluded that it should not be taken forward.

would also be a new junction with the A13 between the Orsett Cock (A128) and Manorway (A1014) junctions. To accommodate this junction, it would be necessary to close the east facing slips at the Orsett Cock junction and upgrade the parallel A1013 between Orsett Cock and Manorway.

4.1.4 **Table 4.1** shows the performance of Route 3 and Route 4, against the scheme objectives. For the economic objectives, both routes have been combined with the WSL to compare performance of the whole route. Green shading indicates the best performing option against a scheme objective; where there is no shading the performance of both options is considered to be similar.

TABLE 4.1 - LOCATION C NORTHERN LINKS COMPARATIVE APPRAISAL

Scheme Objective		Route 3	Route 4
Transport	Relieve the congested Dartford Crossing and approach roads and improve their performance by providing free-flowing north south capacity	Both routes have a similar benefit in relieving congestion at Dartford Crossing and other roads such as M20, A2 and A13. In 2025 total flows at the Dartford Crossing are forecast to reduce by around 9% with HGV flows reduced by 29%.	Route 4 is a longer route for traffic travelling between the A2/ M2 and M25 J29, and requires online widening of the A127, together with a new local access road for local traffic that currently has direct access on to the A127. It includes a new junction with the A13, which would be in close proximity to the existing junctions at Orsett Cock and Manorway. This would require the closure of Orsett Cock east facing slip roads, which would impact local traffic using A13 east of Orsett Cock.
	Improve resilience of the Thames crossings and the major road network	Route 3 is the shortest route for traffic travelling between the A2/ M2 to M25 J29, and is an entirely new route. North of the A13, Route 3 would carry around 20% more traffic than Route 4, providing greater relief to traffic on existing roads.	Both routes would provide an alternative river crossing to the existing crossing, which will improve the resilience of the road network.
	Improve safety	Both routes would be designed to high standards of safety for road users. With Route 3, it is forecast that there would be an overall reduction in the accident rate (Fatal and Weighted Injury (FWI) collision rate) compared to the Without Scheme scenario. Route 4 would be expected to lead to similar reductions.	

Scheme Objective		Route 3	Route 4
Economic	Support sustainable local development and regional economic growth in the medium to long term	The direct benefits, which are made up principally of journey time savings, are £2.3bn. The Wider Impact benefits and reliability benefits are £1.5bn.	The direct benefits, which are made up principally of journey time savings, are £2.3bn. The Wider Impact benefits and reliability benefits are £1.6bn. Route 4 would conflict with Brentwood's proposals for the Dunton Garden Suburb development, situated to the south east of the A127/ A128 junction
	Be affordable to Government and users	Operation and Maintenance Costs (over 60 years)	
		£569m	£591m
		Capital Cost Most Likely-P90 (Nominal Cost)	
	£4,141m - £5,756m	£4,482m - £6,210m	
Value for money	Initial BCR of 1.2 Adjusted BCR of 2.0 (high value for money)	Initial BCR of 1.1 Adjusted BCR of 1.8 (medium value for money)	
Environment and Community	Minimise adverse impacts on health and the environment	Landscape/ Townscape Both routes affect Green Belt land, and would lead to significant changes to landscape character.	
		Historic Environment Directly affects a scheduled monument and 2 Grade II listed buildings.	Historic Environment Direct impact upon Thorndon Park Registered Park and Garden (Grade II*) and the Thorndon Park Conservation Area. Directly affects a Grade II listed building.
		Biodiversity Directly affects functionally linked land and 3 local wildlife sites.	Biodiversity Directly affects functionally linked land, 6 areas of ancient woodland and 8 local wildlife sites.
		Water Environment Affects Mardyke floodplain.	Water Environment Avoids Mardyke floodplain.

	Scheme Objective	Route 3	Route 4
		<p>Air Quality All properties which are predicted to exceed or are at risk of exceeding the NO₂ AQSO in the vicinity of the Dartford crossing would experience an improvement in air quality compared with the Without Scheme situation, although exceedances of the AQSO are still predicted. Generally levels of nitrogen dioxide at the properties that are closest to Routes 3 and 4 are in the order of 20 µg/m³ in the Without Scheme scenario and in the With Scheme scenario levels decrease or increase by only 1 µg/m³ (recognising that the NO₂ AQSO is 40 µg/m³).</p>	
		<p>Noise Within the vicinity of each of the routes there would be properties experiencing an increase in noise as a result of new traffic or increases in traffic on some existing roads. There would be reductions in traffic on other roads; for example the A282 and the A2. Overall Route 3 has a higher noise impact on properties than Route 4.</p>	<p>Noise Within the vicinity of each of the routes there would be properties experiencing an increase in noise as a result of new traffic or increases in traffic on some existing roads. There would be reductions in traffic on other roads; for example, the A282 and the A2. Overall Route 4 has a lower noise impact on properties than Route 3.</p>
		<p>Community Facilities Direct effect on an area of Open Access Land and the westernmost edge of Orsett Golf Course, footpaths, bridleways and local cycle routes.</p>	<p>Community Facilities Direct effect on 2 areas of Open Access Land, woodland which could be used for recreational purposes, Dunton Hills Family Golf Centre, footpaths, bridleways, a Byway Open to all Traffic and local cycle routes.</p>
		<p>Potential property demolition</p> <ul style="list-style-type: none"> • Residential 14 • Traveller Plots 22 • Agricultural 3 	<p>Potential property demolition</p> <ul style="list-style-type: none"> • Residential 14 • Commercial 9 • Agricultural 3

4.2 Consultation Responses

- 4.2.1 The consultation questionnaire included a question about route options north of the river at Location C. Volume 3 of the Post-Consultation SAR provides a summary of the responses.
- 4.2.2 Of the 32,381 members of the public who answered the question about routes north of the river 33% (10,591) favoured Route 3 and 20% (6,557) favoured Route 4.
- 4.2.3 The route options north of the river would directly affect Thurrock and this was reflected in the fact that over half of the responses from members of the public from Thurrock said “None of these” rather than nominating one of the routes offered in the consultation.
- 4.2.4 Of the 432 groups and organisations that answered the question about routes north of the river, 36% (154) favoured Route 3 and 20% (86) favoured Route 4.
- 4.2.5 Reasons stated in support of Route 3 included that it would improve access to the area, be the shortest most direct route with quicker journey times, have least impact on the local area, be less harmful to the environment and have a lower cost. Reasons stated opposing Route 3 included concerns with the effects of congestion on local roads and on local communities. The Port of London supported Route 3 on the condition that it included a junction for the Port of Tilbury, a request that was also raised by other business groups.
- 4.2.6 Reasons stated in support of Route 4 included that it would have less effect on local communities. Opposition to Route 4 came from the fact that it would be the longest route, that it would potentially increase congestion on the A127, that it would impact undeveloped land, and have greater potential effects on the environment.
- 4.2.7 Some stakeholders including Thurrock Council, elected representatives and environmental groups are opposed to a crossing at Location C and are therefore opposed to both Routes 3 and 4. Key objections raised are that the environmental impact that would be caused is not justified by the benefits, that traffic data is out-of-date, that the proposals are in conflict with strategic growth plans, that there is no mention of LTC in the National Policy Statement for National Networks (NPSNN) and that the consultation process was flawed. Concerns were raised over air quality and pollution, damage to wildlife and habitat, impact on environmentally sensitive areas and ancient woodland. Section 6 of Volume 3 of the Post-Consultation SAR provides Highways England’s response to these issues and concerns raised at consultation.

4.3 Summary and Conclusion

- 4.3.1 The comparative performance of Routes 3 and 4 against the scheme objectives is shown in **Table 4.1** and summarised below.

Transport Objectives

- 4.3.1 Both routes would relieve congestion at Dartford Crossing and provide relief to other roads such as the M20, A2 and A13. Route 3 is a shorter route than

Route 4 for traffic travelling between the A2/ M2 and M25 Junction 29, and would provide the highest quality 70mph solution of the two options.

- 4.3.2 Both routes support the provision of improved network resilience.
- 4.3.3 Both routes would provide a new high quality route between the A2/ M2 and the M25, with a high standard of safety for road users, and are forecast to lead to an overall reduction in the rate of accidents across the wider network.

Economic Objectives

- 4.3.4 Both options would generate similar direct benefits; the Wider Impacts with Route 4 are slightly greater than Route 3. Route 4 would conflict with Brentwood's proposals for the Dunton Garden Suburb development, situated to the south east of the A127/ A128 junction.
- 4.3.5 The most likely estimated capital cost of Route 3 is £340m less than Route 4.
- 4.3.6 Route 3 has a higher Benefit Cost Ratio than Route 4 and is assessed as offering high value for money.

Environment and Community Objectives

- 4.3.7 Route 4 would have a greater impact on historic environment and biodiversity. Route 4 affects ancient woodland and a registered park and garden.
- 4.3.8 Route 3 would have a greater impact on the water environment than Route 4, due to effects on the Mardyke flood plain.
- 4.3.9 Routes 3 and 4 would have similar impacts on air quality. Properties within the vicinity of both routes are predicted to be well within the AQSO. At the Dartford Crossing, properties adjacent to the A282 would experience an improvement in air quality with both routes, although there are still predicted exceedances of the AQSO.
- 4.3.10 Within the vicinity of both routes there would be an increase in noise at some properties as a result of new traffic or increases in traffic on some existing roads. There would be a reduction in noise on other roads; for example, the A282 and the A2. Route 4 has a lower overall noise impact on properties than Route 3.
- 4.3.11 Both routes would pass through Green Belt land, and would have a significant impact on the landscape character.
- 4.3.12 Overall Route 3 has a lower environmental impact than Route 4.

Conclusion

- 4.3.13 Route 3 is the shortest route and would provide an entirely new route for traffic between the A2/ M2 south of the river and M25 north of the river. Overall Route 3 best meets the transport objectives of providing free-flowing north-south capacity, improving network resilience and improving road user safety.
- 4.3.14 Whilst the economic benefits generated by both routes are similar, Route 3 has the lowest capital cost and the highest BCR. It would also have the lowest overall environmental impact of the two options.

4.3.15 From the consultation responses, Route 3 had greater support from members of the public and groups and organisations than Route 4.

4.3.16 The recommended northern link route is Route 3, as shown in **Figure 4.2**.

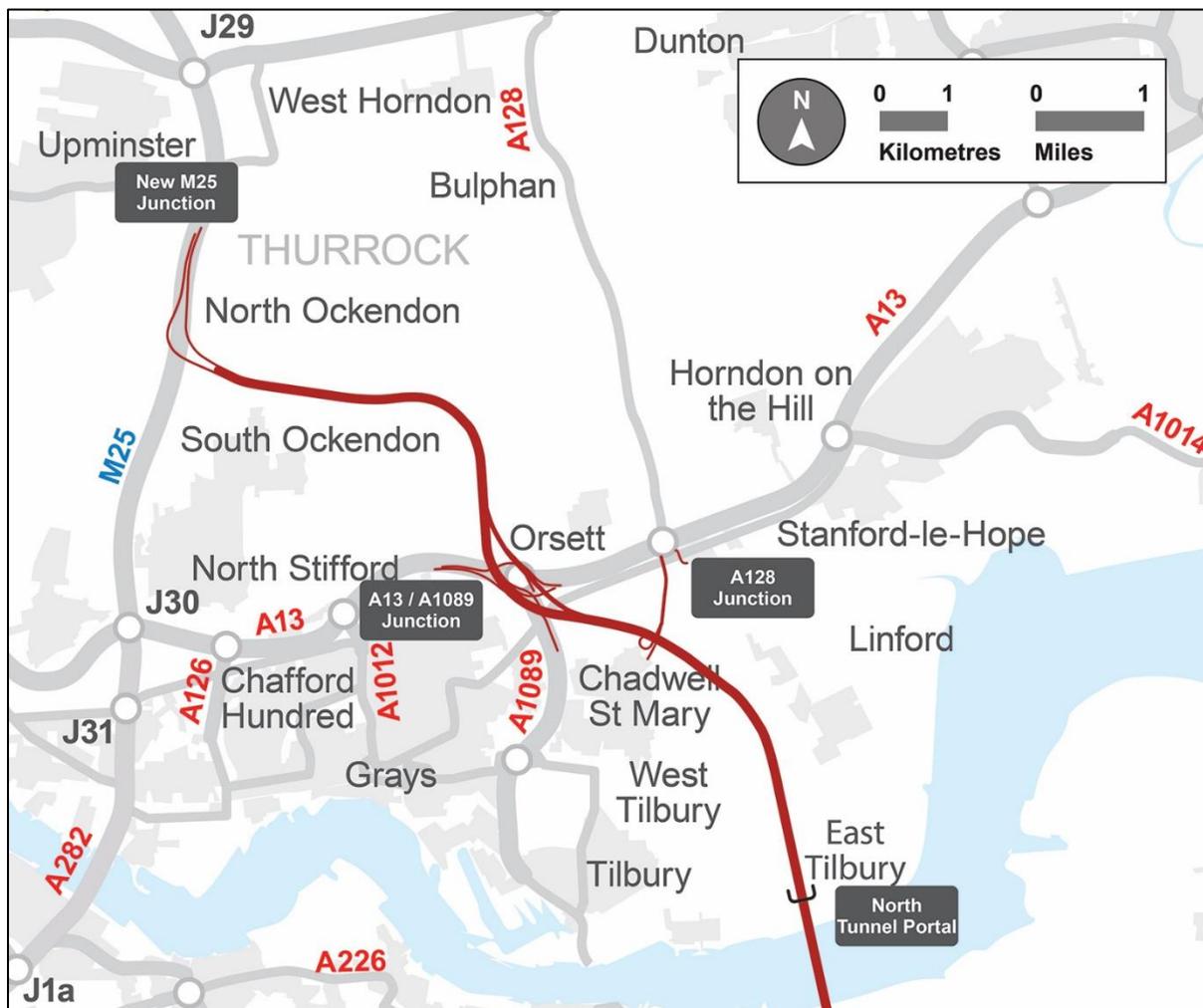


FIGURE 4.2 - RECOMMENDED NORTHERN LINK ROUTE

5 Location C River Crossing

5.1 Appraisal Summary of Bored Tunnel at Location C

- 5.1.1 This section summarises the appraisal and consultation responses, and describes the recommended river crossing at Location C.
- 5.1.2 Possible locations for a crossing of the River Thames at Location C are limited to a narrow corridor approximately 800m wide bounded by the conurbation of Gravesend on the south-western side and the European sites to the east. The sites include the Thames Estuary and Marshes Ramsar site and Thames Estuary and Marshes SPA. These are sites of European and international value and are given the highest level of protection in UK law under the Habitats Regulations. The protection of these sites is due to a number of sensitive habitats and species, including a complex of brackish floodplain grazing marsh ditches, saline lagoons and intertidal saltmarsh and mudflats. These habitats together support internationally important numbers of wintering waterfowl, diverse wetland plants and invertebrates. The Location C routes have the potential to affect both the Ramsar and the SPA.
- 5.1.3 The UK is required to comply with the terms of the EU Habitats Directive and the Wild Birds Directive and has to meet its obligations under the Ramsar Convention. The protection given by the Habitats Directive and the Wild Birds Directive is transposed into UK legislation through the Habitats Regulations. Regulation 61 of the Habitats Regulations requires that where a project is likely to have a significant effect on a European site (either alone or in combination with another project) and is not directly connected with or necessary to the management of that site, the competent authority, before deciding to give consent, must make an 'Appropriate Assessment' of the implications for that site in view of its conservation objectives.
- 5.1.4 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. In the case of LTC, the competent authority will be the Secretary of State for Transport as the application for consent will be made through the Planning Act 2008, as LTC is a Nationally Significant Infrastructure Project (NSIP).
- 5.1.5 Given the presence of the Thames Estuary and Marshes Ramsar and SPA and the proposed proximity of a crossing at Location C, this was a fundamental consideration to the development of the project and the selection of the type of crossing.
- 5.1.6 The appraisal reported in Post-Consultation SAR Volume 6 has demonstrated that there are risks of significant adverse effects on the sites as a result of all options at Location C, but they are greater with a bridge or immersed tunnel and more likely to be mitigated with the bored tunnel option.
- 5.1.7 A bored tunnel crossing at Location C is the only option that does not directly affect the Thames Estuary and Marshes Ramsar site. Both a bridge and immersed tunnel would result in direct loss of habitat in relation to the southern end of and approaches to the crossing.

5.1.8 Therefore, of the crossing types at Location C, a bored tunnel would be the least damaging alternative based upon the assessment work completed to date and the avoidance of a direct impact in the Ramsar site. The bored tunnel crossing was therefore the option proposed by Highways England in the 2016 consultation for the Location C routes.

5.2 Consultation Responses

5.2.1 The consultation questionnaire included a question about the proposal for a bored tunnel at Location C. Volume 3 of the Post-Consultation SAR provides a summary of the responses.

5.2.2 The proposal for a tunnel generated limited consultation responses. Both the Environment Agency and the Port of London Authority supported the bored tunnel proposal, and Natural England agreed that the bored tunnel would be the least environmentally damaging river crossing option.

5.3 Summary and Conclusion

5.3.1 The recommended solution is a bored tunnel crossing at Location C. It represents the only viable alternative that meets the scheme objectives and for which there are a wider and more practical array of mitigation measures that could be implemented to mitigate adverse impacts.

5.3.2 The crossing would comprise a twin-bored tunnel, with one bore carrying northbound traffic and the other southbound traffic. Each tunnel would be large enough to carry three lanes of traffic. Whilst a dual 2 lane solution is currently proposed based on forecast traffic levels, it is recognised that potential future levels of traffic on the river crossing link could require dual 3 lane provision. The recommended solution therefore includes for a future-proofed crossing for this critical piece of infrastructure. **Figure 5.1** shows the proposed tunnel cross-section at a cross passage location.

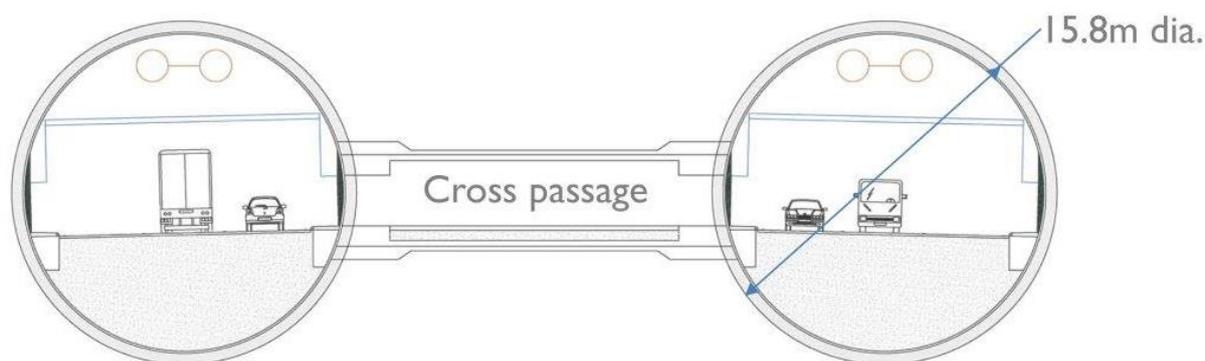


FIGURE 5.1 - BORED TUNNEL CROSS SECTION AT LOCATION C

6 Location C Southern Link Options

6.1 Appraisal Summary of WSL and ESL

- 6.1.1 This section summarises the appraisal and consultation responses, and describes the recommended route south of the river at Location C. The route options are shown in **Figure 6.1**.
- 6.1.2 At Location C there are two alternative route options south of the river in Kent, the WSL and the ESL.

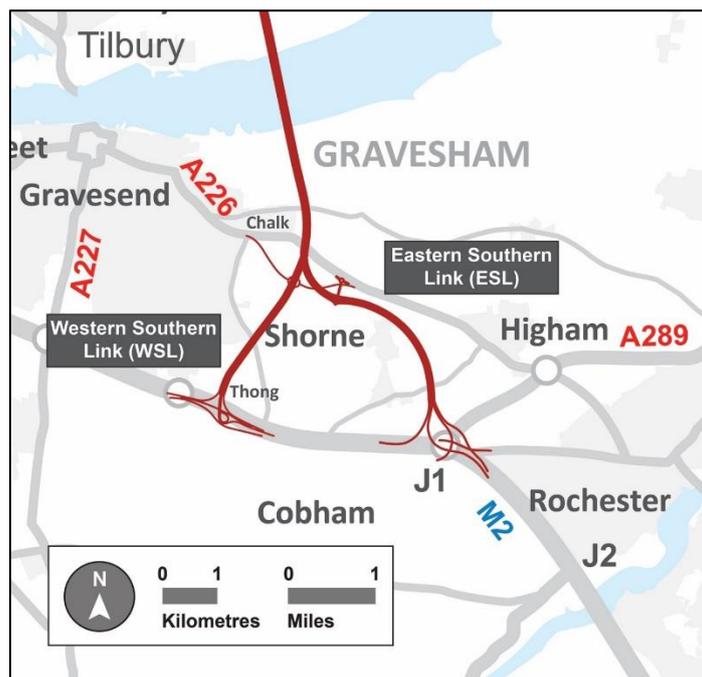


FIGURE 6.1 - SOUTHERN LINK OPTIONS

- 6.1.3 The WSL would connect to a new junction on the A2, along the urban boundary of Gravesend. The new A2 junction has been designed as a compact junction arrangement, with design speeds of the interchange link roads connecting LTC and A2 of 30-50mph. This junction arrangement was developed as a result of the constraints imposed by the High Speed 1 rail line, existing development, existing junctions on the A2, and to minimise environmental impacts.
- 6.1.4 The ESL would provide a direct connection from the M2 to the M25 north of the river. A modified junction would be provided at M2 Junction 1, with the design speed of the interchange link roads connecting LTC and A2/ M2 of 50mph.
- 6.1.5 Both the WSL and ESL would include a local junction with the A226.
- 6.1.6 **Table 6.1** presents the summary appraisal results for the southern links at Location C against the scheme objectives. For the economic objectives, both southern links have been combined with Route 3 to compare performance of the whole route. Green shading indicates the best performing option against a scheme objective; where there is no shading the performance of both options is considered to be similar.

TABLE 6.1 - LOCATION C SOUTHERN LINKS COMPARATIVE APPRAISAL

Scheme Objectives		Western Southern Link	Eastern Southern Link	
Transport	Relieve the congested Dartford Crossing and approach roads and improve their performance by providing free-flowing north south capacity.	Design speed of connecting roads between LTC and A2 30 - 50 mph.	Provides a better free-flow arrangement at the A2/ M2 junction, with design speed of connecting roads between LTC and A2/ M2 of 50mph.	
		Majority of the A2 junction works would be constructed off-line, requiring less traffic management than ESL.	Major viaducts would need to be constructed over live carriageways. Local traffic diversions likely to be required during construction.	
		Both the WSL and ESL (as part of a route at Location C) have a similar positive impact on reducing congestion at Dartford crossing. In 2025 total flows at the Dartford Crossing are forecast to reduce by around 9% with HGV flows reduced by 29%.		
		Daily traffic volumes in 2041 on Route 3 with WSL would be: 96,000 AADT.	Daily traffic volumes in 2041 on Route 3 with ESL would be: 94,000 AADT.	
		For traffic from LTC to M2 Junction 1 WSL is 1.6 miles longer than ESL.	ESL provides a faster route for traffic from LTC to M2 east.	
		WSL offers a faster route for traffic from LTC to A2 at Gravesend east junction.	For traffic from LTC to A2 at Gravesend east junction, ESL is 3.2 miles longer than WSL.	
Improve resilience of the Thames crossings and the major road network.	With a new crossing of the River Thames, both the WSL and the ESL provide improved network resilience as part of a new and completely alternative route to the existing crossing.			
Improve safety	Both the WSL and ESL would provide a new high quality route with a high standard of safety for road users.			
Economic	Support sustainable local development, regional economic growth in the medium to long term	Direct benefits (with Route 3) £2.3bn	Direct benefits (with Route 3) £2.8bn. Provides additional direct benefits as it provides a direct link between the M2 and M25 to the north which is the dominant traffic movement. This is largely due to the ESL being a shorter connection and providing shorter journey times	
		Wider Impact benefits and reliability benefits (with Route 3) £1.5bn	Wider Impact benefits and reliability benefits (with Route 3) £1.7bn.	

Scheme Objectives		Western Southern Link	Eastern Southern Link
Be affordable to Government and users	Operation and Maintenance Costs with Route 3 (over 60 years)		
		£569m	£586m
	Capital Cost with Route 3 Most Likely - P90 (Nominal Cost)		
		£4,141m - £5,756m	£4,342m - £5,970m
Value for money	Initial BCR of 1.2 Adjusted BCR 2.0 (high value for money)	Initial BCR of 1.4 Adjusted BCR 2.2 (high value for money)	
Environment and Community	Minimise adverse impacts on health and the environment	Landscape/Townscape Minor intrusion into Kent Downs Area of Outstanding Natural Beauty (AONB) at the junction with the A2. Impacts on the setting of the AONB.	Landscape/Townscape Greater intrusion into the Kent Downs AONB and greater impact on its setting than WSL at the A2/M2 junction.
		Historic environment Potential setting effects on listed buildings and Thong Conservation Area.	Historic environment Potential setting effects on listed buildings including Grade II* Little St Katherine's Church, and Shorne Conservation Area.
		Biodiversity Direct habitat loss from Claylane Wood ancient woodland and Shorne and Ashenbank Woods Site of Special Scientific Interest (SSSI).	Biodiversity Direct loss of habitat from and fragmentation of the woodland within the Great Crabbles Wood SSSI. Direct loss of 2 areas of ancient woodland and Court Wood LWS.
	Minimise adverse impacts on health and the environment	Water Environment No significant effect	Water Environment No significant effect
		Air Quality AQSO levels are not predicted to be exceeded in the vicinity of either option.	
		Noise Within the vicinity of each of the routes there would be properties experiencing an increase in noise as a result of new traffic or increases in traffic on some existing roads. However, there would be reductions in traffic on other roads; for example the A282 and the A2.	
		Community Facilities Direct effect on Southern Valley Golf Club, Claylane Wood, footpaths, a bridleway, a Sustrans National Cycle Network route and a local cycle route.	Community Facilities Direct effect on Great Crabbles Wood, The Warren Wood and Cole Wood (the latter two forming part of Court Wood LWS), footpaths, a Sustrans National Cycle Network route, a local cycle route and a local trail are all potentially affected.

Scheme Objectives		Western Southern Link	Eastern Southern Link
		Property Potential property demolition: 4 residential 3 commercial includes A2 service station	Property Potential property demolition: 10 residential 2 commercial

6.2 Consultation Responses

- 6.2.1 Highways England's proposed scheme presented at public consultation was Route 3 and the ESL. This was selected on the basis that it would provide the shortest connection between the M2 and M25, creating a 70mph motorway-to-motorway connection and offer the best value for money.
- 6.2.2 The consultation questionnaire included a question about route options south of the river at Location C. Volume 3 of the Post-Consultation SAR provides a summary of the responses.
- 6.2.3 The consultation responses showed that whilst there was greater support for the ESL in terms of the numbers of responses received, some stakeholders, including directly affected local authorities and statutory environmental bodies, favoured the WSL and highlighted the NPSNN policy tests which would need to be met in terms of potential impacts on nationally designated landscapes, habitats, Green Belt and ancient woodland if the ESL option were to be pursued.
- 6.2.4 Of the 32,259 members of the public who answered the consultation question about routes south of the river, 18% (5,889) favoured the WSL and 38% (12,304) favoured the ESL. In the Gravesham area, which includes responses from Shorne and Higham, only 640 supported the ESL and 391 supported the WSL, with 3,088 respondents not supporting either option.
- 6.2.5 Of the 433 groups and organisations that answered the consultation question about routes south of the river 17% (74) favoured the WSL and 42% (181) favoured the ESL.
- 6.2.6 Both Kent County Council and Essex County Council support the WSL. Gravesham Borough Council is opposed to both routes east of Gravesend.
- 6.2.7 Natural England considers that the ESL would be the most environmentally damaging option owing to the loss of SSSI and extensive areas of ancient woodland, and the impact on the Kent Downs AONB, whilst the WSL would have less impact on protected sites. Other environmental and community bodies also stated that the WSL would have a lower impact on environmental features.
- 6.2.8 There was greater support from business for the ESL, with 139 businesses supporting the route, compared to 56 who supported the WSL.

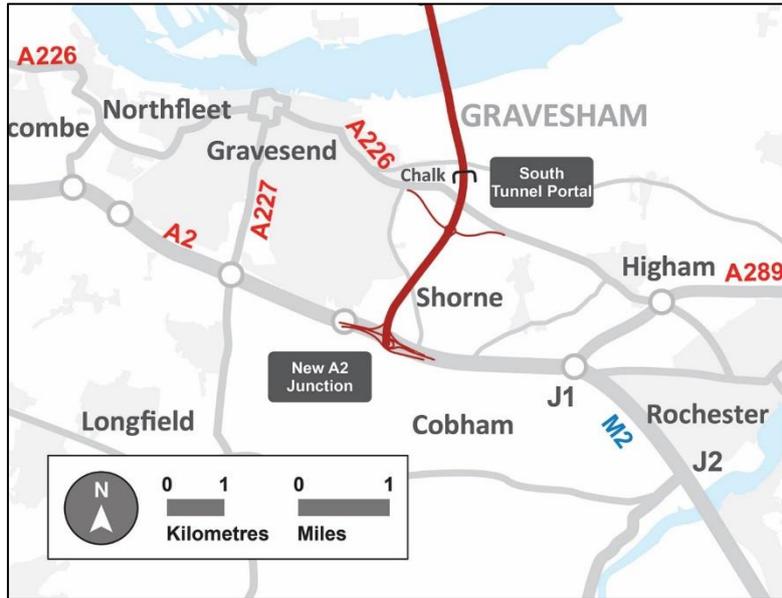
6.3 Additional work undertaken on the Southern Link since Consultation

- 6.3.1 Highways England's proposed scheme presented at public consultation was Route 3 and the ESL. This was selected on the basis that it would provide the best transport alternative by providing the shortest connection between the M2 and M25, creating a 70mph motorway-to-motorway connection. It also offered the best value for money when costs and benefits were taken into account.
- 6.3.2 The responses from the public consultation showed that whilst there was greater support for the ESL in terms of the numbers of responses received, some stakeholders, including directly affected local authorities and statutory environmental bodies, favoured the WSL and highlighted the NPSNN policy tests which would need to be met in terms of potential impacts on nationally designated landscapes, habitats, Green Belt and ancient woodland if the ESL option were to be pursued.
- 6.3.3 In response to environmental and community concerns regarding the impact of the ESL raised in the consultation, further design and appraisal work was undertaken on the southern link proposals. This included examination of the following:
- Improvements to the design of the junction between the WSL and the A2 to provide an unrestricted free-flowing junction to the same standard as that provided where the ESL meets the M2 Junction 1. The WSL junction presented at consultation was of "compact" design with consequent speed restrictions.
 - The extent to which the impact of the ESL on both the protected sites and the community could be mitigated.
- 6.3.4 The further work undertaken since consultation has shown that:
- There is very limited opportunity with the ESL to reduce the community and environmental impacts on the AONB, SSSI and ancient woodland. The NPSNN provides significant protection to these nationally important sites.
 - It is possible to improve the performance of the WSL and provide a full standard free-flowing junction solution at the new A2 junction. This option could be achieved without significantly increasing impacts on nationally important environmental sites (AONB, ancient woodland and SSSI).

6.4 Summary and Conclusion

- 6.4.1 On the basis of the consultation responses and the work undertaken since consultation, it is now concluded that the WSL would best meet the scheme objectives. The WSL would achieve the transport objectives and provide a high-quality solution. It would offer high value for money and would fully support wider regeneration and economic objectives, whilst having a materially lower impact than the ESL on the environment and local communities.

6.4.1 In a change to the proposed scheme presented in the 2016 consultation, the recommended southern link route is now the WSL, as shown in **Figure 6.2**.



NOTE: THIS DRAWING IS BASED ON THE ROUTE PRESENTED AT PUBLIC CONSULTATION. THE INCLUSION OF A LOCAL JUNCTION WITH THE A226 WILL BE EXAMINED IN THE NEXT STAGE OF SCHEME DEVELOPMENT

FIGURE 6.2 - RECOMMENDED ROUTE SOUTHERN LINK

7 Recommended Preferred Route and Next Steps

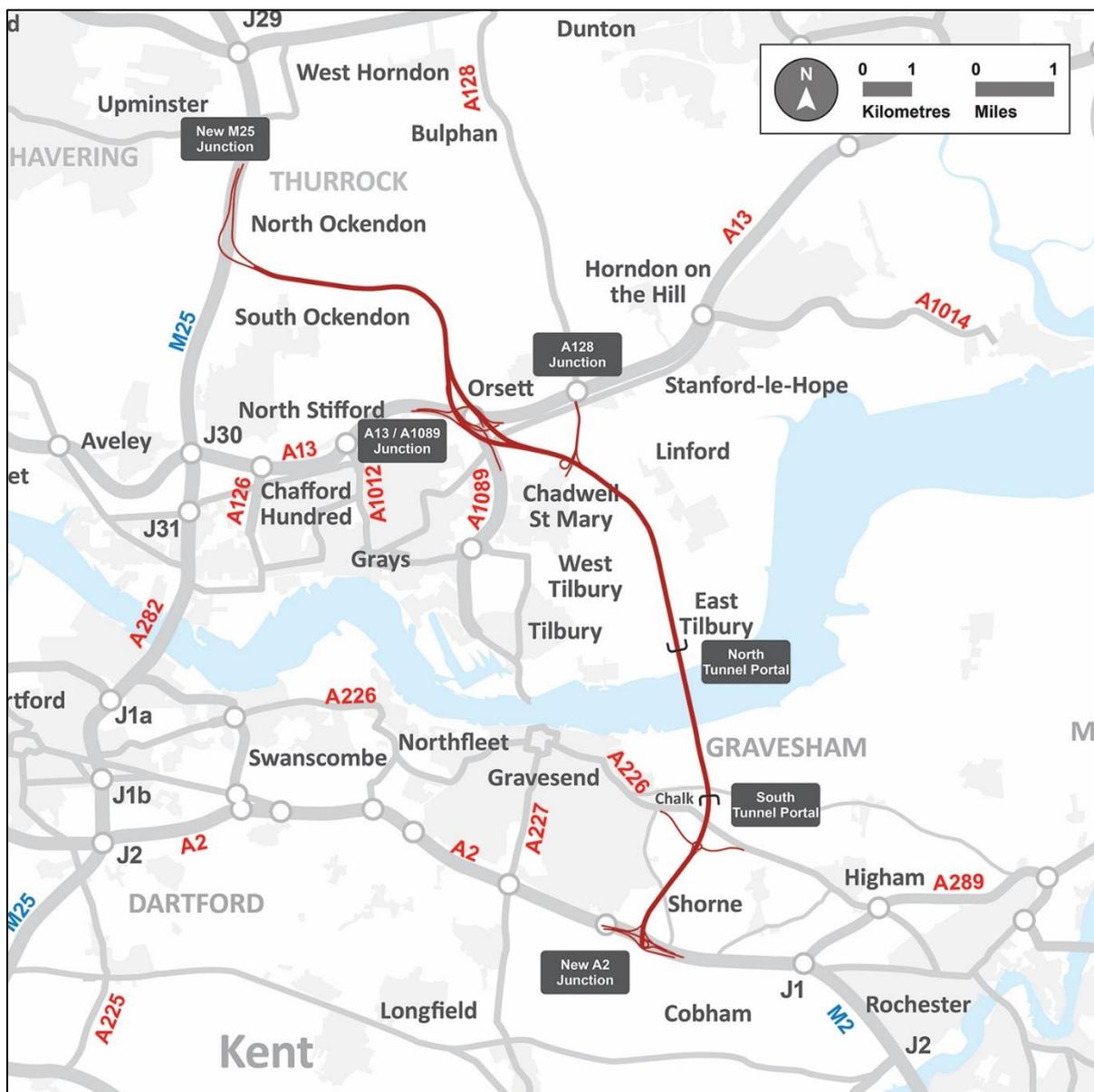
7.1 Strategic considerations in the selection of the Recommended Preferred Route

7.1.1 The strategic considerations which have led to the selection of the Recommended Preferred Route are as follows:

- Of the two locations considered, only a new crossing at Location C satisfies the transport scheme objectives, particularly in regard to resilience. Options at Location A did not meet the strategic objectives of the scheme.
- A new crossing at Location C opens up new opportunities for development and would strongly support the regional economic growth objectives.
- A bored tunnel provides the best opportunity to mitigate adverse impacts on the Thames Estuary and Marshes Ramsar and SPA sites, which are international and European designations.
- Route 3 provides the most direct route with the lowest environmental and community impacts north of the river.
- The WSL is the recommended route south of the river. This would achieve the transport and economic objectives and provide a high-quality solution, whilst having a materially lower impact than the ESL on the environment and local communities.

7.2 Description of Recommended Preferred Route

7.2.1 The Recommended Preferred Route, as shown in **Figure 7.1**, is Route 3 north of the River Thames with the WSL south of the River Thames, and a bored tunnel river crossing.



NOTE: THIS DRAWING IS BASED ON THE ROUTE PRESENTED AT PUBLIC CONSULTATION. THE INCLUSION OF LOCAL JUNCTIONS AT TILBURY AND WITH THE A226 WILL BE EXAMINED IN THE NEXT STAGE OF SCHEME DEVELOPMENT

FIGURE 7.1 - RECOMMENDED PREFERRED ROUTE

7.2.2 The recommended scheme would provide a new 70 mph route to expressway standards between the M25 in Essex and the A2 in Kent. It would include the following junctions:

- A new free-flow junction with north-facing slip roads on the M25 between Junctions 29 and 30.
- A modified junction with the A13/ A1089 in Essex, including a spur to the Orsett Cock junction, incorporating an improvement to the A128.
- A new free-flow junction with the A2 to the east of Gravesend.

7.2.3 Further work will be undertaken in the next stage of scheme development to determine whether new local junctions should be provided with the A226 south of the river and at Tilbury north of the river.

7.2.4 It is proposed that the route would be a dual two lane carriageway. However, further work will be undertaken in the next stage of scheme development to examine whether a dual three lane solution should be provided for all or part of the route. The recommended scheme includes twin bored tunnels large enough to accommodate a dual three lane carriageway, in order to provide a future-proofed solution. The new tunnels would accommodate all vehicles and would not be restricted by size or load type, unlike the northbound tunnels at the existing crossing.

7.3 Performance against Scheme Objectives

7.3.1 **Table 7.1** summarises the performance of the Recommended Preferred Route against the scheme objectives. This is described in more detail in the remainder of this section.

TABLE 7.1 - PERFORMANCE OF RECOMMENDED PREFERRED ROUTE AGAINST SCHEME OBJECTIVES

Scheme Objectives	Performance of Recommended Preferred Route
Transport	<ul style="list-style-type: none"> • Reduces congestion and delays at the existing crossing, local roads and on the approach roads including the A2 and A13. Heavy goods vehicle movements are predicted to reduce at the existing crossing by 29% in 2025 reducing congestion and reducing the risk of incidents and the impact of conveying hazardous goods northbound. • Provides a faster route with improved journey times for users of the new and the existing crossings. • Provides a more reliable road improving journeys for all road users. • Provides more than 70% additional north-south capacity on opening, and an alternative river crossing to the existing crossing, which will improve the resilience of one of the least reliable sections of the Strategic Road Network (SRN). • Provides a safer route, as a result of a new high quality expressway route and reduced congestion along the existing A282 corridor which has a poor safety record.
Economic	<ul style="list-style-type: none"> • Drives economic benefit by unlocking constraints on economic growth and stimulating local and regional development, as well as supporting national growth. • Improves transport connections at a critical part of the SRN supporting businesses and improving productivity. • Connects communities in Kent and Essex and provides better access to jobs, housing, leisure and retail facilities either side of the river. • Opens up new opportunities for investment, regeneration and housing. • Creates jobs, apprenticeships and training opportunities during construction and in the longer term. • Would require an investment in the range of £4.1bn to £5.8bn and generate £2.35bn of direct economic benefits and £1.53bn of Wider Impact and reliability benefits. Adjusted BCR is 2.0, which represents high value for money.
Environment & Community	<ul style="list-style-type: none"> • Minimises the environmental impact on sensitive and valuable habitats close to the river by adopting a bored tunnel solution. • Reduces congestion at the existing crossing thereby improving air quality along the A282 corridor, where exceedances of the NO₂ AQSO currently occur. • Reduces congestion at the existing crossing reducing noise, although there will be some adverse noise impacts close to the new route.

- 7.3.2 The Recommended Preferred Route would provide the best solution in meeting the transport, economic, and environment and community scheme objectives.

Transport objectives

- 7.3.3 The preferred scheme would reduce congestion and delays at the existing crossing and on the approach roads including the A2 and A13. Heavy goods vehicle movements are predicted to reduce at the existing crossing by 29% in 2025.
- 7.3.4 It would provide a faster route with improved journey times for users of the existing Dartford crossing and the new crossing. On opening of the new crossing, under typical morning peak conditions, for northbound journeys between M25 Junction 3 and M25 Junction 28 across the existing Dartford Crossing, journey speeds would increase by 7mph from 44mph to 51mph with a 3 minute time saving. Average journey speeds between the M2 Junction 4 and M25 Junction 28 would increase by 9mph from 47mph to 56mph with a journey time saving of 8 minutes via the new crossing.
- 7.3.5 It would provide an additional 70% north-south capacity on opening, enabling a significant increase in cross-river journeys to be made which are currently not possible due to the lack of capacity.
- 7.3.6 It would provide an alternative river crossing to the existing crossing, which will improve the resilience of one of the least reliable sections of the SRN, and provide a more reliable road improving journeys for all road users. The existing route is prone to frequent incidents which increase the likelihood of congestion, not only at the crossing but also on the wider road network. With increasing congestion in the future, the likelihood of incidents will lead to greater unreliability. The scheme will substantially improve the resilience of the SRN east of London, by providing a high quality diversionary route when incidents occur on the existing crossing.
- 7.3.7 The scheme would provide a safer route, as a result of a new high quality expressway route and reduced congestion along the existing A282 corridor, which has a poor safety record.

Economic objectives

- 7.3.8 The preferred scheme would drive economic benefit by unlocking constraints on economic growth and stimulating local and regional development, as well as supporting national growth.
- 7.3.9 It would improve transport connections at a critical part of the SRN supporting businesses, through increased cross-river capacity and by providing more reliable and quicker journey times and reduced operating costs.
- 7.3.10 It would connect communities in Kent and Essex and improve connectivity with Europe providing better access to jobs, housing, leisure and retail facilities either side of the river. It would provide improved connections between major centres of economic activity, including Tilbury Port and London Gateway Port, Medway Ports, the Port of Dover and the Channel Tunnel.

- 7.3.11 Through improving connectivity, it would open up new opportunities for investment, regeneration and housing. Planned developments in the area could lead to an increase of up to 92,000 new homes and 122,000 new jobs by 2041, which include a 21st century garden city at Ebbsfleet. In addition, the Thames Estuary 2050 Growth Commission, which has been established to develop an ambitious vision and delivery plan for North Kent, South Essex and East London up to 2050, is expected to explore the development of high productivity clusters in specific locations, looking at future regeneration and planned infrastructure projects.
- 7.3.12 The scheme could create jobs, apprenticeships and training opportunities during construction and in the longer term. The lack of a reliable cross river connection has restricted movement of labour; only 2% of workers commute between Dartford and Thurrock compared with 10% who commute the same distance between Dartford and Gravesend.
- 7.3.13 The preferred scheme would generate estimated direct economic benefits of £2.35bn, with estimated Wider Impact benefits and reliability benefits of £1.53bn. The Adjusted BCR would be 2.0, which represents high value for money. The discounted scheme costs, benefits and Initial and Adjusted BCRs are presented in **Table 7.2**, based on the core traffic growth scenario and the most likely capital costs.

TABLE 7.2 – PRESENT VALUE OF COSTS, BENEFITS AND BENEFIT COST RATIOS (2010 PRICES DISCOUNTED TO 2010)

	Value
Present Value Costs (£bn)	1.93
Present Value Direct Benefits (£bn)	2.35
Present Value Wider Impact benefits and Reliability benefits (£bn)	1.53
Initial BCR	1.2
Adjusted BCR	2.0 (High value for money)

- 7.3.14 A complementary appraisal of wider economic benefits has also been carried out alongside the conventional WebTAG analysis which was the basis for Wider Impact benefits reported in **Table 7.2**. The objective of this analysis was to capture the “transformational” nature of the project. This used “Spatial Computable General Equilibrium” on a similar basis to that used for the Airports Commission economic appraisal. This approach is widely used by Government departments including HM Treasury and HMRC. This assessment indicates that the scheme could add over £8bn cumulatively to the economy in terms of GDP, by stimulating investment and business opportunities and create over 6000 new long-term jobs nationally by 2050.
- 7.3.15 The preferred scheme would require an estimated investment in the range of £4.1bn to £5.8bn.
- 7.3.16 Users of the existing crossing are currently required to make a user payment via the Dart Charge system. It is anticipated that these charges will continue

to be applied in the future and that user charges would also be applied to the new crossing in line with current Government policy.

Environment and community objectives

- 7.3.17 The preferred scheme would reduce congestion at the existing crossing thereby improving air quality along the A282 corridor, where exceedances of the NO₂ AQSO currently occur. Properties within the vicinity of the recommended scheme are not expected to experience exceedances and levels are predicted to be well within NO₂ AQSO limit.
- 7.3.18 It would reduce congestion at the existing crossing, thereby reducing noise at properties along the A282. There would be increases in noise levels for properties close to the new route, but, based on the predicted traffic flows, and with the incorporation of mitigation measures, levels at properties are expected to be within appropriate standards.
- 7.3.19 It would minimise the environmental impact on sensitive and valuable habitats along the river by adopting a bored tunnel solution. The main impacts would be during the construction phase and there is potential for hydrogeological changes because of the dewatering required. The bored tunnel would avoid direct loss of habitat from the Ramsar site. On completion, the tunnel would not impact the marine environment and the coastal/ terrestrial impacts would be much less than for a bridge or immersed tunnel.
- 7.3.20 The selection of the WSL, in preference to the ESL, would help to minimise impacts on ecology, protected habitats, and protected landscapes.
- 7.3.21 The scheme would provide a new road corridor and would impact on the openness of the Metropolitan Green Belt. There is an overriding national need for the scheme, which constitutes very special circumstances for the purposes of Green Belt policy.

7.4 Next Steps

- 7.4.1 Following the Preferred Route Announcement by the Secretary of State for Transport, the next steps in the development of the scheme will involve:
- Environmental, geotechnical and topographical surveys.
 - Preparation of the preliminary design of the route.
 - Environmental, traffic, and economic assessment.
 - Engagement and consultation with stakeholders.
 - Subject to the outcome of consultation, the submission of a Development Consent Order (DCO) application to the Planning Inspectorate.
- 7.4.2 Survey work will include a comprehensive suite of ecological surveys to further understand bird movements and usage of land in the internationally protected sites. These surveys will also support the development of appropriate mitigation measures to ensure that there are no adverse impacts on the integrity of the sites, and that wider impacts elsewhere are minimised during construction and once the scheme is in operation.

- 7.4.3 In developing the preliminary design, further detailed consideration will be undertaken regarding:
- Whether a dual-3 lane solution should be provided for all or part of the route.
 - Whether new local junctions should be provided with the A226 south of the river and at Tilbury north of the river.
 - Whether tunnelling should continue further south of the river to mitigate the impacts of the scheme.
 - Development of the junction arrangements with the A2, A13 and M25 to reduce their impacts on the community and the environment.
 - Alternative alignments for the route where it passes through the landfill site north of South Ockendon.
 - Further assessment of the impacts of the preferred route on the wider road network. This work will form part of Highways England’s ongoing route strategy planning.
- 7.4.4 An environmental assessment of the local environment will be undertaken to ensure that local conditions are fully understood. This will include a Habitats Regulations Assessment to understand the impacts on European protected sites and further assessment of the effects on nationally protected landscapes, ancient woodland and ecological sites.
- 7.4.5 A detailed air quality assessment will be undertaken in the next stage of scheme development. This will use updated data and will consider changes in emissions as a result of the scheme, to ensure that air quality effects are minimised as far as possible.
- 7.4.6 A detailed noise and vibration assessment will be undertaken, considering potential impacts of the scheme in accordance with the NPSNN and the National Planning Policy Framework. The noise and vibration assessment will consider construction and operational effects at individual receptors, as well as appropriate mitigation measures such as low-noise surfacing, bunds or acoustic barriers to reduce noise levels at sensitive receptors.
- 7.4.7 The environmental assessment will also consider potential impacts of the preferred scheme on:
- The historic environment, including listed buildings, scheduled monuments, scheduled areas and conservation areas.
 - The water environment, including flood risk and hydrogeological changes during dewatering of the bored tunnel construction.
 - Community facilities including Open Access Land, golf courses, footpaths, bridleways and local cycle routes.
 - Private and commercial property, agricultural land and farms.
- 7.4.8 The LTC traffic model will be developed to include updated travel demand data and to reflect the latest information on committed planned developments. This work will include further traffic surveys. Future significant developments in the area include Ebbsfleet Garden City, and expansion of

London Gateway Port and Tilbury Port, as well as proposals for an entertainment resort in the Swanscombe peninsular. There will also be engagement with the Thames Estuary 2050 Growth Commission, which is looking at future growth up to 2050 in North Kent, South Essex and East London.

- 7.4.9 There will be further engagement and consultation with local communities, local authorities, environmental bodies, businesses, landowners, homeowners, utility providers and other interest groups. Statutory consultation will be undertaken before the DCO application is made. This consultation will provide stakeholders and the community with further opportunities to contribute to the development of the scheme. A Statement of Community Consultation will be prepared setting out how local communities in the vicinity of the scheme will be consulted. A Consultation Report will be prepared to accompany the DCO application to record consultations undertaken, views received and how respondents' views have been considered. Statements of Common Ground will be prepared with stakeholders to agree positions on subjects such as assessment methods and design and mitigation measures, in advance of the examination of the proposals submitted in the DCO application.

8 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.
BSL	British Sign Language
BT	Bored tunnel
BTEC	Business and Technology Education Council

Abbreviation	Description
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 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.

Abbreviation	Description
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 Assessment (HRA)	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, 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

Abbreviation	Description
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 entertainment resort 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
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.

Abbreviation	Description
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
FACTS	Parliamentary Advisory Council for Transport Safety: a registered charity and an All-party parliamentary group of the UK parliament. Its charitable objective is to protect human life through the promotion of transport safety for the public benefit.
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

Abbreviation	Description
	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-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 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 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.

Abbreviation	Description
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
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.

Abbreviation	Description
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.

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