Highways England

A2 Bean and Ebbsfleet Junction Improvements

Scheme Assessment Report

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1 Executive Summary

1.1.1 Improvements to the Bean and Ebbsfleet Junctions on the A2 are considered necessary to support the level of development proposed for Kent Thameside. Without improvements to these junctions, significant future traffic congestion will result which will have an adverse impact on the operation of the A2 and will be a constraint on economic development and housing growth in the area.

1.1.2 The key scheme objectives captured in the Client Scheme Requirements are to:

- Support economic development and housing growth in Kent Thameside
- Minimise the impact of developments on the performance of the A2 mainline
- Achieve a BCR of at least 2.0
- Minimise environmental impact
- Reduce accident rates for all users
- Integrate with the wider strategic objectives of accessibility within Kent Thameside

1.1.3 Following consideration of the objectives set out above and a close examination of the full range of existing conditions, a number of options for the improvement of the junctions were identified and sifted, resulting in an accepted recommendation that three options at Bean and one option at Ebbsfleet be taken forward for further appraisal. These were Bean Options 3, 4 and 5 and Ebbsfleet Option 1b. Appraisal was undertaken for each of the Bean options in conjunction with Ebbsfleet Option 1b (i.e. B03E01b, B04bE01b and B05E01b).

1.1.4 The conclusion of the Stage 1 appraisal was that Option B05E01b had the best performance against the Scheme Objectives and against the majority of the appraisal factors and hence the recommendation was accepted that this option be taken forward as the Proposed Option to a non-statutory public consultation. It was agreed that this be taken forward as a single option as none of the other options appraised had a satisfactory performance against the Scheme Objectives.

1.1.5 The public consultation took place between 18 January 2017 and 1 March 2017. Five public information events were held at two local venues and a scheme brochure was deposited at a number of public locations such as libraries. The public were encouraged to provide comments and a number of ways of responding were provided.

1.1.6 The results of the public consultation indicated that there was general agreement for the need for the scheme and overall support for the proposals. There were objections to the Bean proposal mainly concerned with the impact on Ightham Cottages and on the closure of the slip road from the B255.

1.1.7 Noise and air quality are concerns and the Stage 1 environmental assessment concluded that it was unlikely that the scheme would have a significantly detrimental impact on noise or air quality. Further modelling undertaken as part of Stage 2 and noise and air assessment has concluded that it is unlikely that the scheme would have a significant detrimental impact on noise and air quality. It should be noted that the air and noise assessments will be further refined at future stages to incorporate updated traffic forecasts.

1.1.8 Whilst it is recognised that Option B05E01b requires the demolition of Ightham Cottages and the acquisition of assets at the Spirits Rest Horse Sanctuary, this Option has the best performance against the Scheme Objectives and against the majority of the appraisal factors and hence it is recommended that Option B05E01b is considered as the Preferred Option and taken forward to Preferred Route Announcement.

2 Introduction

2.1 Purpose of this report

2.1.1 The A2 Bean and Ebbsfleet Junction Improvements Project is currently in the Project Control Framework (PCF) Stage 2 - Option Selection. Following consideration of the objectives and a close examination of the full range of existing conditions, a number of options for the improvement of the junctions were identified and sifted.

2.1.2 This Scheme Assessment Report (SAR) summarises the Technical Appraisal Report and the Report on Public Consultation, provides a technical appraisal of the consultation options, and provides updated costs, economics and an environmental assessment for the options considered. The report also provides a recommended option for the Preferred Route Announcement (PRA) that will be undertaken at the end of Stage 2. Following PRA the scheme will be taken forward into an application for statutory powers to construct.

2.1.3 The PCF Stage 1 Technical Appraisal Report (report number HA543917-HHJV-GEN-PCF-0005-TAR), brought together the traffic, economic, safety and environmental assessments, and was the basis for deciding which option(s) were to be taken to non-statutory Public Consultation. Following appraisal the TAR provided an accepted recommendation that Bean Option 5 and Ebbsfleet Option 1 (referenced as Option B05E01b) was to be taken forward to public consultation.

2.1.4 Public Information Events (PIE) and the Non-Statutory Consultation was undertaken from 18 January 2017 – 1 March 2017 to allow the public to provide their views on the options presented. The Report on Public Consultation (Report number HA543917-HHJV-GEN-PCF-0033) provides details of the results of the PIE and the Non-Statutory Consultation and a summary is provided in this SAR.

2.2 Scheme Brief

2.2.1 The Project Objectives are set out in the Client Scheme Requirements are summarised in Table 1 as follows:

Table 1 - Project Objectives and Client Scheme Requirements

Reference	Project Objective	Client Scheme Requirements
1	Environment	Minimise environmental impact as measured in accordance with DMRB. Where possible, improve air quality with regard to vehicle emissions in declared Air Quality Management Areas (AQMAs).
2	Economy	In combination with other measures (e.g. Kent Thameside Strategic Transport Programme), support economic development and housing growth in Kent Thameside. Minimise the impact of the developments on the performance of the A2 mainline (performance criteria to be defined). A scheme which achieves a BCR of at least 2.0
4	Safety	Reduce accident rates for all users. Minimise the exposure to road workers to harm during construction, operation and maintenance.
5	Accessibility	Integrate with the wider strategic objectives of accessibility within Kent Thameside by providing infrastructure within the junction improvement that enables choices of modes of travel to existing and proposed facilities. Provides access to the local and sustainable transport options and public transport hubs

3 Summary of Existing Conditions

3.1 Statement of the Problem

3.1.1 The A2 Bean and Ebbsfleet Junctions are adjacent grade-separated Junctions on the A2 trunk road, approximately 2km apart as shown in Figure 1. The Bean Junction connects the A296 and B255, which provides access to the Bluewater regional shopping centre, to the A2. The Ebbsfleet Junction connects the A2 to the A2260 and B259 Southfleet Road. Ebbsfleet Junction was constructed in 2005 to serve the Ebbsfleet International Rail Station and the surrounding Ebbsfleet Valley and Eastern Quarry developments. Although this junction is not currently heavily trafficked, it is expected that traffic flows will increase considerably as the adjacent developments proceed.

3.1.2 The proposed improvements to the Bean and Ebbsfleet Junctions form part of the Kent Thameside Strategic Transport Programme (STP) and are considered necessary to support the level of development growth proposed for Kent Thameside, which could ultimately lead to the development of some 20,000 homes and 54,000 jobs (source: A2BE Stage 2 Uncertainty Log*), in the area served by the Bean and Ebbsfleet Junctions.

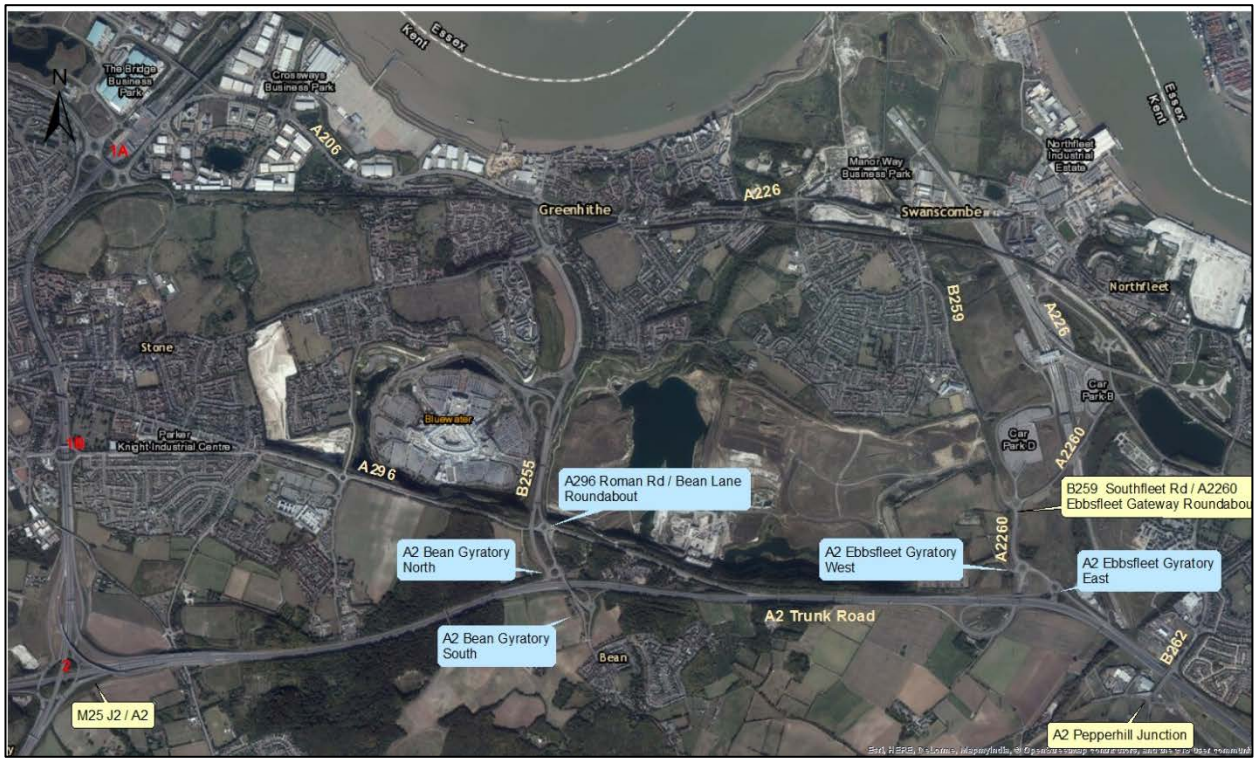
The Stage 2 traffic forecasting has identified that by 2038 (the notional design year):

- traffic using the A2 Bean Junction (including the A296) will increase by 43 - 75% during weekday peak periods by 2038 compared with 2014 traffic levels; and
- traffic using the Ebbsfleet Junction will increase by between 160 -180% during weekday peak periods by 2038 compared with 2014 traffic levels.

3.1.3 As a consequence, improvements will be required at both junctions to improve capacity and manage these increases in traffic.

3.1.4 The locations of the Bean and Ebbsfleet Junctions are shown in Figure 1.

Figure 1 - A2 Bean & Ebbsfleet Junction Improvements – Location Plan



*HHJV Doc. Ref. 0058-UA007244-UT22TN-01 Stage 2 A2BE Uncertainty Log

3.2 Existing Conditions

3.2.1 The existing junction layouts are shown on Drawing Nos HA543917-HHJV-HGN-XXXX-DR-D-0144 to 0146 in Volume 2.

3.2.2 Bean Junction is the first junction on the A2 to the east of the M25. The land south of the A296 (Watling Street and Roman Road) and south of the A2 east of the Bean Junction merge is designated as green belt in the Dartford Local Plan and consists of villages, fields and woodland. North of the green belt, the land is urban with areas of housing and employment centred on Northfleet and Swanscombe. To the north of the A2, between the junctions, is an old chalk pit.

3.2.3 Major developments accessed from the junctions are Bluewater Shopping Centre (located to the north of Bean Junction off the B255) and Ebbsfleet International Station (north of Ebbsfleet Junction off the A2260).

3.3 Existing Highway Network

A2 Dual Carriageway

3.3.1 The existing A2 highway through the study area is a 4-lane dual all-purpose road which reduces to 3-lanes through Bean Junction. The alignment generally runs in an east/west direction, with large radius curves, and follows the existing undulating topography, falling from a high point just east of Bean Junction to a low point at Pepperhill.

3.3.2 The A2 was originally constructed as a three lane dual carriageway in the mid-1960s and in the subsequent decades various improvements have been made, including the addition of hard shoulders. The eastbound carriageway of the A2 between the Bean entry slip road and Pepperhill was widened from three to four lanes in 1999 as part of the Bluewater development. The westbound carriageway was then widened in 2003 under Phase 1 of the A2 Bean to Cobham Widening Scheme. The A2 between the M25 and the A2 Bean Junction was widened to four lanes in each direction in 2008 as part of the A2/A282 Dartford Improvement Scheme.

Bean Junction

3.3.3 The Bean Junction was rebuilt in 1999 as part of the Bluewater development and comprises three roundabouts and associated slip roads. The eastbound onslip road is formed from the old A2 (now the A296 Watling Street). As part of the redesign of the junction layout significant modifications were made to the overbridge linking the east and west bound slip roads.

Ebbsfleet Junction

3.3.4 The Ebbsfleet junction connects the A2 to the A2260 Southfleet Road. The junction comprises two roundabouts joined by a short link road and associated slip roads. It was constructed in 2005 by Union Railways to serve the Ebbsfleet International Rail Station.

Highway Authority Responsibility

3.3.5 Highways England is the Highway Authority for the A2 Trunk road including the slip roads at the Bean Junction and the whole of the Ebbsfleet Junction. Kent County Council is the Highway Authority for all other public roads connecting at the junctions. Drawings HA543917-HHJV-GEN-ZZZZ-DR-D-0167 to 0170 in Volume 2 show the extent of Highways England's network at the junctions.

3.4 Existing Structures

3.4.1 The locations of existing structures are shown in Drawings HA543917-HHJV-SGN-ZZZZ-DR-Z-1700 to 1702 contained in Volume 2. The main bridges and large culverts within the vicinity of the junctions are described in the following sections. For a summary of existing structures refer to Table 2.

Table 2 - Summary of Existing Structures

Reference	Existing Structure	Description
1	Darenth Wood Farm Bridge	It carries Wood Lane over the A2 0.7km west of Bean Junction. It is a private access track with access from the A296 to the north.
2	Bean Road Bridge	It carries the B255 Bean Road over the A2 and accommodates two lanes

		northbound and one lane southbound. Below the bridge is the A2 comprising of three lanes in each direction plus two lanes of the west bound on-slip.
3	Sandy Lane Bridge	It carries the A2 over Sandy Lane on the outskirts of Bean. There is a subway which provides access for pedestrians and cyclists across the A2.
4	Swanscombe Footbridge	Swanscombe Footbridge crosses over the A2 approximately 50m east of the end of the A296 east bound merge with the A2. It carries a public footpath over the A2. Swanscombe Footbridge is a Grade II listed structure.
5	KCC Bridge – B255 over A296	A bridge owned by Kent County Council carries the B255 road over the A296, approximately 250m north of Bean Junction. For the purposes of this report it is referred to as 'KCC Bridge'. The bridge currently accommodates two lanes northbound and two lanes southbound. Below the bridge is the A296 comprised of one lane in each direction, with the eastbound widening to two lanes to join a roundabout just to the east.
6	Park Corner Underbridge	It carries the A2 over Park Corner Road/Southfleet Road at the Ebbsfleet Junction.
7	Ebbsfleet Junction Eastbound Offslip Underbridge	Ebbsfleet Junction Eastbound Off Slip was constructed in 2003 with the provision of Ebbsfleet Junction.
8	Pepperhill Bridge	It carries the B262 over the A2 south west of Gravesend.

3.5 Traffic

3.5.1 In order to understand and evaluate the existing traffic conditions on the A2 in the Bean and Ebbsfleet area, traffic flow data was extracted from Highways England's Traffic Information Database System (TRADS) for the months of June and July 2014 for the section of A2 between Pepperhill Interchange to the M25 Junction 2 Interchange. Typically, recording locations were on the main A2 carriageway through the junctions and on the corresponding off-slip roads.

3.5.2 Traffic surveys were also carried out on adjacent local roads in June - July 2014 to establish traffic conditions on the adjacent local road network. Volumetric data was collected by a combination of two-week Automatic Traffic Counters and one day Classified Link or Junction counts.

3.5.3 Based on the TRADS data, plots were produced of Hourly Speed vs Flow for the mainline sections of the A2 between M2 J1 and the M25 J2 for neutral periods between late March to June 2014 and September to November 2014.

3.5.4 Data collected shows that in 2014 most of the local road network and the slip roads at the Bean and Ebbsfleet Junctions are, for much of the time, operating within the nominal capacities, with respect to the existing demand in the area, although it should be noted that the A2 Bean eastbound on-slip is approaching capacity in the evening peak.

3.5.5 For the peak directions between the B262 Hall Road Pepperhill Junction and the M25 J2 westbound in the morning peak and M25 J2 and the B262 Hall Road Pepperhill Junction eastbound in the evening peak, traffic volume to capacity ratios range between 76% and 90% in the period of data collection late June-July 2014.

3.5.6 The A2 mainline has little reserve capacity to support future development in the A2 study area and surrounding areas especially as new local development traffic wanting to use the A2 to access and egress the local area would have to compete with new traffic arising from development outside the A2BE area making longer distance trips.

3.5.7 The operation of the A2 Bean and Ebbsfleet Junction Improvements is affected by the available capacity of the A2 mainline and A2 junctions in conjunction with the capacity of the local road network.

3.5.8 Although traffic data wasn't collected during exceptionally peak shopping occasions at Bluewater Shopping Centre, such as on Bank Holidays and in the period leading up to Christmas and when the Dartford Crossing approaches are severely congested, comments were made at the public consultation event that on these occasions, queueing at the Bean junction can extend back onto the A2 mainline. In the case of congestion on the Dartford Crossing approaches, traffic trying to avoid the congestion leaves the A2 at the Bean junction and makes use of the local road network to access the crossing via Junction 1a on the A282. In both instances, Bean village residents find it extremely difficult to join the Bean junction southern roundabout.

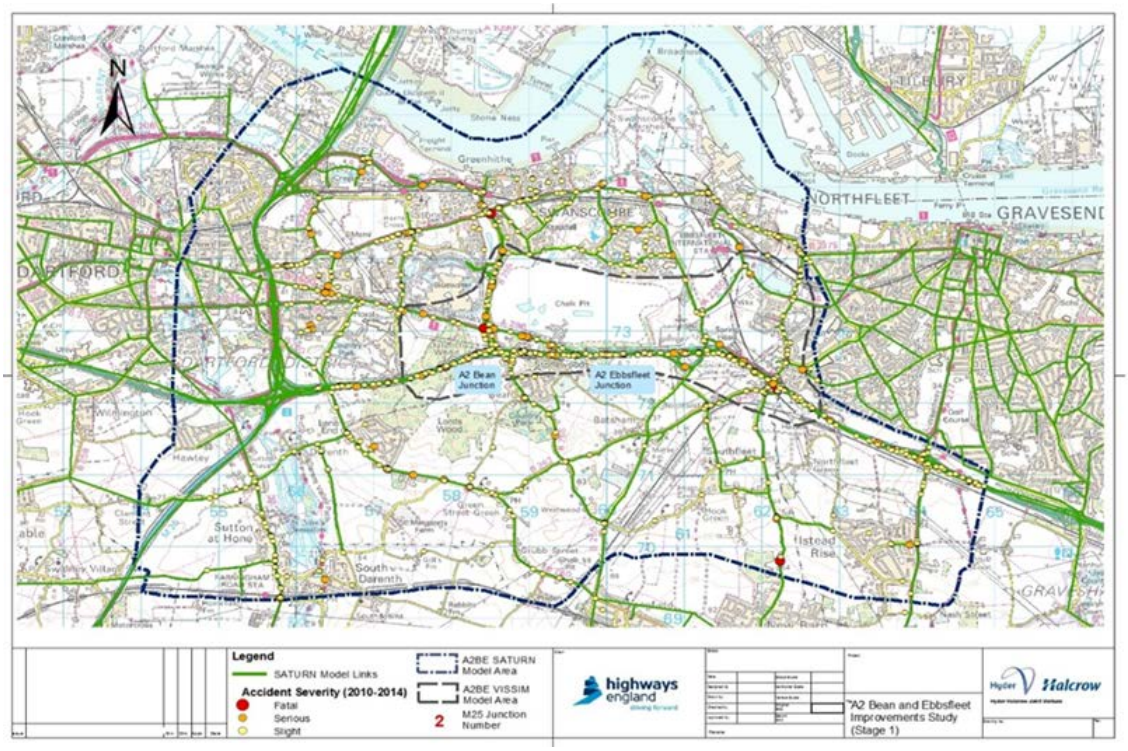
3.6 Accidents

3.6.1 Accident data was analysed to derive local accident rates by class of road for use in the safety assessment of the scheme.

3.6.2 Personal injury accident data for the modelled area was downloaded from the www.data.gov.uk website. This data covered the three year period between 2013 to 2015 on the A2 and the five year period between 2011 and 2015 on the local highway network. The longer period on the local network was used in order to obtain an improved statistical local safety baseline.

3.6.3 It was noted that there was 1 fatal incident on the local network (B255) in 2011 at a point where it crosses over the A296 to the east of Bluewater when an elderly driver was involved in a minor collision with another vehicle but then left the carriageway on the nearside hitting an undefined object. Refer to Figure 2 for accident locations.

Figure 2 - Accident Locations and Severity for the Study Area



3.6.4 Whilst the majority of accidents within the study area limits have occurred on the A2, the majority of works relate to the local highway network. For the purpose of determining the road-user safety baseline for the scheme the accident data on the A2 has been analysed between points 300m either side of scheme extents over a length of 3.5km (2.175 miles). Since a significant proportion of works

also takes place on the local highway network a separate baseline will be provided for the local highways.

3.6.5 The causes of the accidents on the A2 will not all relate to the Bean and Ebbsfleet junctions, however any changes to the junction merge and diverge arrangements may impact on subsequent weaving manoevres. The accidents that have occurred on the A2 result in an FWI per billion vehicle miles travelled of 9.636 as identified in Table 3. This rate being the baseline against which the safety objective is to be set.

Table 3 - Casualties for A2 main line 2013-2015 (300m either side of scheme extents – 3.5km (2.175 miles)

	Fatal casualties	Seriously injured Casualties	Slight Casualties
A2 mainline (5years)	0	19	118
Average per year	0.0	6.3	45.7
FWI Casualties per year	1.03		
AADT (2013 - 2015)	133,996		
Total annual vehicle miles	106,375,810		
FWI rate per billion vehicle miles	9.636		

Note: FWI = (Number of fatalities) + 0.1 x (number of serious casualties) + 0.01 x (number of slight casualties).

3.6.6 In order to obtain a better statistical analysis of injury collisions in the local road network a 5-year period of data has been considered.

3.6.7 In relation to the local roads a baseline is determined from the ratio of the FWI and the total number of vehicles entering the impacted road network in terms of FWI per million vehicles resulting in a figure of 3.942 FWI/100mv rate of as identified in Table 4. This rate being the local baseline against which a local safety objective is to be set.

Table 4 - Casualties for A2 slip roads and local road connections 2011-2015

	Fatal casualties	Seriously injured Casualties	Slight Casualties
A2 slip roads at Bean	0	1	24
A2 Slip roads at Ebbsfleet	0	0	8
B255	1	3	29
A296/Roman Road	0	7	37
Bean Lane (and roundabouts)	0	1	26
A2260 (and roundabouts)	0	0	11
Total (5years)	1	12	135
Average per year	0.2	2.4	27.0
FWI Casualties per year	0.71		
Total inflow AADT (2014)	49,345		
Total Yearly inflow (2014)	18,010,925		

	Fatal casualties	Seriously injured Casualties	Slight Casualties
FWI rate per 100 million vehicles per year	3.942		

Note: FWI = (Number of fatalities) + 0.1 x (number of serious casualties) + 0.01 x (number of slight casualties).

3.6.8 It should be noted that over the same five-year period (2011 and 2015) there has been a marked year on year increase in the FWI on the A2 as identified in Table 5 below.

Table 5 - FWI Casualties for A2 between 2011 and 2015

	FWI	AADT	FWI / bn veh miles
2015	1.15	140376	10.319
2014	1.00	135967	9.264
2013	0.93	125644	9.324
2012	0.47	129347	4.577
2011	0.43	127094	4.262

3.6.9 For further details of accidents refer to the Safety Plan, document reference HA543917-HHJV-GEN-PCF-0004 which will be updated as further analysis is undertaken through subsequent design stages.

3.7 Journey Time Reliability

3.7.1 Average journey times on the journey time routes for the A2 and the local road network during 2014 have been constructed using Trafficmaster data. Data was collected for the morning, inter peak and evening peak periods. Figure 3 and Figure 4 show the 12 journey time routes for which data at 15-minutes intervals for Monday to Friday (excluding bank holidays and school holidays) has been used. Table 6 shows the data collected.

3.7.2 From the above data, it is possible to determine an indication of journey time reliability of journeys along key route corridors in the area.

3.7.3 The median journey speeds along the A2 from M25J1b to the A2/A227 in the AM, PM and Inter peak periods were 93kph, 85kph and 98kph (58mph, 53mph and 61mph) respectively. In the westbound direction, the journey speeds in the AM, PM and Inter peak periods are 81kph, 93kph and 94kph (50mph, 58mph and 58mph) respectively, with slow sections where the A2 joins the M25/A282. Comparison of the peak period speeds with the Inter peak speeds suggests the eastbound journey times in the PM peak may be unreliable, but reasonably reliable in the AM peak. In the westbound direction the journey times in the AM peak may be unreliable, but more reliable in the PM peak.

3.7.4 Route 1 includes journeys along the A226 and B255 via the Bean Junction. With the exception of movement though the Bean Junction, where the speeds are on average 20-30kph (12mph-19mph), the median speed is just below 50kph (31mph). As the Inter peak speeds are on average 48kph (30mph) it can be assumed this route has reasonable journey time reliability.

3.7.5 Route 8 includes journeys along the B259 and A2260 via the Ebbsfleet Junction. The median journey times for this route are 47kph-51kph (29mph-32mph). As the Inter peak period has similar speeds, it is reasonable to assume the journey times along this route are currently reliable.

Figure 3 - Journey Time Survey Routes – 1 of 2

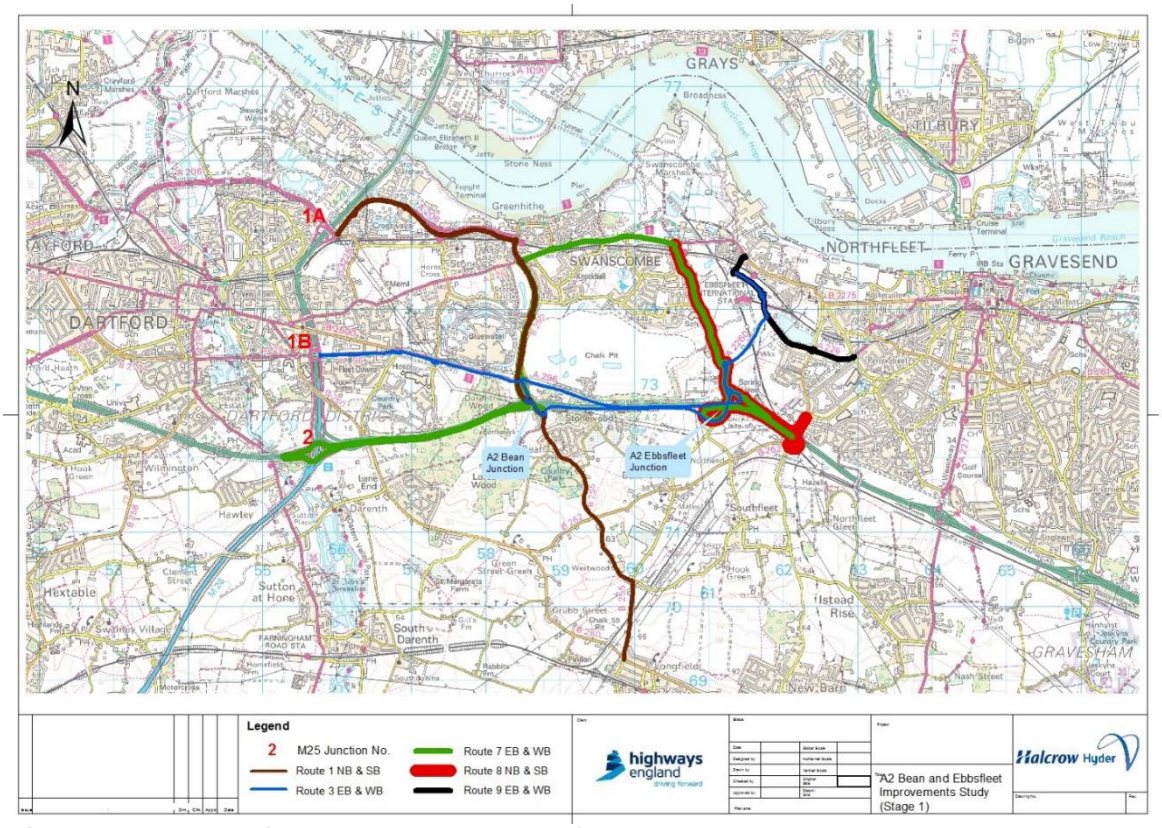


Figure 4 - Journey Time Survey Routes – 2 of 2

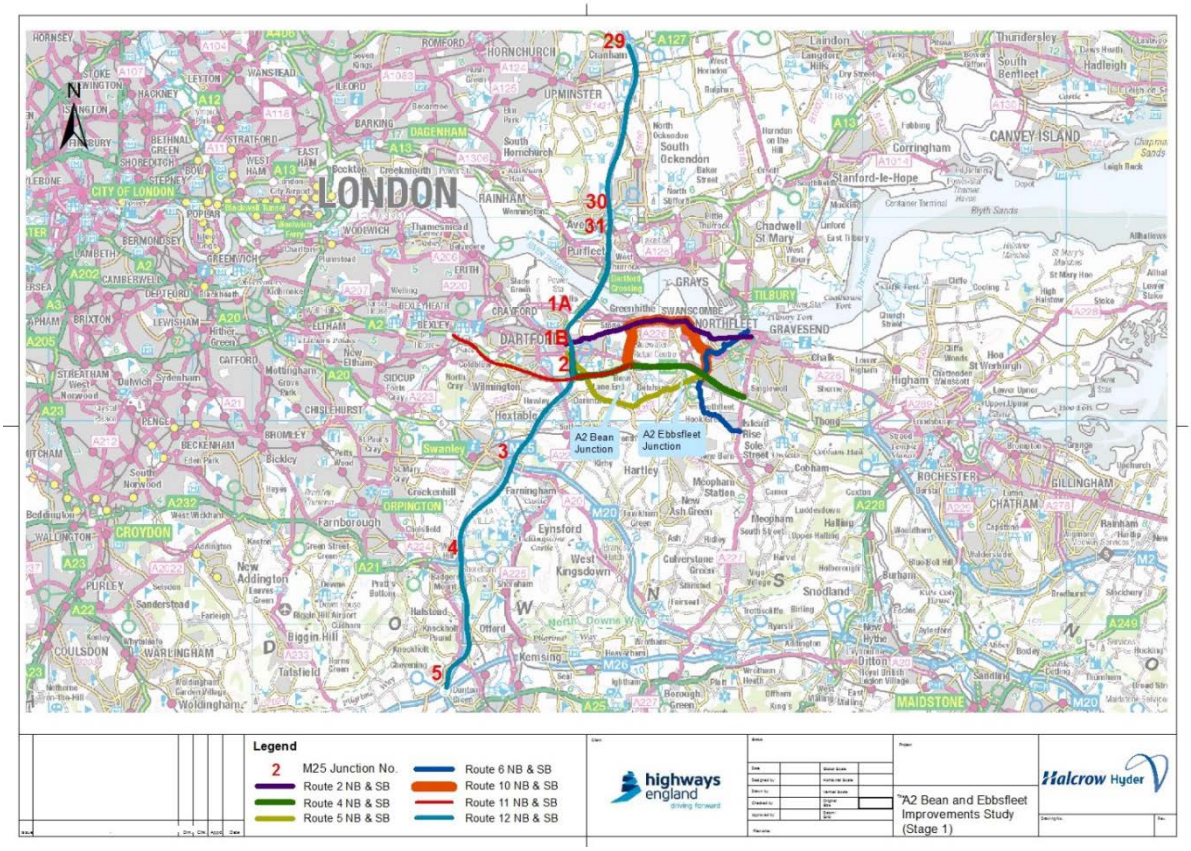


Table 6 - Trafficmaster Journey Times

Route	Location	Dir	Length (km)	Average Journey Time (mm:ss)			Average Journey Speed (kph)		
				AM	IP	PM	AM	IP	PM
1	B255 (Longfield to M25 J1a)	NB	9.0	11:15	11:06	12:08	47.70	48.40	44.22
		SB	9.3	11:46	11:30	12:41	47.39	48.46	43.96
2	A226 (Dartford to Gravesend)	EB	9.9	14:00	13:44	14:25	42.44	43.26	41.19
		WB	10.0	14:14	14:07	14:14	42.16	42.51	42.14
3	A296, A2 and B262 (M25 J1b to Ebbsfleet)	EB	8.2	09:45	08:46	10:49	50.57	56.25	45.63
		WB	8.4	09:22	08:46	08:55	54.08	57.81	56.76
4	M25 J1b to A2/A227 Junction	EB	15.7	10:06	09:34	11:07	92.95	98.12	84.54
		WB	16.0	11:50	10:13	10:19	81.13	93.85	93.00
5	M25 and A2 (M25 J1b to A2/A227 junction)	EB	8.2	09:07	09:06	10:20	53.75	53.88	47.43
		WB	8.1	10:07	09:08	09:46	48.23	53.44	49.95
6	Istead Rise to Gravesend	NB	7.2	10:10	09:13	09:27	42.43	46.78	45.59
		SB	7.1	09:30	09:15	10:15	44.56	45.82	41.30
7	M25 J2 to A2/B259	EB	11.6	13:11	12:55	13:57	53.00	54.14	58.90
		WB	13.6	16:02	14:53	15:47	50.75	54.68	51.57
8	A226 to Hall Road	NB	6.3	08:13	07:16	07:33	45.79	45.79	51.77
		SB	4.7	05:55	05:44	05:58	47.67	49.13	47.22
9	Stonebridge Rd to Hall Rd	NW	2.5	03:10	03:05	03:05	47.45	48.64	48.72
		SW	2.4	03:13	03:00	03:02	45.36	48.64	48.19
10	KTS-Pepperhill	EB	8.6	11:09	10:47	11:46	46.25	47.81	43.83
		WB	8.5	11:24	10:44	11:21	44.60	47.38	44.85
11	KTS-A2 A226 – Bean	EB	9.4	05:34	05:37	06:33	101.09	100.27	86.01
		WB	9.5	06:11	05:36	05:44	91.81	101.44	99.12
12	HATRIS-M25 J29-5	NB	34.5	21:33	22:39	25:37	96.20	91.56	80.94
		SB	34.5	25:30	21:42	25:39	81.28	95.47	80.78

3.8 Topography, Land Use, Property and Industry

Topography

3.8.1 The topography in the area of the Bean and Ebbsfleet Junctions can be split into four areas:

- Bean Junction is located on a ridge in the landscape with a valley to the west of the junction
- The area south of the A296/A2 consists of a hilly terrain from Darenth Country Park to the west of the Ebbsfleet Junction
- To the north of the A296, the topography is dominated by quarries. The western quarry has been developed as Bluewater Shopping Centre and the eastern quarries are planned for housing and mixed use development
- To the west of Ebbsfleet Junction is a valley where the River Ebbsfleet is located

Land Use, Property and Industry

3.8.2 At Bean Junction, the land south of the A296 (Watling Street and Roman Road) is designated as green belt in the Dartford Local Plan. At Ebbsfleet Junction the green belt is south of the A2. This

southern area consists of villages, fields and woodland, including Bean, which is located immediately to the south of Bean Junction on the B255.

3.8.3 North of the green belt, the land is urban with areas of housing and employment centred on Northfleet and Swanscombe.

3.8.4 Major facilities in the area of Bean Junction are:

- Darenth Valley Hospital with access from the A296, approximately 1km west of Bean Junction
- Bluewater Shopping Centre is located off the B255 immediately to the north of Bean Junction

3.8.5 To the south of the A2 is Bean Village. Bean Bridge crosses the A2 at the junction, with Hope Cottages and Ightham Cottages located to the south and north respectively.

3.8.6 The eastern area within the junction between the A296 and A2 is known as the Bean Triangle. Within this area there are several business and residential properties.

3.8.7 There is an area of existing car parking at the corner of Bean Road and the Roman Road. There is no signage at the site concerning its usage. However, local sources believe it to be used as an interchange for commuting using coach travel and shared car use. The Kingsferry coach hire company refer to free parking at Bean for their commuter service 700. Discussions with Kent County Council and Dartford Borough Council indicated that this is an unofficial site but recognised that it provides a useful facility as part of a wider public transport provision. However, the existence of this facility should not be seen as a constraint to the improvement solutions being developed at Bean.

3.8.8 Major facilities in the area of Ebbsfleet Junction are:

- Ebbsfleet International Station with access from the A2260 to the north of Ebbsfleet Junction

3.9 Climate

3.9.1 The climate in the project area is generally mild, with sunny summers and cold, wet winters. Snowfall is infrequent, but winter days can be frosty and clear. High pressure systems can occasionally cause very hot summer temperatures or very cold winter temperatures.

3.10 Drainage

3.10.1 The existing road network has 15 drainage catchments within the Scheme limits. These catchments are shown on Drawing HA543917-HHJV-HDG-ZZZZ-DR-D-0001 in Volume 2 and are summarised in Table 7.

Table 7 - Details of Existing Drainage Catchments Zones and Discharge Points

Catchment (Reference)	Description	Approx. impervious Area (ha)	Receiving Waterbody ./ Discharge Point
C1	A2 western scheme limit up to the eastbound off-slip at Bean Junction	3.122	Discharges to attenuation pond (WB3) then to ground via soakaway chambers
C2	A2 between eastbound off-slip to Bean Junction to Woodbine Cottage Underpass, including both eastbound and westbound slip roads to Bean Junction	4.788	Discharges to ground via attenuation / infiltration pond (WB5)
C3	A2 between Woodbine Cottage Underpass and Swancombe Footbridge	1.693	Discharges to ground via soakaway chambers
C4	Part of A296 Roman Road (Swanscombe on-slip road to A2 eastbound carriageway)	0.535	Discharges to ground via infiltration ditch
C5	A2 from Swanscombe Footbridge extending eastwards including Ebbsfleet Junction. Catchment extends to Church Road Footbridge approx. 1.52km southeast of Tollgate Junction	13.562	Discharges to River Ebbsfleet (WB11)
C6	Part of A2260 north roundabout at Ebbsfleet and Northfleet West Sub-Station access road. Extent of catchment unclear, believed to extend northwards including A2260 up to roundabout with B259	0.798	Outlet pipe heads towards River Ebbsfleet but outfall destination unknown
C7	B255 Bean Lane south of A2 including Hope roundabout (near Hope cottages), extending southwards to the north of Bean village	0.579	Discharges to ground via soakaway chamber
C8	Ightham roundabout (near Ightham cottages) and part of Bean Lane north of A2	0.427	Discharges to ground via soakaway chamber
C9	B255 (north of A2) from Ightham roundabout up to A296 bridge	0.565	Discharges to ground via soakaway chamber
C10	A296 from roundabout with Bean Lane to side road Wood Lane	0.386	Discharges to ground via soakaway chamber
C11	Bean Lane (north of A2) including roundabout with the A296 and part of Roman Road	0.571	Discharges to ground via soakaway chamber
C12	B255 (north of A2) from A296 bridge to merger with Bean Lane	0.350	Discharges to ground via soakaway chamber
C13	B255 southbound between on-slip from Bluewater Parkway to Bean Lane	0.885	Discharges to ground via soakaway chamber

Catchment (Reference)	Description	Approx. impervious Area (ha)	Receiving Waterbody ./ Discharge Point
C14	B255 northbound to the east of Bluewater shopping centre up to bridge over Bluewater Parkway, including part of B255 southbound	0.729	Discharges to ground via soakaway chamber
C15	A296 Roman Road	0.976	Unknown. Believed to be soakaway chambers located at road low point approximately 285m east of roundabout with Bean Lane

3.10.2 Existing flooding incidents and 'hotspots' have been identified and reviewed using the Highways England database (HADMMS). The assessment has identified 13 flooding incidents within the Scheme limits, 7 incidents located in the proximity of the Bean Junction and 6 incidents at Ebbsfleet Junction. A review of the incidents suggests that the majority of the flooding incidents were related to blocked gullies or filter drains becoming over grown. The incidents do not record information about the storm return period and its duration. Consequently, it is not possible to determine whether the recorded incidents were a result of storms with a greater return period than the design return period for the drainage networks, or if the current drainage networks are inadequate.

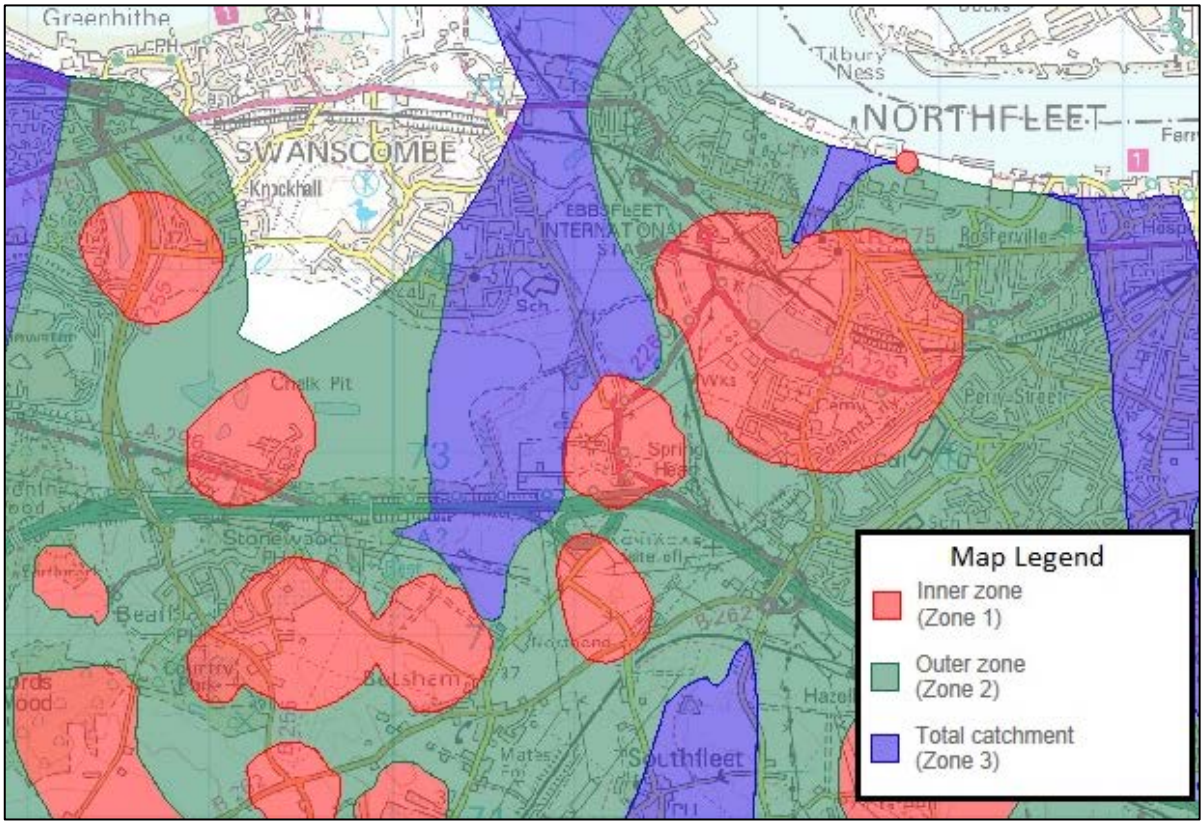
3.10.3 HADMMS flood 'hotspots' mapping shows where flooding is considered significant, with levels of risk ranging from very high to low. The A2 through Bean Junction has an overall status of 'Very High'. Any works within this location must review the potential to reduce the risk of flooding as much as practically possible.

3.10.4 The Environment Agency (EA) has a duty to monitor and protect the quality of groundwater and to conserve its use for water resources as set out in their Policy and Practice for the Protection of Groundwater (1998). As a result the EA have defined Source Protection Zones (SPZs) to protect existing abstraction points from the risk of contamination by activities that might cause pollution in the area; the closer the activity the greater the risk. Figure 5 shows three main zones:

- Inner zone (Zone 1) - Defined as the 50 day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres
- Outer zone (Zone 2) - Defined by the 400 day travel time from a point below the water table. This zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction
- Total catchment (Zone 3) - Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source

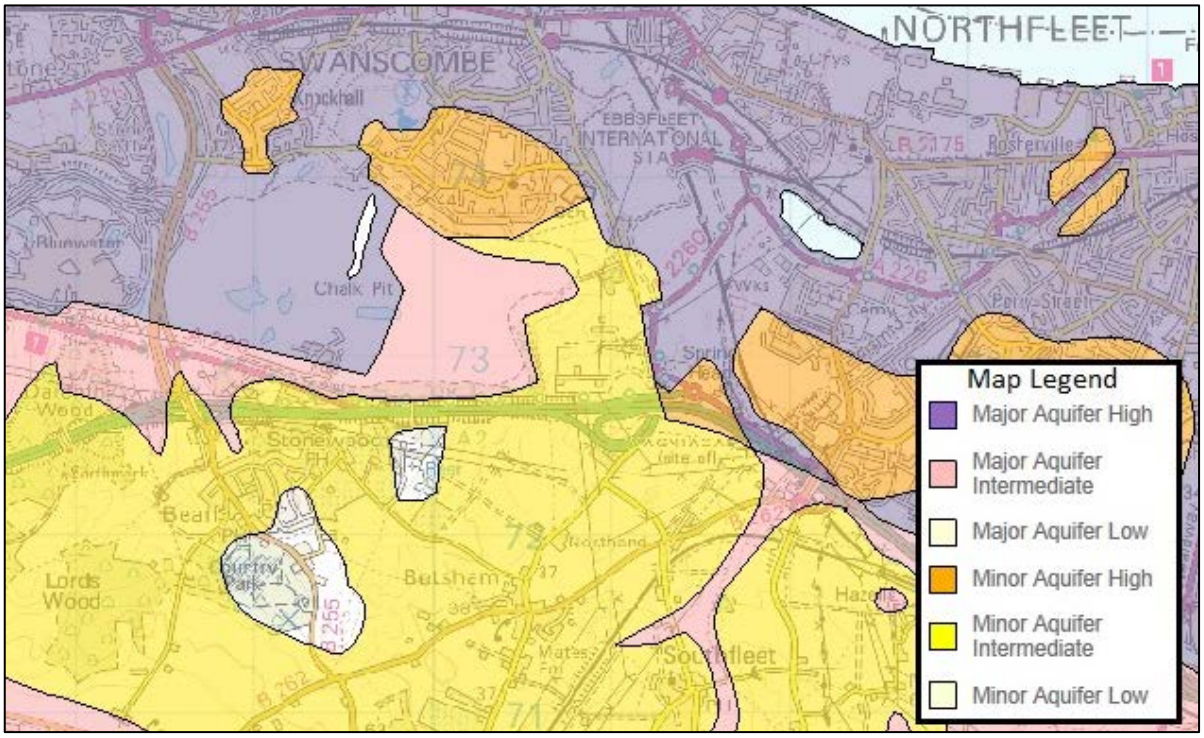
3.10.5 A review of the EA mapping in the vincity of the scheme shows that the majority of the Scheme to be within the Outer Zone (Zone 2) with one section of the A296 Roman Road a section of the A2260 at Ebbsfleet Junction and Ebbsfleet Junction itself being within the Inner Zone (Zone 1). A small portion of the A2 is shown as being within the Total Catchment (Zone 3), as shown in Figure 5.

Figure 5 - EA Source Protection Zone Mapping Overview (1 in 40:000 scale)



3.10.6 A review of the Groundwater Vulnerability Mapping has also been undertaken to examine the EA's assessment of the likelihood of a pollutant discharged at ground level reaching groundwater in superficial and bedrock aquifers. The status of the aquifer shown in Figure 6 is an indication of the importance of the groundwater for drinking water supply.

Figure 6 - EA Groundwater Vulnerability Mapping Overview (1 in 40:000 scale)



3.10.7 The A2 between Bean Junction and Pepperhill Junction is underlain in parts by Chalk deposits, which is the principal aquifer in south-east England. The water table in this aquifer is assumed to be tens of metres below existing ground level. The distance between road level and water table becomes a minimum of approximately 10m near the River Ebbsfleet (to be confirmed via groundwater monitoring boreholes).

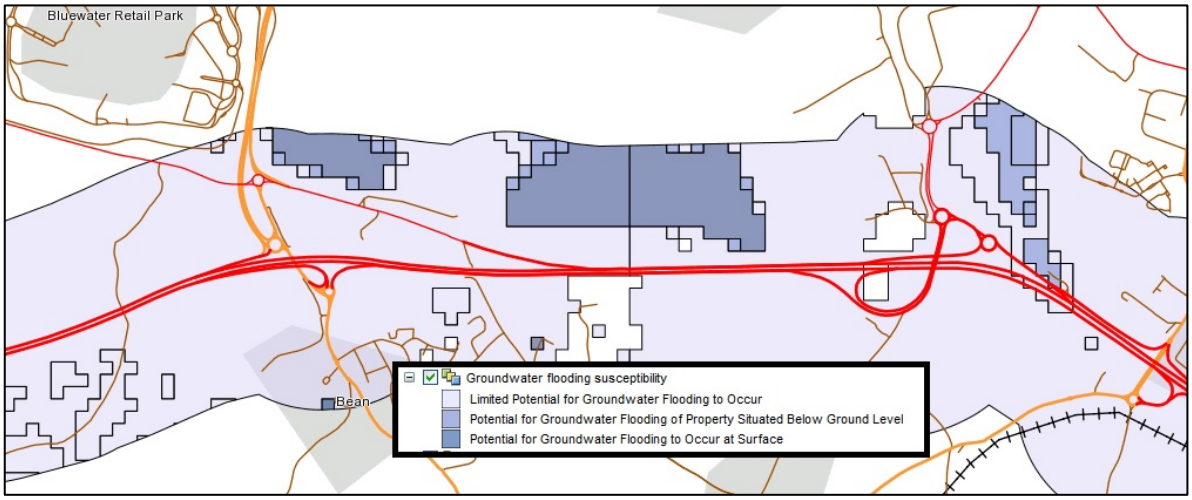
3.10.8 From a previous scheme undertaken on the A2 in 2004, eight groundwater abstraction licences exist within 1km of the Scheme extents, which include a public water supply at Southfleet and industrial or agricultural supplies.

3.10.9 It should be noted that the thickness of the unsaturated zone between the base of the attenuation / infiltration pond (WB5) that serves the existing A2, and the existing level of the groundwater is believed to be more than 50m, providing protection to the groundwater aquifer.

3.10.10 The implication of any amendments to the existing drainage regime within the SPZ will require appropriate assessment to be undertaken and discussion with the EA, which will ultimately determine the type of drainage systems used.

3.10.11 A review of the Groundwater Flooding Susceptibility Mapping from HADMMS has shown that there is no risk to roads within the scheme limits from surface water flooding caused by groundwater. Refer to Figure 7.

Figure 7 - Groundwater Flooding Susceptibility Mapping



3.11 Geology

3.11.1 The generalised geological succession of the area under study is depicted in Table 8 below with the distribution of the superficial and bedrock deposits shown on drawings HA543917-HHJV-HGT-ZZZZ-DR-GE-0007 and HA543917-HHJV-HGT-ZZZZ-DR-GE-0008 respectively in Volume 2.

Table 8 - Generalised Geological Succession

System/ Period	Series	Group	Formation	General Description	Stratigraphical Thickness
Quaternary	Holocene		Alluvium	Marine and Estuarine Alluvium Silt and clay with lenses and beds of peat, and seams of sand and gravel.	Not identified
Quaternary	Pleistocene		Head Deposits Terrace Gravel	Undifferentiated, pebbly sandy clay; some gravel, sands and silts River Terrace Deposits – Gravel, sandy and clayey in part.	Up to 4m at Bean and 2m at Ebbsfleet Approximately 2m at Bean
Palaeogene	Palaeocene	Lambeth Group	Thanet Formation (Thanet Sand)	Greenish to brownish grey silty, fine-grained sand, clayey and siltier in the lower part, with a conglomerate of flint pebbles and nodular flints at the base.	Up to 16m
Cretaceous	Upper Cretaceous	White Chalk Subgroup	Seaford Chalk Formation	Fossiliferous nodular chalk with bands of nodular flints, hardgrounds and marl seams.	Up to 70m

Notes: Excludes stratigraphical units that are absent from the site area. Stratigraphical thicknesses have been taken from existing information

3.11.2 The site area at Bean and Ebbsfleet is dominated by the Thanet Formation and White Chalk. The Palaeogene and Late Cretaceous deposits are overlain in places by Quaternary deposits mainly of Alluvium, Head and Terrace Gravel. The Alluvium deposits are found locally around Ebbsfleet. For further information on the geology, refer to the Preliminary Sources Study Report (HA543917-HHJV-GEN-PCF-0030).

3.11.3 Naturally occurring solution features, often infilled, are common in the area. Two mapped historical solution features were encountered within the Bean Triangle. Another two are shown to be present in close proximity to the proposed works at Bean.

3.11.4 Plans depicting the location of solution features and the BGS classification of the likely presence of soluble rock can be seen on drawings HA543917-HHJV-HGT-ZZZZ-DR-GE-0009 at Bean and HA543917-HHJV-HGT-ZZZZ-DR-GE-0010 at Ebbsfleet, in Volume 2.

3.12 Mining

3.12.1 Quarrying of sand and gravels, and the excavation of chalk and clay has been previously carried out within the site region. The Bluewater and Swanscombe Chalk Pits lie just to the north of Watling Street at Bean. A dataset indicates two areas of land underlying the northern extent of the existing Ebbsfleet Junction with valid planning permission for surface mineral working, of which some the land has been previously worked.

3.12.2 Several Dene (sink) holes are recorded west of Bean Junction and two have been mapped between the A2 and the historic electrical distribution grid in close proximity to the Ebbsfleet Junction. In addition, a Dene hole collapsed in the 1990s, which is now covered by the Ebbsfleet westbound on slip. The location of Dene holes is generally, very difficult to predict.

3.12.3 A small sand and gravel pit and two small chalk pits are reported north of the existing balancing pond at Bean within the Bean Triangle, in an area where a brick works existed in the past.

3.12.4 Plans presenting the known locations of Dene holes, and the previously mentioned areas that hold planning permission for surface extraction, and areas of worked ground are included in Volume 2, on drawings HA543917-HHJV-HGT-ZZZZ-DR-GE-0011 at Bean and HA543917-HHJV-HGT-ZZZZ-DR-GE-0012 at Ebbsfleet.

3.13 Public Utilities

3.13.1 Enquiries were made with the Statutory Undertakers through the Line Search website and details provided by Area 4 MAC. All responses have been received and locations of the public utilities are shown on drawings HA543917-HHJV-VUT-ZZZZ-DR-D-0001 to 0004 in Volume 2. Further details can be found in the Statutory Undertakers Report (HA543917-HHJV-GEN-PCF-0009).

3.13.2 Services provide a significant constraint to the project. The main constraints include:

- High voltage overhead power lines at the Bean Junction with a pylon located in the middle of Ightham Cottages roundabout and a pylon immediately north of Hope Cottages roundabout
- National Grid Underground Transmission line which runs along the A296 Roman road and A2 to the Northfleet East sub-station site
- A high pressure gas main at the Bean Junction

3.14 Technology

3.14.1 The A2 is unusual for a trunk road in that it has extensive motorway type technology installed including gantries equipped with EMS (MS2 with two lines of 12 characters) and lane signals capable of displaying advisory speed limits, lane control aspects and a mandatory lane closed aspects supplemented by red lanterns. Emergency Road Telephones (ERT) are also located on both carriageways of the A2.

3.14.2 In summary, the existing provision of gantries, VMS and lane signals on the approaches to the Bean and Ebbsfleet junctions on both carriageways is as shown in Table 9:

Table 9 - Summary of Technology

	Gantries with technology	VMS (MS2)	Lane signals
A carriageway (eastbound)	8	7	8
B carriageway (westbound)	6	5	6
Total	14	12	14

3.14.3 A single MS3 message sign is located on the westbound carriageway within the Bean Junction for the approach to the M25 junction. There is also a M3 message sign located on the eastbound carriageway between the 2/3 mile and 1/3 mile ADS gantries. Post mounted entry signals (MS1) are located at the start of each on slip at both the Bean and Ebbsfleet Junctions.

3.14.4 CCTV coverage at the junctions is limited to a single mast mounted camera located at a cabinet cluster on the Ightham Cottages roundabout. This is sufficient to monitor the whole of this junction area.

3.14.5 A summary of the equipment on the A2 at the junctions includes:

- Motorway traffic information gantries
- Non-Enforcement Advanced Motorway Indicators (AMI)
- Enhanced Message Sign (EMS) – 2x12 Portal type
- Ambient Light Monitor (ALM)
- MS3 Message Signs - 3x18 Cantilever type
- Roadside Controller outstations
- Motorway Incident Detection and Automatic Signalling (MIDAS) loops and associated MIDAS Detector outstations
- Emergency Roadside Telephones (ERT)

Non-Motorway technology

3.14.6 Additional equipment is located off the A2 at both junctions including traffic count loops located at the Ightham Cottages roundabout and A296 Roman Road and traffic signal controlled pedestrian crossings at both junctions. A ducted route with power and data cabling is located at the Ightham Cottages roundabout associated with the traffic loops.

3.15 Maintenance Operations/Maintenance Access

General

3.15.1 Maintenance on the A2 is carried out by the Asset Support Contract (ASC) team and the Regional Technology Maintenance Contractor (RTMC) on behalf of Highways England. Drawings HA543917-HHJV-GEN-ZZZZ-DR-D-0167 to 0170 in Volume 2 show the extent of Highways England's Network at the Bean and Ebbsfleet Junctions. The maintenance on the approach roads from Ebbsfleet and Bean is carried out by Kent Highway Services, Kent County Council's highways arm which is responsible for most local highway assets including: street lighting, carriageway repairs, dropped kerb applications, grass verge cutting, road closures, highway drainage and culverts, bollards, winter service activities and highways safety schemes.

Access Paths and Steps

3.15.2 There are access paths, steps and hard-standing areas leading to communication equipment on the A2. These are maintained by the ASC team.

3.15.3 Wide verges exist on the local highway network where maintenance vehicles currently stop and operatives will gain access to the various assets by means of footways and verges and by local traffic management measures on the local highway network. Existing maintenance hardstanding and access points are indicated on drawings HA543917-HHJV-HGN-XXXX-DR-D-0144 to 0146 in

Volume 2.

Access to Technology Assets

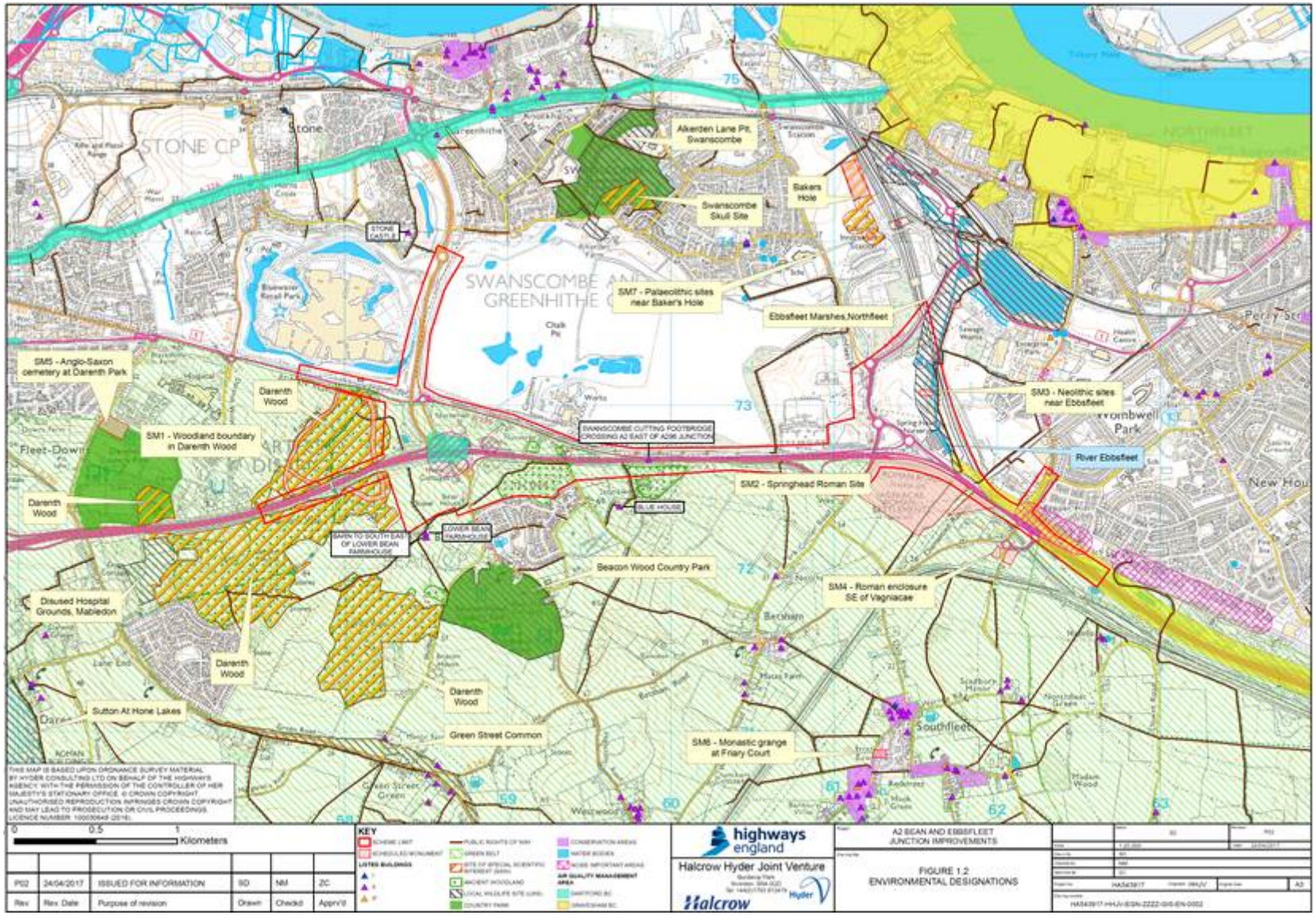
3.15.4 Current access to technology assets on the A2 is carried out during short/ medium term stops on the hard shoulder or under traffic management following the roadspace booking procedure.

3.15.5 Off-network access, currently used in some locations, requires liaison with the region's ASC team and third party stakeholders.

3.16 Environmental Status

3.16.1 Detailed environmental baseline conditions are presented within the Stage 2 Environmental Assessment Report, reference (HA543917-HHJV-GEN-PCF-0011) (hereafter termed the EAR). Key environmental designations are shown on Figure 8. A summary of environmental baseline information is provided within Section 3.17 and key environmental constraints are provided within Section 4.4.

Figure 8 - Environmental Designations



3.17 Environmental Baseline and Study Area

3.17.1 Detailed environmental baseline information is provided within the EAR and is summarised below:

Noise and Vibration

3.17.2 The study for the noise assessment has been defined in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7, HD213/11. The noise assessment study area accounts for a total of 2,257 residential dwellings and 3 identified other sensitive receptors: one school, one residential home, and one care home (refer to Chapter 8 of the EAR).

3.17.3 Seven Defra Noise Important Areas (NIAs) have been identified within the vicinity of the scheme. Three of these Noise Important Areas (NIAs) are located within the scheme boundary, on the A2 between Bean and Ebbsfleet Junction (refer to Chapter 8 of the EAR).

Air Quality

3.17.4 The study area in relation to the scheme is defined by the changes in traffic flows on the local road network (in accordance with DMRB guidance).

3.17.5 The scheme is located within the administrative boundaries of Dartford Borough Council (DBC) and Gravesham Borough Council (GBC):

- Dartford Borough Council: There are four Air Quality Management Areas (AQMAs) designated within the DBC administrative area. All the Dartford AQMAs have been declared for exceeding annual mean NO2 concentrations. Dartford AQMA No.1 also declared 24-hour PM10 exceedances. The scheme is located within the Dartford AQMA No.4 and therefore does have the potential to affect traffic flows within the AQMA.
- Gravesham Borough Council: There are seven AQMAs designated within the GBC administrative area. All the Gravesham AQMAs have been declared for exceeding annual mean NO_2 concentrations. The Echo Junction AQMA, Gravesham A2 AQMA and the Northfleet Industrial Area AQMA also declared 24-hour PM_{10} exceedances. The Scheme is located within the Gravesham A2 AQMA and therefore does have the potential to affect traffic flows within the AQMA.

Landscape & Visual

3.17.6 The study area for the assessment of the landscape and visual impacts has been defined by a combination of desk studies and site survey work along with professional judgement and consideration of the extent of the Zone of Theoretical Visibility (ZTV), derived from modelling and verified in the field (summer and winter views).

3.17.7 Bean Junction, and land to the south of the A2 and Ebbsfleet Junction, lies within the Green Belt (refer to Figure 11 and the EAR, Chapter 6).

3.17.8 Country Parks within the Landscape and Visual Impact Assessment study area include Swanscombe Heritage Park to the north, Beacon Wood to the south and Darenth Country Park to the west of the scheme (refer to Figure 11 and the EAR, Chapter 6).

Cultural Heritage

3.17.9 The study area encompasses an area extending 500m from the site boundary. The size of the study area was determined through a combination of the requirements of DMRB Volume 11, Section 3, Part 2, HA208/07 and taking into account the significance of specific cultural heritage assets.

3.17.10 The study area contains four scheduled monuments: Medieval woodland boundary in Darenth Wood (SM1), Springhead Roman Site (SM 2), Neolithic sites near Ebbsfleet (SM3); and a Roman enclosure SE of Vagniacae (SM4).

3.17.11 The medieval woodland boundary in Darenth Wood (SM1) lies immediately adjacent to the A2 (west of Bean Junction). Springhead Roman site (SM2) lies immediately adjacent to the A2 at Ebbsfleet Junction.

3.17.12 The study area contains five Grade II listed buildings: Stone Castle (LB1), Lower Bean Farmhouse (LB2), Barn South East of Lower Bean Farmhouse (LB3), Swanscombe Cutting footbridge crossing A2 east of A296 Junction (LB4) and Blue House (LB5), refer to the EAR Chapter 9 and EAR Figure 9.3 for further detail.

Ecology and Nature Conservation

3.17.13 The study area has been defined by determining the zone of influence (ZoI) of the Scheme in relation to the effect it would have on each individual resource, based on professional judgement. The study area for biodiversity receptors extends to 2km from the site for statutory designated sites and 1km from the site for non-statutory designated sites.

3.17.14 There are no statutory designated sites of International or European importance to nature conservation within the study area.

3.17.15 There are three nationally designated sites within the study area: Darenth Wood SSSI, Swanscombe Skull SSSI and National Nature Reserve (NNR) and Baker's Hole SSSI. Both Swanscombe Skull SSSI NNR and Baker's Hole SSSI are located approximately 1km north of the scheme and designated for geological interest. Darenth Wood SSSI lies immediately adjacent to the scheme to the west of Bean Junction.

Accessibility and Integration

3.17.16 A Non-Motorised User (NMU) route links the A296 with Bean, and a number of Public Rights of Way (PRoW), footways and cycleways, pass in close proximity to both the Bean and Ebbsfleet Junctions. There are pedestrian and cycle facilities to the north of the A2 connecting Bean and Ebbsfleet Junctions. In addition, there are NMU crossing facilities at both junctions connecting to the wider network.

3.17.17 At Bean Junction, bus routes use all links within the junctions with bus stops located on Bean Lane, just north of Igtham Cottages and south of Hope Cottages. At Ebbsfleet Junction there is a bus service which travels between the A2 and the B259. There are no bus stops at this junction.

Journey Quality

3.17.18 Views from the A2 are generally restricted as a result of the road being intermittently situated in cutting and extensive local vegetation, however more open views are available from the A2 Bean and Ebbsfleet Junctions where the road is on embankment or bridge structures. The local scenery is made up a mix of urban and rural influences, including elements that make a positive contribution to the view (such as farmland and woodland) and those that are detracting (including high voltage power transmission infrastructure). There are a number of planned developments in the area, which would increase urban influences on views in future. The A2 Bean and Ebbsfleet Junctions carry high volumes of traffic, becoming more congested during morning and afternoon peak hours and resulting in high levels of driver stress - particularly during the peak times.

4 Planning Factors and Constraints

4.1 General

4.1.1 This section will focus on the key constraints and challenges associated with the identification of options at the two junction locations, such as existing and future land use, the environmental, existing public utilities and future planning development constraints. These are outlined below and shown on drawings HA543917-HHJV-HGN-XXXX-DR-D-0051 to 0054 in Volume 2.

4.2 Future Land Use Proposals

4.2.1 There are several major planned developments in the area. Within the immediate vicinity of the junctions, these will come under the planning authority of Ebbsfleet Development Corporation.

4.2.2 The Ebbsfleet Valley and Eastern Quarry developments are located to the north of the A2 and consist of the following areas:

- Eastern Quarry
- Station Quarter North
- Northfleet Rise
- Springhead
- Station Quarter South
- Northfleet West Substation/Ebbsfleet Green

4.2.3 The final development of Ebbsfleet Valley and Eastern Quarry, which would be established over a 20 year period, would create a community with up to 10,000 homes and up to 38,000 jobs (source: Ebbsfleet Development Corporation Land Use Quantums and Homes and Communities Agency Employment Densities Guide). There will also be schools, medical centres, leisure facilities and shops.

4.2.4 The proposed improvements to the Bean and Ebbsfleet Junctions form part of the Kent Thameside Strategic Transport Programme (STP), which could ultimately lead to the development of some 20,000 homes and 40,000 jobs in the area served by the Bean and Ebbsfleet Junctions. Refer to Figure 9.

4.2.5 In addition to the above, London Resort Company Holdings (LRCH) are proposing to build a theme park (Swanscombe Theme Park) on the Swanscombe Peninsula. Although there is still some uncertainty regarding its implementation, as it still needs to go through the statutory planning process, consideration needs to be given to the impact the development may have on the A2 and the proposed Bean and Ebbsfleet junction improvements. Whilst the development will predominantly be a theme park, the site will also include significant mixed-use development.

4.2.6 The development has been designated as a Nationally Significant Infrastructure Project (NSIP) by the Secretary of State for Communities and Local Government. The NSIP status of the project means that LRCH will apply directly to the Secretary of State for planning permission, rather than the local planning authorities. The site lies within the boundary of the Ebbsfleet Development Corporation.

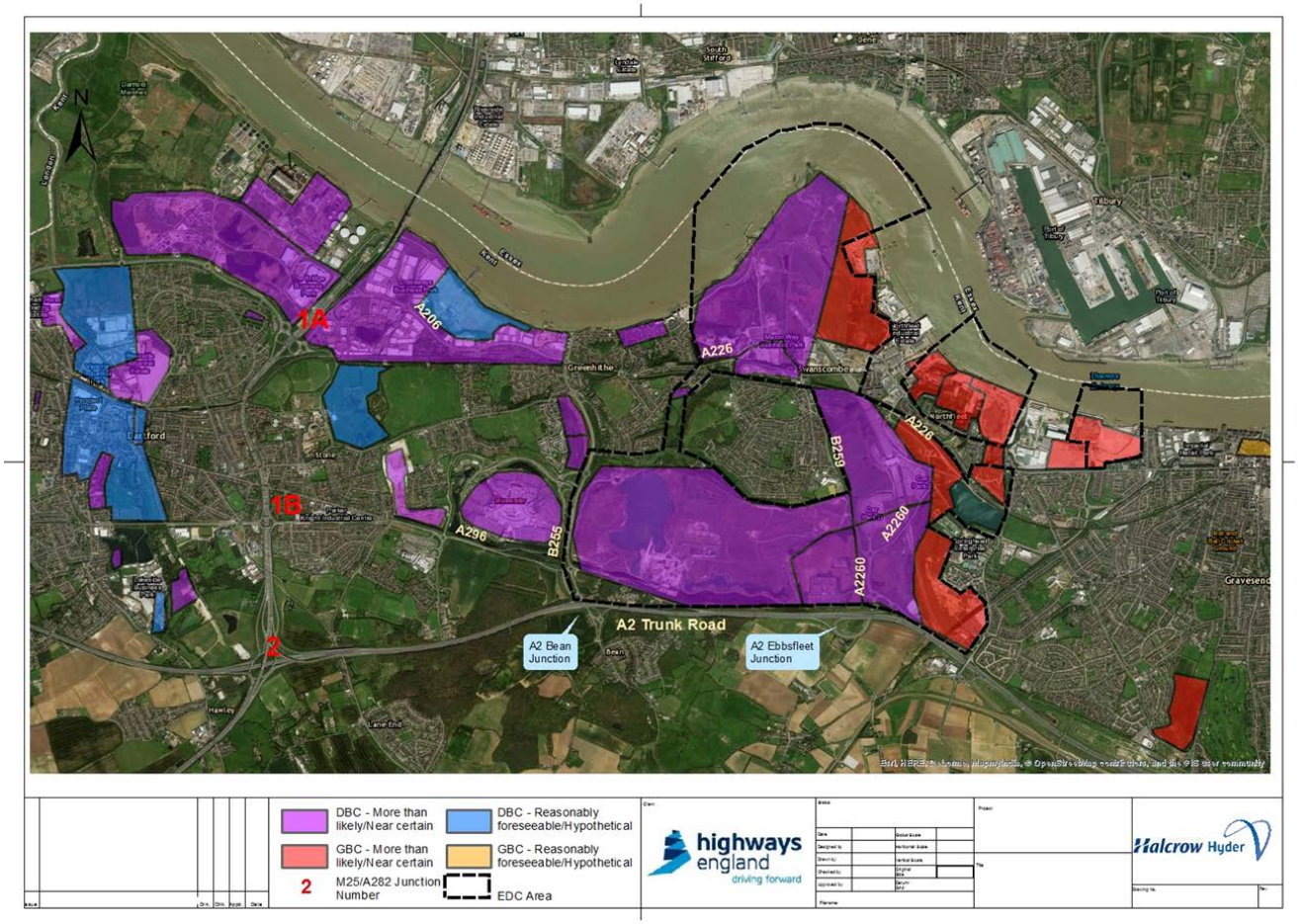
4.2.7 As Swanscombe Theme Park currently has no Local Plan status (and hence does not constitute development that conforms to the objectives of the Client Scheme Requirements) and is not certain to go ahead as planned, or within the timescale planned, Highways England has decided that the theme park should be categorised as ‘Hypothetical’ in accordance with government guidance for transport assessments and has therefore not been included in either the Stage 1 or Stage 2 traffic forecasting. However, the Swanscombe Theme Park is currently preparing for 2017 Planning Application and a Statutory Consultation in September 2017. The status of the planning application will be reviewed for inclusion in the Stage 3 traffic model.

4.2.8 The development proposals may include:

- £2 Billion project
- 10 million visitors / year rising to 15 million after Year 5
- 27,000 jobs, 17,000 of which will be on site

- Bulk of the site to be designated as Leisure including 5-6000 hotel rooms
- Potential for a staff village of up to 2000 bed spaces

Figure 9 - A2 Bean and Ebbsfleet Development Areas (With Categorisation)



4.3 Land Constraints

4.3.1 The residential properties at Ightham Cottages and Hope Cottages located next to the Bean Junction form constraints to the design of the options. Some of the options involve loss of some of the cottages and loss of access.

4.3.2 The residential properties and commercial properties along the A296 Roman Road and within the Bean Triangle area also form a constraint.

4.3.3 Springhead Nursery, located to the north east of the Ebbsfleet Junction is a constraint to the development of the options at this junction.

4.3.4 Options for the Ebbsfleet Junction have been constrained by the need to maintain direct access to developments for Ebbsfleet Green and the Station Quarter South from the Ebbsfleet Junction, as shown in the development masterplans.

4.4 Environmental Constraints

4.4.1 Detailed environmental constraints are presented within the Stage 2 Environmental Assessment Report HA543917-HHJV-GEN-PCF-0011.

4.4.2 A summary of the key environmental designations is provided below and shown on: Figure 8.

- The Thrift ancient woodland and Darenth Wood ancient woodland are located to the east and west of the A2 Bean Junction respectively. Darenth Wood is also designated as a Site of Special` Scientific Interest, SSSI (refer to the EAR, Chapter 5).
- Medieval woodland boundary in Darenth Wood, scheduled monument (a woodland

boundary of medieval origin) is located to the west of Bean Junction. Springhead Roman Site, scheduled monument is located immediately to the south of the Ebbsfleet Junction (refer to Figure 11) and the EAR, Chapter 9).

- Bean Junction, and land to the south of the A2 and Ebbsfleet Junction, lies within the Green Belt (refer to the EAR, Chapter 6).
- There are two Air Quality Management Areas (AQMAs) within the scheme: (AQMA) No.4 and Gravesham A2 AQMA (refer to the EAR, Chapter 7).
- There are three Noise Important Areas within the scheme: DEFRA NIA ref. 5959; 6265; 5960, which are located along the A2 between Bean Junction and Ebbsfleet Junction (refer to the EAR, Chapter 8).
- Swanscombe Cutting footbridge crossing A2 east of A296 Junction is a Grade 2 listed structure (refer to the EAR, Chapter 9).
- Listed buildings located within 500m of the scheme include Lower Bean Farmhouse (Grade II listed) and Barn to the South East of Lower Bean Farmhouse (Grade II listed) and Blue House (Grade II listed), (refer to the EAR, Chapter 9).
- A number of Public Rights of Way (PRoWs), footpaths and cycleways, pass in close proximity to both the Bean and Ebbsfleet Junctions (refer to the EAR, Chapters 6 & 11).
- The Bean and Ebbsfleet Junctions are underlain by principal aquifer and secondary A aquifers and there are also Source Protection Zones (SPZs) present (refer to the EAR, Chapter 10).
- The River Ebbsfleet is the only designated Main River within the scheme boundary (refer to the EAR, Chapter 10).

4.5 Public Utilities

4.5.1 There are significant existing services located at both junctions which present constraints to scheme development. The main constraints include;

- High voltage overhead power lines at the Bean Junction with a pylon located in the middle of Ightham Cottages roundabout and a pylon immediately north of Hope Cottages roundabout. Two of the options at the Bean Junction involve the diversion of the overhead lines at the junction.
- National Grid Underground Transmission line which runs along the A296 Roman road and A2 to the Northfleet East sub-station site
- A high pressure gas main at the Bean Junction

4.6 Existing Structures

4.6.1 There are several width and headroom constraints posed by existing structures on the mainline A2, which have an impact on the option layout design. These are summarised in Table 10 below.

Table 10 - Summary of Existing Structures

Reference	Existing Structure Reference	Existing Constraint
1	Downs Farm Overbridge	Limited clear span to accommodate additional carriageway widening resulting in potential restriction on widening of the west facing slip roads at the Bean Junction
2	Bean Road Overbridge	Limited width to accommodate additional traffic lanes to improve capacity at the junction. All the options considered at the Bean Junction involved either widening the existing structure or provision of new bridge crossing.

3	Swanscombe Footbridge	Limited head room resulting in potential restriction on widening of the east facing slip road at the Bean Junction and widening of the A2 mainline. The footbridge is also a Grade II listed structure.
4	Pepperhill Link Road gabion wall and Pepperhill Link Road soil nail wall	The options at Ebbsfleet have been developed to attempt to avoid any impact on these existing structures. This includes relocating the merge nosing for the eastbound on slip at the Ebbsfleet Junction to provide the widened slip road and merge before the structures.

4.7 Traffic flows during construction

4.7.1 Significant traffic congestion is currently experienced at the Bean Junction during peak periods. There are also significant increases in traffic accessing and leaving the Bluewater Shopping Centre via the Bean Junction during the Christmas period from the end of the first week of November to the end of the first week in January and at weekends.

4.7.2 Any temporary traffic management or temporary road layout during the construction phase would therefore need to have sufficient capacity to accommodate traffic flows to prevent congestion building up during the construction period to a level that would not be supported by the Local Highway Authorities. Lane restrictions will not be permitted during the Christmas period.

4.8 Adjacent Road Schemes

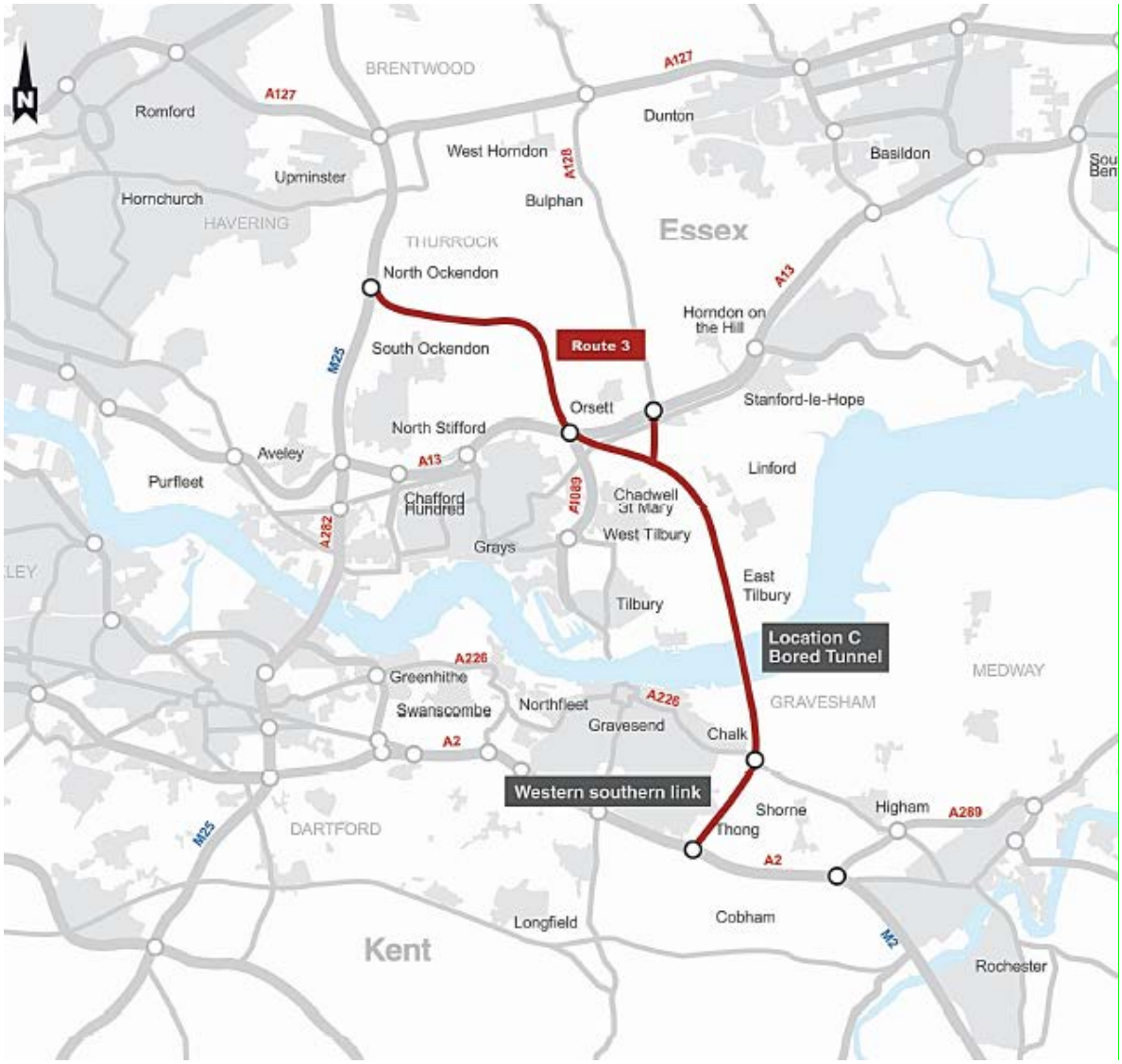
4.8.1 There are a number of future planned road schemes that may affect traffic levels on the A2 and the surrounding road network (these are reported in more detail in the Stage 2 Uncertainty Log**); however, of most significance is the Lower Thames Crossing (LTC). LTC, is a proposed new crossing of the Thames estuary linking the county of Kent with the county of Essex, to the east of the existing Dartford Crossing. At Stage 1 the A2 Bean and Ebbsfleet Junction Improvements project included Location C, Route 3 ESL traffic forecasting as this option was Highway England's proposed scheme that was taken to public consultation that was held between January and March 2016. The LTC preferred route announcement from the Secretary of State was announced on 12th April 2017.

4.8.2 The Secretary of State for Transport announced the preferred route for the LTC as the following (Refer to Figure 10):

- a bored tunnel crossing under the River Thames east of Gravesend and Tilbury (Location C)
- a new road north of the river which will join the M25 between junctions 29 and 30 (Route 3)
- a new road south of the river which will join the A2 east of Gravesend (the Western Southern Link)

4.8.3 As the Secretary of State for Transport's announcement was made after the Stage 2 traffic forecasting was carried out, the A2 Bean and Ebbsfleet Junction Improvements traffic model still includes the ESL rather than the WSL announced in the LTC Preferred Route Announcement. It is unlikely that this change from the ESL to the WSL will result in a significant change to forecast traffic levels on the A2 in the vicinity of the Bean and Ebbsfleet junctions and hence the traffic forecasts produced by the Stage 2 model for A2 Bean and Ebbsfleet Junction Improvements model are considered appropriate for a Stage 2 assessment. When the A2 Bean and Ebbsfleet traffic model is updated in Stage 3 it will include the WSL.

Figure 10 - LTC Preferred Route announced on 12th April 2017



**HHJV Doc. Ref. 0058-UA007244-UT22TN-01 Stage 2 A2BE Uncertainty Log

4.8.4 The development of the improvement schemes for the A2 Bean and Ebbsfleet junctions will be influenced by the investment in road schemes throughout the modelled period. Committed highway improvement schemes are a mix of local, strategic and developer planned network upgrades. Refer to the Traffic Forecasting Report 0003-UA007244-UT22R-05. There are no planned improvements connecting the local developments with Highways England Strategic Road Network.

5 Summary of Do Nothing Consequences

5.1.1 The proposed improvements to the Bean and Ebbsfleet Junctions form part of the Kent Thameside Strategic Transport Programme (STP) and are considered necessary to support the level of development growth proposed for Kent Thameside, in the area served by the Bean and Ebbsfleet Junctions.

5.1.2 The Stage 2 traffic forecasting has identified that by 2038 (the notional design year):

- traffic using the A2 Bean Junction (including the A296) will increase by 43 - 75% during weekday peak periods by 2038 compared with 2014 traffic levels
- traffic using the Ebbsfleet Junction will increase by between 160 - 180% during weekday peak periods by 2038 compared with 2014 traffic levels, and

5.1.3 As a consequence, improvements will be required at both junctions to improve capacity and manage these increases in traffic.

6 Summary of Alternative Schemes

6.1 General

6.1.1 This section contains a brief description of the development of the options. For further details of the junction improvement options developed and considered for assessment refer to Section 6 of the TAR (report number HA543917-HHJV-GEN-PCF-0005-TAR).

6.2 Concept Options

6.2.1 A workshop was held on the 24 July 2014 with key stakeholders at which it was agreed that the Client Scheme Requirements for the Project should be expanded from the PCF Stage 0 AECOM study (KTS Preliminary Design of Bean and Ebbsfleet Junctions on the A2 – 2 April 2008) to ensure that a wider range of options were considered for the improvements. As a result, high level alternative junction arrangements were developed for Bean and Ebbsfleet junctions. These are described inTable 11 and illustrated on drawings HA543917-HHJV-HGN-XXXX-DR-D-0147 to 0154 in Volume 2.

6.2.2 The high level concept options were presented to key stakeholders at a workshop held on 26 March 2015. At the workshop, it was identified that

- Bean Concept Option 4 (Free flow layout) did not provide a connection between the A2 and the A296 and was therefore rejected at the workshop.
- Ebbsfleet Concept Options 3 and 4 removed access to development areas as indicated in the current development masterplans and relocated access to within the development area. While this would greatly simplify the traffic movements at the junction it would require modification to existing masterplans for the proposed developments and so would not meet the Client Scheme Requirements as agreed with key stakeholders. Therefore, these options were rejected.

6.3 Long List Options

6.3.1 For each of the remaining high level junction options a number of layouts were developed to accommodate initial forecast 2041 traffic flows and taking into account topography and environmental and physical constraints at the junctions.

6.3.2 The Stage 0 AECOM options (Bean Concept Options 1a and 1b) were found not to accommodate the forecast traffic flows and an alternative layout was developed (Bean Option 1c).

6.3.3 Although initially rejected at the workshop on 26 March 2015, variations to the Bean Concept Option 4 were developed which retained connections to the A296 and modified slip road layouts on the Bean eastbound carriageway. This resulted in a number of schemes incorporating a dumb-bell layout to the west of Hope Cottages and a modified slip road layout to the A2 eastbound carriageway was provided.

6.3.4 Ebbsfleet Concept Option 2 was rejected during the development of the long list options as traffic modelling showed that the junction could not be made to operate due to the relatively high forecast traffic movements between the A2 eastbound carriageway to the Pepperhill Link road having to pass through the whole of the gyratory resulting in greater conflict with other traffic movements compared to Ebbsfleet Concept Option 1.

6.3.5 The resulting option layouts are outlined in Table 12 and Table 13 and are shown in Drawings HA543917-HHJV-HGN-XXXX-DR-D-0009 to HA543917-HHJV-HGN-XXXX-DR-D-0015 in Volume 2.

Table 11 - Concept Options: Bean and Ebbsfleet Junction:

Bean Options	Bean Concept Options 1a and 1b	Bean Concept Option 2	Bean Concept Option 3	Bean Concept Option 4
Description	Enlarge and signalise the two A2/B255 roundabout junctions Widening of Bean Lane Bridge might be required. Enlarge and signalise, or convert to a signalised crossroads, the A296/B255 roundabout. See drawing HA543917-HHJV-HGN-XXXX-DR-D-0147.	Enlarge and signalise the two A2/B255 roundabout junctions New bridge over the A2 west of Hope Cottages and link road between the two roundabouts Enlarge and signalise, or convert to a signalised crossroads, the A296/B255 roundabout. See drawing HA543917-HHJV-HGN-XXXX-DR-D-0148.	Reconstruction of the junction as a standard 'two bridge roundabout' solution. See drawing HA543917-HHJV-HGN-XXXX-DR-D-0149.	Redesign of the junction as a free flow layout between the A2 and the B255. Access between the A2 and A296 would be via the B255. See drawing HA543917-HHJV-HGN-XXXX-DR-D-0150.
Outcome of Workshop held on 26 March 2015	Further development resulting in Bean Option 1c	Further development resulting in Bean Options 2a	Further development of Bean Option 3	**REJECTED because connections to the A296 and Bean Lane could not be provided. Further development resulting in Bean Options 4a, 4b and 4c**.
Ebbsfleet Options	Ebbsfleet Concept Option 1	Ebbsfleet Concept Option 2	Ebbsfleet Concept Option 3	Ebbsfleet Concept Option 4
Description	Enlarge and signalise the A2/B259 roundabouts and dual the link between. Realign the Hall Road link and widen the westbound and eastbound merges. See drawing HA543917-HHJV-HGN-XXXX-DR-D-0151.	As Ebbsfleet Concept Option 1 but the two roundabouts forming the junction are combined into a single large gyratory with a through-about link for the link to A2 westbound. See drawing HA543917-HHJV-HGN-XXXX-DR-D-0152.	Redesign of the junction with the eastbound and westbound slip roads accessed from a single roundabout. Proposed development accesses are relocated away from the A2 junction to new access arrangements to the B259. A single large gyratory is shown. See drawing HA543917-HHJV-HGN-XXXX-DR-D-0153.	Redesign of the junction as a free flow layout by relocating the eastbound off-slip. Proposed development accesses are relocated away from the A2 junction to new access arrangements to the B259. A single large gyratory is shown. See drawing HA543917-HHJV-HGN-XXXX-DR-D-0154..
Outcome of Workshop held on 26 March 2015	**Further development resulting in Ebbsfleet Concept Option 1b**	**REJECTED during further development of the option as traffic modelling showed that the junction could not be made to operate**	**REJECTED because it would not meet the Client Scheme Requirements**	**REJECTED because it would not meet the Client Scheme Requirements**

Table 12 - Long List Options: Bean Junction 'dumbbell' junctions to the west of Hope Cottages

Option Name	Bean Junction – Option 2a	Bean Junction – Option 4a	Bean Junction – Option 4b	Bean Junction – Option 4c
Key features	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0010 Retain 'dumbbell' junction layout but construct in new location to the west. New permanent bridge crossing of A2 to west of existing structure to carry 3 lanes N/B and 2 lanes S/B. This will provide new north/south connection to west of Hope Cottages with new terminal roundabouts and slip roads to A2 Retain existing bridge for local/NMU use Potential need to divert existing 133KV electricity pylons to accommodate new junction Provide three lane exit on B255 N/B Convert A296/Bean Lane roundabout to signalised junction Widen A296 to 2 lanes eastbound and 1 lane westbound plus junction access to Eastern Quarry development. Realign A296 eastbound on-slip merge onto A2 before Swanscombe footbridge (retained)	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0012 Retain 'dumbbell' junction layout in new location to west with double eastbound diverge off-slip. As Option 2a except: Divert existing 133KV electricity pylons to accommodate new junction Construct double diverge off A2 eastbound to separate traffic flows to B255 N/B from other movements Widen B255 N/B to 3 lanes from Bean junction to Bluewater	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0013 Retain 'dumbbell' junction layout in new location to west with double eastbound merge slip road. As Option 2a except: Construct new A2 eastbound on-slip off the north roundabout adjacent to Ightham Cottages. Widen A2 eastbound carriageway to 4 lanes from new slip road to Swanscombe footbridge Convert A296/Bean Lane roundabout to signalised junction and provide Eastern Quarries junction (optional or developer works)	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0014 Retain 'dumbbell' junction layout in new location to the west. As Bean Option 2a except: Widens the B255 to 3 lanes N/B from Bean Junction to the Bluewater exit.
Outcome of Workshop held on 14 April 2016 workshop	**REJECTED in favour of Bean Option 4b as traffic modelling showed it could not be made to operate.**	**REJECTED as widening of the B255 north of the existing bridge over the A296 was considered beyond the scope of the project**.	Option to be appraised following further development. APPRAISAL OPTION REFERRED TO AS **BEAN OPTION 4**	**REJECTED as widening of the B255 north of the existing bridge over the A296 was considered beyond the scope of the project.**

Table 13 - Long List Options: Bean and Ebbsfleet Junction – Other options

Option Name	Bean Junction – Option 1c	Bean Junction – Option 3a	Bean Junction – Option 5	Ebbsfleet Option 1c
Key features	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0009 Retain "dumbbell" junction layout Enlarge and signalise existing roundabouts by Hope and Ightham Cottages Widen existing Bean Lane Bridge to 3 lanes N/B and 2 lanes S/B Provide three lane exit on B255 N/B Convert A296/Bean Lane roundabout to signalised junction Widen A296 to 2 lanes eastbound and 1 lane westbound plus junction access to Eastern Quarry development.	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0011 Twin-bridge signal controlled gyratory junction. Connect gyratory roundabout with new slip roads to A2 and connection to Bean village Construct new permanent bridge crossing of A2 to west of existing structure providing 3 lanes N/B and retain existing Bean Lane bridge for S/B traffic. Partial demolition of Hope Cottages. Provide three lane exit on B255 N/B Convert A296/Bean Lane roundabout to signalised junction Widen A296 to 2 lanes eastbound and 1 lane westbound plus junction access to Eastern Quarry development. Realign A296 eastbound on-slip merge onto A2 before Swanscombe footbridge (retained) Divert existing 133KV electricity pylons to accommodate new junction	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0135 Retain the existing junction layout but with the existing roundabouts enlarged and converted to full traffic signal control new bridge crossing of the A2 provided immediately to the east of Bean Road Overbridge for southbound traffic additional slip road provided from the Ightham Cottages roundabout connecting the junction directly with the A2 eastbound carriageway to serve traffic from the B255 Existing eastbound on-slip at the A296 which is retained Demolition of Ightham Cottages B255 southbound carriageway the slip road between the B255 and the A296 is closed A296/Bean Lane roundabout is converted to a three arm roundabout and the existing A296 layout is retained	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0015 Retain two-roundabout junction layout Enlarge and signalise existing roundabouts Widen link between roundabouts to dual two lane Provide access points to Ebbsfleet Green new development and Station Quarter South new development A2 westbound on-slip widened to two lanes A2 eastbound on-slip/Pepperhill link road reconfigured.
Outcome of Workshop held on 14 April 2016 workshop	**REJECTED due to traffic restrictions that would be imposed while widening the bridge. But developed as Bean Option 5 to overcome operational difficulties during construction**.	Option to be appraised following further development. APPRAISAL OPTION REFERRED TO AS **BEAN OPTION 3**	Option to be appraised APPRAISAL OPTION REFERRED TO AS **BEAN OPTION 5**	Option to be appraised. APPRAISAL OPTION REFERRED TO AS **EBBSFLEET OPTION 1**

6.4 Short List Options

6.4.1 An assessment of the long list layout options was undertaken and reviewed at a workshop on the 14 April 2016, with representatives of Highways England, to confirm which layouts would be developed further for assessment. The reasons for rejecting some of the Long List Options are set out in Table 12 and Table 13.

6.4.2 Layouts which involved widening of the B255 (Bean Option 4a and 4c) were considered outside of the scope of the project and so were not included in the assessment and not developed further.

6.4.3 Bean Option 1c was rejected following a buildability review that highlighted the traffic management arrangements that would be required during construction. To enable the existing Bean Road Overbridge to be widened a temporary bridge crossing would be required to accommodate traffic diverted from the existing bridge. This would be located west of Hope Cottages requiring a temporary access road. To enable the bailey bridge to be constructed the existing Ightham Cottages roundabout would need to be modified to provide sufficient space for construction. The temporary road layout would not have sufficient capacity to accommodate traffic flows resulting in unacceptable levels of congestion during construction which would be unlikely to be supported by the Local Highway Authority.

6.4.4 Bean Option 5 was developed to overcome the buildability issues associated with the widening of the existing Bean Road Bridge required in Bean Option 1c. A new bridge crossing would be provided immediately to the east of the existing bridge. This would require widening of Ightham cottages roundabout to the east resulting in the demolition of the cottages.

6.4.5 Following the 14th April 2016 Workshop, the Options to be appraised were renamed for ease of reference as follows:-

- Bean Option 3a was renamed as Bean Option 3
- Bean Option 4b was renamed as Bean Option 4
- Bean Option 5 reference was kept as Bean Option 5
- Ebbsfleet Junction Option 1c was renamed as Ebbsfleet Option 1.

6.4.6 The Short Listed options developed for appraisal were: Bean Junction Option 3, Bean Junction Option 4, Bean Junction Option 5 and Ebbsfleet Junction Option 1. They are described in Table 14 and shown in Figure 11 to Figure 14. The options are shown in more detail on Drawings HA543917-HHJV-HGN-XXXX-DR-D-0129 to 0137 in Volume 2.

6.4.7 The current strategy for the A2 junction improvements at A2 Bean and A2 Ebbsfleet Junctions is for both junctions to be open to the public within the same year. Accordingly, the appraisal of each of the considered options assumed a junction improvement also in place at the other junction. The three Bean Junction options were appraised in combination with Ebbsfleet Junction Option 1 as below. The appraisal options are described in Table 14

- Bean Junction Option 3 with Ebbsfleet Junction Option 1 (B03E01b)
- Bean Junction Option 4 with Ebbsfleet Junction Option 1 (B04bE01b)
- Bean Junction Option 5 with Ebbsfleet Junction Option 1 (B05E01b)

Table 14 - Appraisal Options

Option Name	Bean Junction – Option 3	Bean Junction – Option 4	Bean Junction – Option 5	Ebbsfleet Option 1
Key features	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0129-0131 Single large traffic signal controlled gyratory with two structures crossing the A2 (existing Bean Road Bridge and new bridge to the west) New westbound slip roads are provided to the south of the A2 Down Farm Bridge demolished and rebuilt to accommodate new westbound merge New eastbound off-slip to A2 provided with dedicated left turn lane at the B255 roundabout. New road west of Hope Cottages linking Bean Road to the gyratory. Eastbound on-slip to A2 via A296 retained with realignment west of Sandy Lane to enable 2 lane merge west of Swanscombe Footbridge. A296/B255 junction replaced with signal controlled junction A296 widened to provide 2 lanes E/B Two-way collector road provided adjacent to A296 to provide access to properties in the Bean Triangle New traffic signal junction for Eastern Quarry to be provided by developer	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0132-0134 Dumb-bell arrangement comprising 2 new signal controlled roundabouts located on either side of the A2 and connected by dual carriageway link road (via new bridge) to the west of Hope Cottages. Existing Bean Road Bridge will be demolished. New westbound slip roads are provided to the south of the A2 Revised eastbound off-slip to A2 provided with dedicated left turn lane at the B255 roundabout. Additional eastbound on-slip to A2 from Ightham Cottages roundabout. Retaining wall would be provided to avoid impact on existing pond. Eastbound on-slip to A2 via A296 retained with revised merge. Eastbound A2 carriageway converted to 4 lanes by removing the existing hard shoulder and using narrow lanes from the end of the new slip road to east of Swanscombe footbridge, which is retained by continuing the narrow lanes through the structure. B255 southbound link to A296 is closed. B255/A296 junction converted to 3 arm roundabout.	See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0135-0137 Dumb-bell arrangement retained in existing location. Roundabouts on either side of the A2 are enlarged and signal controlled. Existing Bean Road Bridge is retained for N/B traffic. New bridge is constructed to the east for S/B traffic. Existing westbound slip roads, to the south of the A2, are modified Modified eastbound off-slip to A2 incorporates a dedicated left turn lane at the B255 roundabout. Additional eastbound on-slip to A2 from Ightham Cottages roundabout. Retaining wall would be provided to avoid impact on existing pond. Eastbound on-slip to A2 via A296 retained with revised merge. Eastbound A2 carriageway converted to 4 lanes by removing the existing hard shoulder and using narrow lanes from the end of the new slip road to east of Swanscombe footbridge which is retained by continuing the narrow lanes through the structure. B255 southbound link to A296 is closed. B255/A296 junction converted to 3 arm roundabout Demolition of Ightham Cottages.	Retain two-roundabout junction layout Retains the existing junction layout but with the existing roundabouts enlarged and signal controlled The eastern roundabout is extended to the north with an additional arm to accommodate access to Station Quarter South development. Access to Ebbsfleet Green development will be via the enlarged and signal controlled western roundabout Link road between the roundabouts is widened from the existing single carriageway to dual carriageway. Existing eastbound and westbound off-slips are retained Eastbound on-slip widened to two lanes and separated from the one-way link road to Pepper Hill Junction. Slip road is realigned to enable the merge to be moved further west. Constraints are created by the existing Channel Tunnel Rail Link Tunnel, Pepper Hill Underbridge and soil nail retaining wall. Eastbound off-slip widened at the approach to the roundabout with a dedicated signal controlled left turn lane.

Figure 11 - Short List Developed Option: A2 Bean Option 3

Figure 12 - Short List Developed Option: A2 Bean Option 4

Figure 13 - A2 Bean Option 5

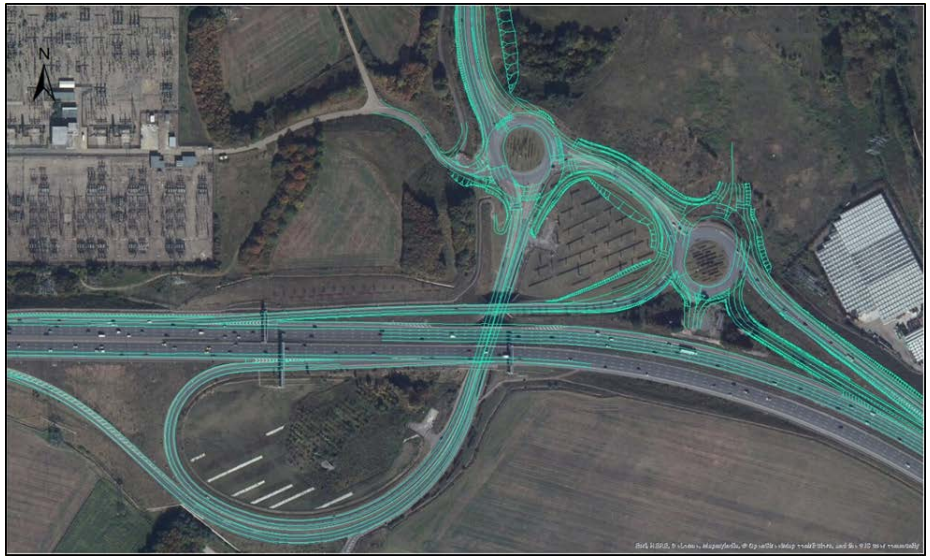


Figure 14 - A2 Ebbsfleet Option 1

7 Stage 1 Summary of Traffic, Economics, Costs

7.1 Traffic Data

7.1.1 Traffic data were collected for refining the Lower Thames Crossing Model (2009 Base Year) in the A2 Bean and Ebbsfleet area. These include:

- Automatic Traffic Counts (ATCs) from both permanent and temporary counters
- Manual Classified Counts (MCCs) for junctions and links
- Manual Classified Turning Counts (MCTCs)
- TrafficMaster data for routes through the model area
- ANPR data
- Network Inventory Posted Speed Data.

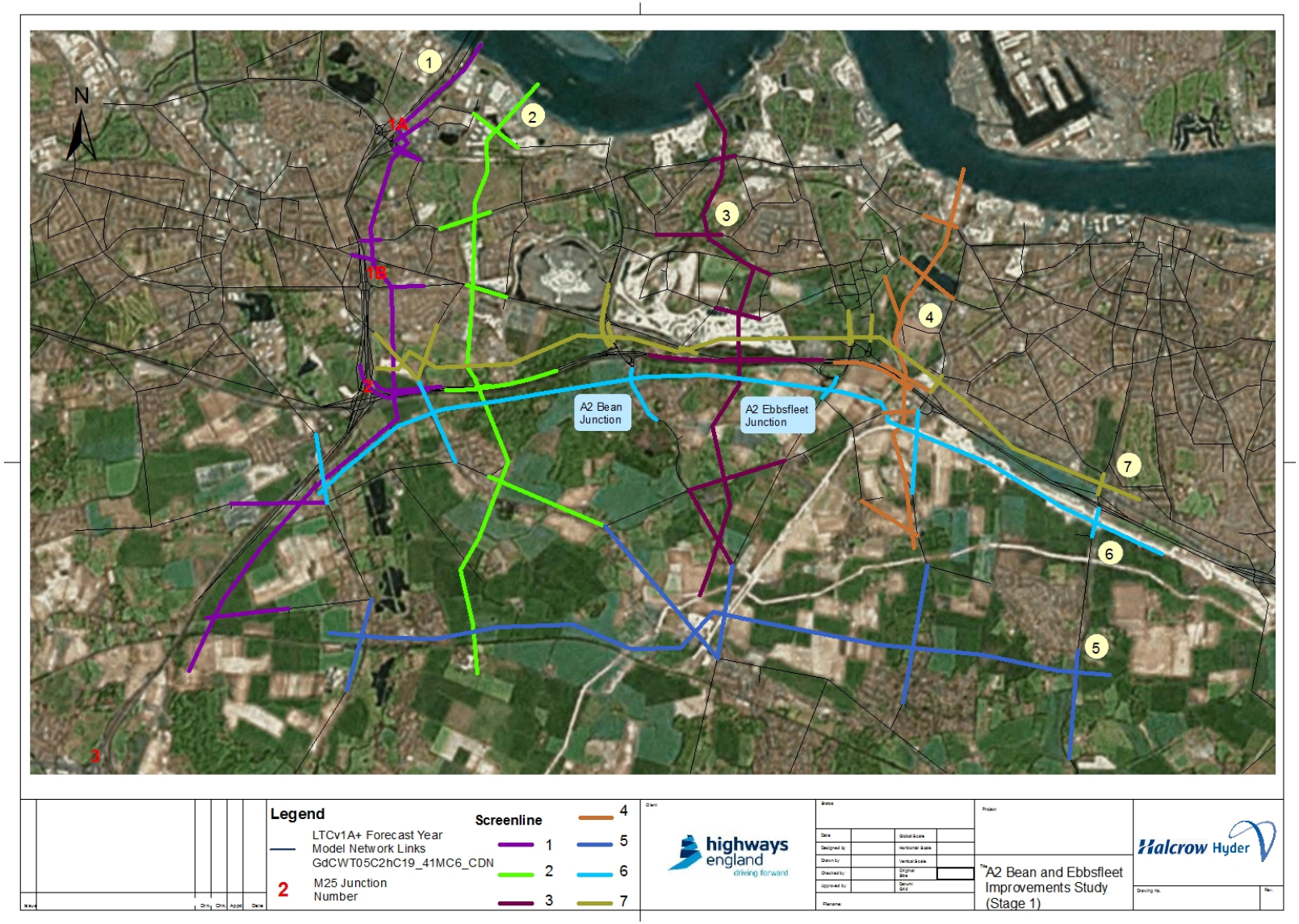
7.1.2 A full explanation and presentation of the collected data is contained within the Traffic Data Collection Report (TDCR) and associated appendices (report reference 0001-UA007244-UT22R-06).

7.1.3 Screenlines locations for calibrating and validating the model are shown in Figure 15.

7.1.4 The structure of the network was based on the Integrated Transport Network (ITN) layer. The ITN layer is produced by the Ordnance Survey (Great Britain's National mapping agency) and is a map of Great Britain's road network. This mapping was used in the network development of the SATURN highway model for initial digitising of the location of junctions.

7.1.5 The geometry of the junctions and junction type were based on online aerial photography and an inventory of posted speed and local speed data was collected on site.

Figure 15 - A2 Bean and Ebbsfleet Screenline Locations



7.2 Traffic Analysis

7.2.1 Traffic Forecasts for the A2 Bean and Ebbsfleet Junction Improvements were prepared using a traffic model developed for the Product Control Framework (PCF) Stage 1 based on an updated version of the Lower Thames Crossing Model which comprised of a variable demand model and a SATURN based highway assignment model.

7.2.2 Highway demand matrices were derived for three weekday time periods.

- AM Peak (08:00 – 09:00)
- Inter Peak (average hour from 10:00 – 16:00)
- PM Peak (17:00 – 18:00)

7.2.3 A Local Model Validation Report (LMVR) was produced to demonstrate that the base year traffic model satisfactorily reproduces an existing, independently observed, situation. The LMVR (0002-UA007244-UT22R-03 Stage 1 A2 Bean and Ebbsfleet Local Model Validation Report) provides a summary of the accuracy of the base from which the forecasts were prepared.

7.2.4 The traffic forecasts were prepared in accordance with the advice set out in WebTAG[1], and were principally determined using factors obtained from TEMPRO v6.2 (NTEM 6.2). The reference forecasts represent travel demand based on the outputs from the Stage 1 A2 Bean and Ebbsfleet Uncertainty Log (0004-UA007244-UT22TN-11 A2 Bean and Ebbsfleet Uncertainty Log) and controlled to NTEM for the core scenario.

7.2.5 The A2 Bean and Ebbsfleet model forecasting matrix building procedure is based on the Lower Thames Crossing Model (LTCM) and incorporates a customised reference forecast matrix procedure which allows the production of TEMPRO equivalent forecasts using LTCM model zoning rather than NTEM level zoning.

7.2.6 Traffic forecasts were prepared for Central Growth Forecasts only.

7.2.7 For actual or 'equilibrium' demand to be determined, Variable Demand Modelling (VDM) was undertaken. Further detail regarding the preparation of traffic forecasts for the Stage 1 A2 Bean and Ebbsfleet Junction Improvements Study can be referred to in 0003-UA007244-UT22R-04 Stage 1 A2 Bean and Ebbsfleet Traffic Forecasting Report.

7.2.8 A review of the major development zones within the study area highlights areas of significant demand model suppression within the morning and evening peak.

7.2.9 Global network statistics were extracted from the forecast year assignments for the following criteria:

- Total transient queues (PCU-hours)
- Total over capacity queues (PCU-hours)
- Total travel time (PCU-hours)
- Total travel distance (PCU-kilometres)
- Average network speed (kph).

7.2.10 These statistics for the morning, inter peak and evening peaks are reported in the Stage 1 A2 Bean and Ebbsfleet Traffic Forecasting Report, as shown in Table 15, Table 16 and Table 17. This document also contains Summary tables showing the scheme effect of the A2 Bean and Ebbsfleet Junction Improvements for each of the modelled years (2025, 2041) by time period for the Core Scenario (Central Growth).

7.2.11 The results were also expressed by way of turn schematics, as shown in the example below in Figure 16.

7.2.12 The flows are presented for the turning movements indicated by the arrow of direction of travel. The top box represents the actual flow (total vehicles) for each option under consideration. The second box represents the Without Scheme actual flow (total vehicles) and the third box shows the scheme effect on flow as a positive increase (shaded in black) or a reduction in flow (shaded in red).

[1] TAG Unit M1: Principles of Modelling and Forecasting, Chapter 5 Forecasting, p15, Department for Transport, January 2014

Table 15 - Core Scenario (Central Growth) Assignment Statistics – AM Peak (Cordon Model)

Network Performance Effect	2009 Base Year	2025 Forecast Year				2041 Forecast Year			
		WT05	B03E01b	B04bE01b	B05E01b	WT05	B03E01b	B04bE01b	B05E01b
Transient Queues (pcu-hrs)	1183	1625	1616	1612	1599	1928	1982	1966	1962
Over-Capacity Queues (pcu)	5	264	127	135	135	595	365	361	364
Link Cruise Times (pcu-hrs)	6876	7467	7456	7479	7469	7970	7943	7973	7958
Average Speed (km/hr)	55	53	53	53	54	49	50	50	50
Total Delay (mins / pcu)	1.4	1.8	1.7	1.7	1.7	2.3	2.1	2.1	2.1
Congestion Index* (mins /pcu.km)	0.16	0.23	0.21	0.21	0.21	0.29	0.27	0.27	0.27
Average Trip Length (km)	9.0	8.2	8.2	8.2	8.3	8.2	8.2	8.2	8.2

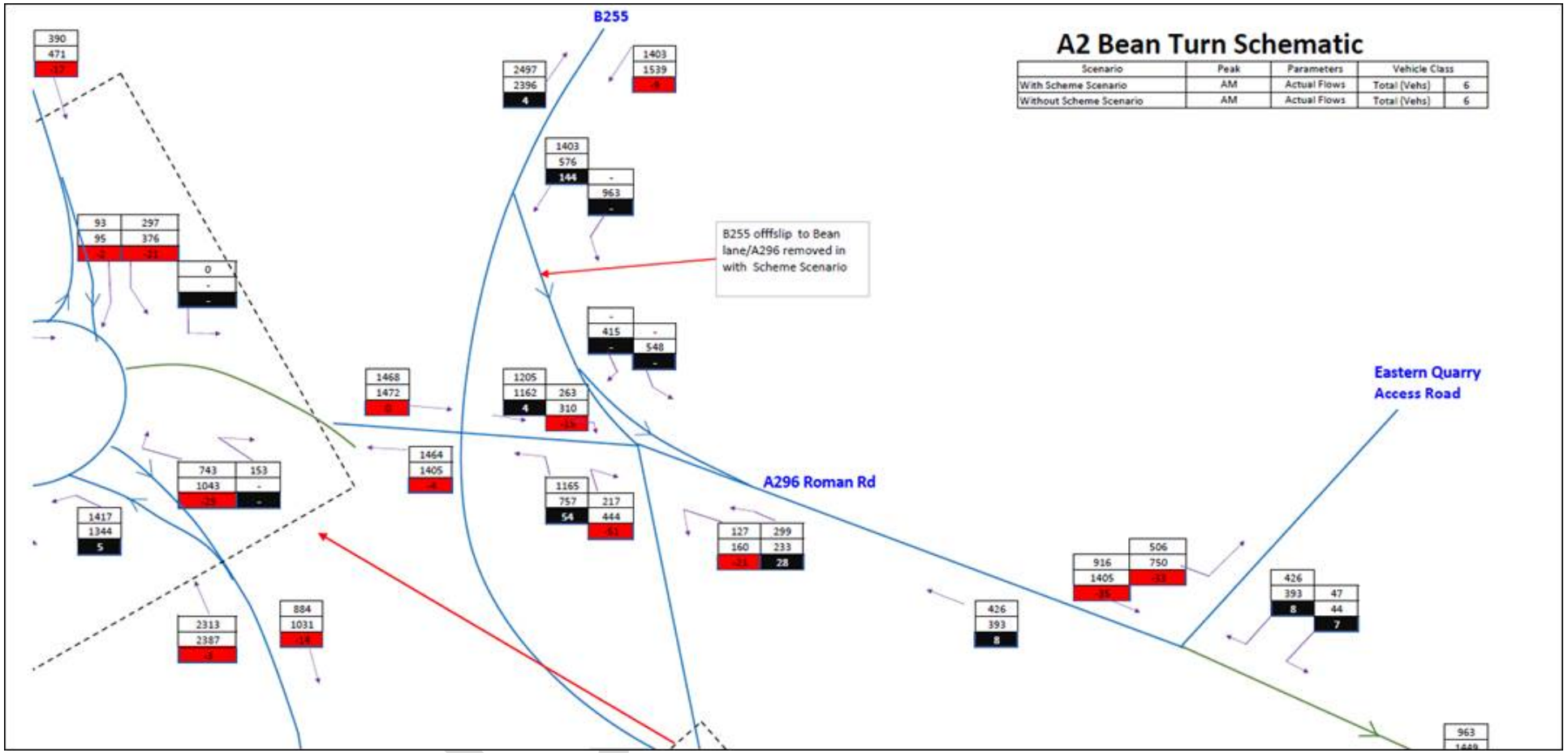
Table 16 - Core Scenario (Central Growth) Assignment Statistics – Inter Peak (Cordon Model)-

Network Performance Effect	2009 Base Year	2025 Forecast Year				2041 Forecast Year			
		WT05	B03E01b	B04bE01b	B05E01b	WT05	B03E01b	B04bE01b	B05E01b
Transient Queues (pcu-hrs)	604	820	822	815	817	1009	1000	995	996
Over-Capacity Queues (pcu)	0	0	0	0	0	0	0	0	0
Link Cruise Times (pcu-hrs)	4944	5526	5520	5540	5534	6271	6260	6284	6274
Average Speed (km/hr)	63	61	61	61	61	59	60	60	60
Total Delay (mins / pcu)	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1
Congestion Index* (mins /pcu.km)	0.10	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14
Average Trip Length (km)	8.9	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1

Table 17 - Core Scenario (Central Growth) Assignment Statistics – PM Peak (Cordon Model)

Network Performance Effect	2009 Base Year	2025 Forecast Year				2041 Forecast Year			
		WT05	B03E01b	B04bE01b	B05E01b	WT05	B03E01b	B04bE01b	B05E01b
Transient Queues (pcu-hrs)	1288	1703	1709	1694	1668	2137	2126	2137	2079
Over-Capacity Queues (pcu)	311	245	240	232	158	392	255	273	193
Link Cruise Times (pcu-hrs)	7158	7651	7611	7639	7641	8310	8256	8289	8285
Average Speed (km/hr)	53	53	53	54	54	50	51	51	52
Total Delay (mins / pcu)	1.8	1.9	1.9	1.9	1.8	2.3	2.1	2.2	2.0
Congestion Index* (mins /pcu.km)	0.21	0.23	0.23	0.23	0.21	0.28	0.26	0.27	0.25
Average Trip Length (km)	9.4	8.6	8.6	8.6	8.6	8.5	8.5	8.5	8.6

Figure 16 - Forecast Turn Flow Schematic Example – Scheme Effect



7.3 Operational Modelling

7.3.1 To ensure that proposed junction layouts were feasible in terms of network capacity and safe operation, more detailed traffic modelling analyses were undertaken using local junction models and a microsimulation model that covered both junctions, the A2 mainline and the adjacent road network. The network coverage of the microsimulation model is shown below in Figure 17.

7.3.2 Two time periods were developed for a typical weekday:

- AM peak from 08:00 to 09:00 hours
- PM peak from 17:00 to 18:00 hours

7.3.3 A sensitivity test was also carried out for how the junctions would operate at the weekend.

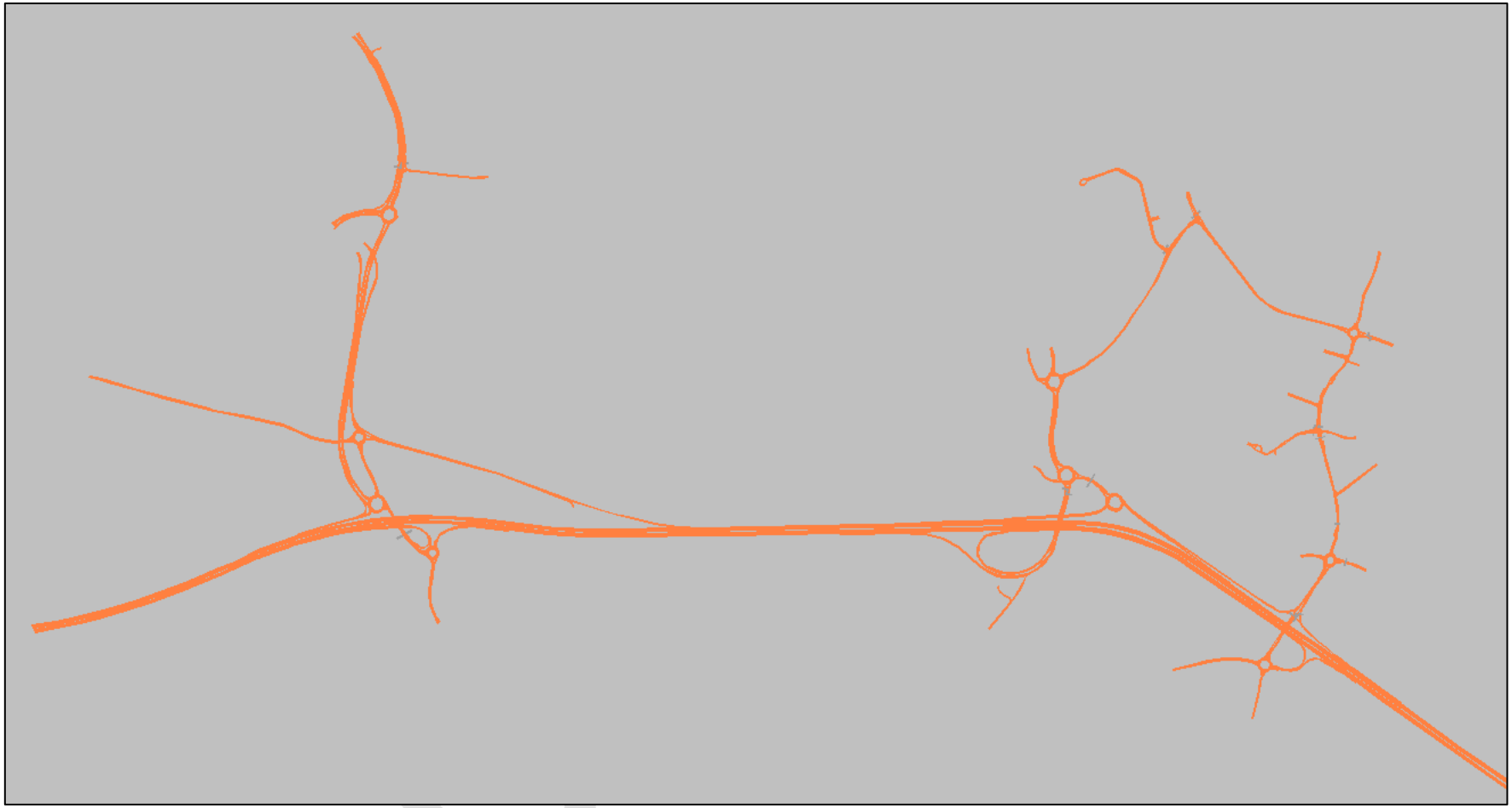
7.3.4 Traffic forecast flows were obtained from the Stage 1 A2 Bean and Ebbsfleet strategic traffic model for 2041 and tested for Option 3 (B03E01), Option 4b (B04bE01) and Bean Option 5 (B05E01). As there isn't a weekend traffic forecast model, the forecasts traffic flows for the weekend test were developed using a 'Synthetic Approach'.

7.3.5 The results from the Without Scheme model demonstrate that without any improvements to the Bean and Ebbsfleet Junctions the AM and PM peak periods would experience unacceptable levels of delay and congestion in 2041. The modelling indicates that blocking back onto A2 mainline would occur at Bean Junction in the AM period causing safety issues and flow breakdown on the mainline. Furthermore, the Bean and Ebbsfleet Junctions do not provide sufficient capacity for the local traffic to access the strategic road network in the PM peak, with extensive queueing and delays on the B255 and B2260, respectively.

7.3.6 In the With Scheme scenarios in 2041, each of the options were seen to operate without blocking back onto the mainline on the off-slips at each junction in the AM and Inter-peak time periods, but blocking back was shown to occur in the PM peak period in each option on the eastbound off-slip at Ebbsfleet. The reason for this occurring in the With Scheme scenario but not the Without Scheme scenario is because eastbound traffic is able to flow more freely because of the Bean Junction improvements and hence allows more traffic to reach the Ebbsfleet slip road.

7.3.7 Option 5 was concluded as providing the best junction performance. All options operate without blocking back onto the A2 mainline, except at the eastbound off slip in the PM peak period, which occurs in all three options. Initial work suggests this safety concern can be addressed.

Figure 17 - Network coverage of microsimulation model



7.4 Economic Assessment and Appraisal

7.4.1 The economic appraisal of the A2 Bean and Ebbsfleet options consists of the appraisal of:

- Direct economic impacts on road users and government and other related economic impacts
- Wider economic impacts - specifically Wider Economic Benefits.

7.4.2 DfT's standard economic appraisal tools were used to appraise these impacts using data provided from the Stage 1 highway assignment model (described in Section 7.2). For each option, outputs from the model, such as traffic flows and generalised costs, provided inputs to the process of estimating impacts.

7.4.3 Further detail regarding the economic assessment of the Stage 1 A2 Bean and Ebbsfleet Junction Improvement can be referred to in 0004-UA007244-UT22R-05 Stage 1 A2 Bean and Ebbsfleet Economic Assessment Report.

7.4.4 The appraisals were undertaken in accordance with DfT's WebTAG guidance, with all benefits and costs calculated in monetary terms and expressed as present values (PV) in 2010 prices, discounted to 2010. The work includes the following components:

- TUBA (Version 1.9.6) appraisal – for assessing travel time, vehicle operating cost and greenhouse gas benefits;
- COBALT appraisal – for assessing monetised changes in safety benefits;
- Noise appraisal, and
- Appraisal of wider impacts (WI), otherwise known as wider economic benefits (WEBs).

7.4.5 Based on the best information available at the time, there was no grants or subsidies applicable to the A2 Bean and Ebbsfleet scheme.

7.4.6 However, a developer contribution element totalling £45m to be made available is available by the STIP (Strategic Transport Infrastructure Programme) fund and the Ebbsfleet Development Corporation.

7.4.7 The Scheme parameters are principally determined by the parameters used in the traffic forecasting model, as follows:

- Current Year – 2016
- First Year – 2025 (proxy for Scheme Opening Year)
- Modelled Years – 2025, 2041
- Horizon Year – 2084.

7.4.8 Costs from construction delays were not included in the assessment as information on the traffic management for each option was not available.

7.4.9 The three shortlisted options described in Chapter 6 (and as shown in Figure 11 to Figure 14 above), were assessed.

User benefit appraisal

7.4.10 The results of the user benefit assessments for the various options are summarised in the following tables. All figures reported in the following paragraphs are in 2010 prices discounted to 2010. However, the figures do not include the impact of wider economic benefits, which are discussed at a later stage.

- Table 18 shows the User and Provider Benefits,
- Table 19 shows the Public Accounts Table, and
- Table 20 shows the AMCB Summary Table

Table 18 - User and Provider Benefits (£ PVB in 2010 prices, discounted to 2010)

£bn PVB 2010 prices		Ebbsfleet 1b		
		Option 3	Option 4b	Option 5
Commuting	Travel time	£19,026,360	£15,867,714	£22,300,191
	VOC	£1,087,725	£416,914	£53,957
	Charges	£0	£0	£0
	Construction delays	n/a	n/a	n/a
	Subtotal	£20,114,085	£16,284,628	£22,354,148
Other consumers	Travel time	£61,183,840	£40,688,805	£65,754,868
	VOC	£2,964,076	-£1,708,270	-£2,092,005
	Charges	£0	£0	£0
	Construction delays	n/a	n/a	n/a
	Subtotal	£64,147,916	£38,980,535	£63,662,863
Business	Travel time	£42,993,073	£18,899,357	£41,586,927
	VOC	£3,478,687	£97,098	£889,278
	Charges	£0	£0	£0
	Construction delays	n/a	n/a	n/a
	Subtotal	£46,471,760	£18,996,455	£42,476,205
Other Business	Developer Contributions	-£31,725,391	-£31,725,391	-£31,725,391
	Net Business Impact	£14,746,369	-£12,728,936	£10,750,814
Total		£99,008,370	£42,536,227	£96,767,825
Business user benefits as percentage of total user benefits		35.5%	25.6%	33.1%

VOC = vehicle operating costs

n/a = not appraised

7.4.11 The great majority of the benefits for all of the options are generated by travel time savings. The business impact of the project represents a considerable proportion of the total user and provider benefit, being 35% of the total for Option B03E01b, 26% for Option B04bE01b and 33% for Option B05E01b. These proportions would however be considerably reduced if expressed in terms of overall benefit because of the impact of the developer contribution.

Table 19 - Public Accounts (PVC £ 2010 prices, discounted to 2010)

Scheme Option	Ebbsfleet 1b		
	Option 3	Option 4b	Option 5
Central Government Funding			
Most likely outturn costs at 2014 prices (including inflation)	£145,900,000	£143,000,000	£123,900,000
Investment Costs (a)	£106,219,058	£104,122,959	£90,211,136
Developer Contribution (b)	-£31,725,391	-£31,725,391	-£31,725,391
Operating Costs (c)	n/a	n/a	n/a
Net Central Government Impact (a+b+c)	£74,493,667	£72,397,568	£58,485,745
Revenues (d)	£0	£0	£0
Cost to Broad Transport Budget (a+b+c+d)	£74,493,667	£72,397,568	£58,485,745
(Reduction in) Indirect Tax Revenue	£2,755,263	£315,771	£649,640

Table 20 - AMCB Summary Table for Shortlist Options (PVB £m 2010 prices, discounted to 2010)

Option at Ebbsfleet	**Option 1b**		
Option at Bean	**Option 3**	**Option 4b**	**Option 5**
Noise	0.04	-0.00	-0.11
Green-house Gases	1.44	0.17	0.38
Accidents	7.72	-0.16	3.15
Economic Efficiency: Commuting	20.11	16.28	22.35
Economic Efficiency: Other	64.15	38.98	63.66
Economic Efficiency: Business	14.75	-12.73	10.75
Wider Public Finances (ITR)	-2.76	-0.32	-0.65
PVB	105.45	42.23	99.54
PVC	74.49	72.40	58.49
NPV	30.95	-30.16	41.05
BCR	**1.4**	**0.6**	**1.7**

7.4.12 On the basis of these results it can be seen that Option B04BE01b represents poor value for money (its costs exceed its benefits) and Option B03E01b lies towards the top of the low value for money category. Meanwhile Option B05E01b lies towards the middle of the medium value for money range.

Wider Economic Benefits

7.4.13 A Wider Impacts Assessment was undertaken using the methodology for the appraisal of Wider Impacts published by the UK Department for Transport.

7.4.14 Three categories of wider economic benefit were relevant to the A2 Bean options:

- Agglomeration benefits;
- Imperfect competition effects, and
- Labour supply impacts.

7.4.15 The scale and breakdown of these wider impacts by type is summarised in Table 21. At Stage 1 of

the A2 Bean and Ebbsfleet Junction Improvements economic assessment, the wider economic benefit assessment was carried out only for Option B05E01b, and estimates have been used for the other two options. Agglomeration benefits account for over 80% of the total.

Table 21 - Wider Economic Benefits (£m 2010 prices, discounted to 2010)

	Ebbsfleet 1b		
	Option 3	Option 4b	Option 5
Agglomeration	£18.85m	£10.36m	£18.85m
Output in imperfectly competitive markets	£0.60m	£0.33m	£0.60m
Tax revenue from labour market impact	£3.04m	£1.67m	£3.04m
Total	£22.49m	£12.36m	£22.49m
Agglomeration as % of WEBs	83.8%	83.8%	83.8%

Overall Appraisal and Conclusion

7.4.16 The effects of adding the wider impacts into the economic appraisal for the A2 Bean and Ebbsfleet options are set out in Table 22.

Table 22 - Summary of Economic Results for A2 Bean and Ebbsfleet Options (£m in 2010 prices, discounted to 2010)

Option at Ebbsfleet		Ebbsfleet 1b		
Option at Bean		Option 3	Option 4b	Option 5
Excluding WEBS	PVB	105.45	42.23	99.54
	PVC	74.49	72.40	58.49
	NPV	30.95	-30.16	41.05
	Initial BCR	1.4	0.6	1.7
Including WEBs	WEBs	22.49	12.36	22.49
	PVB	127.94	54.59	122.03
	NPV	53.44	-17.80	63.54
	Adjusted BCR	1.7	0.8	2.1
WEBs as % of total benefits		17.6%	22.6%	18.4%

7.4.17 Adding the wider economic benefits to the initial PVC for Option B05E01b has the effect of bringing that option into the high value for money category. Option B03E01b moves into the medium value for money category, but Option B04bE01b remains poor value for money.

7.4.18 The initial BCRs for Options B05E01b, B03E01b and B04bE01b are 1.7, 1.4 and 0.6 respectively. Adding in wider benefits to Option B05E01b increases the BCR to 2.1 and brings it into the high value for money (VFM) category. Adding in the estimated wider benefits for Options B03E01b and B04bE01b increases their BCRs to 1.7 (medium VFM) and 0.8 (poor VFM) respectively.

7.4.19 In economic terms, the appraisal process indicates that Option B05E01b provides best value for money.

7.5 Appraisal Summary Tables

7.5.1 Appendix I of the Stage 1 Appraisal Specification Report includes Appraisal Summary Tables for each of the Short List options.

8 Summary of Operational Assessment

8.1 Economic operation and maintenance of the completed scheme

Safety Projection of completed scheme

8.1.1 The accident records currently show a significantly higher than average casualty rate for the A2 between Bean and Ebbsfleet which has been increasing year on year between 2011 and 2015 and the objective of the scheme within the strategic safety action plan is to ensure that the casualties per 100 million vehicle miles reduces on the A2 taking into account the national trend of a reduction in casualties as reported in Table 23.

Table 23 - PACTS Projection of Road Casualties in Great Britain to 2030

Year	2010	2020	2030
Casualties No.	208,648	180,000	162,000
% change from 2010		-13.73%	-22.36%

8.1.2 Whilst it may be difficult to make significant safety improvements to the A2 due to the limitations of the scheme extents, all practical measures shall be considered in order to reduce the number of casualties below the national trend rates identified above. This will subsequently contribute to the target reduction of 40% as highlighted in Highways England's 5 year plan and the current strategic outcome for a safe and serviceable network by reducing the number of people killed or seriously injured on the network to no more than 1,393 in year by the end of 2020, a 40% reduction from 2010.

8.1.3 The side roads will be low speed and by definition the severity of any incidents will therefore also be low. The safety objectives for the side roads will be based on ensuring that the numbers of killed or seriously injured incidents reduce together with a reduction in the number of other injury accident and damage only incidents.

8.2 Construction Health & Safety - Construction Design and Management Regulations 2015

8.2.1 During Stages 1 and 2 of the A2 Bean and Ebbsfleet scheme, designers have applied the principles of prevention and elimination, where possible, to hazards for construction, operation, maintenance and demolition, as required by the Construction Design and Management Regulations, 2015 (hereafter referred to as the CDM Regulations). The designers have developed Hazard Elimination Schedules highlighting the key residual risks remaining at Stage 2 which need to be managed by those involved in the subsequent development of the scheme. The Hazard Elimination Schedules are contained in the Pre-Construction Information, reference HA543917-HHJV-GEN-PCF0035.

Maintenance Operations

8.2.2 The Short List options involve lengths of new highways, junction improvements, earthworks, drainage and other items of highways infrastructure including structural and electrical systems such as signalization control. All of these would require a programme of maintenance and periodic renewals.

8.2.3 There are no specific maintenance operations or access restrictions that are considered will be an issue with respect to any of the Short List options for the completed scheme.

8.2.4 Hazards and Risks associated with maintenance activities, such as access to roadside equipment (traffic signals, traffic signal control cabinets, street lighting, feeder pillars etc), access to drainage network (for gulley cleaning, pipe jetting etc) are identified in the Maintenance and Repair Strategy Statement, reference HA543917-HHJV-GEN-PCF-0034.

8.2.5 With regard to the Short List Options, the principal differences of the maintenance of the completed scheme are set out in Table 24 below:

Table 24 - Safe and economic operation and maintenance of the completed scheme)

Option	Impact from structures	Impacts from on-line widening works
Option B03E01b	New 3 lane bridge required. Retain existing Bean Bridge.	Significant on-line widening of local roads (including the A296). Minor on-line works on A2. Signalisation of new single large gyratory.
Option B04E01b	New 5 lane bridge required. Option to demolish existing Bean Bridge.	Extensive on-line works on the A2. Some on-line widening of local roads. Signalisation of two new roundabouts.
Option B05E01b	New 2 lane bridge required. Retain existing Bean Bridge.	Extensive on-line works on the A2. Some on-line widening of local roads. Existing roundabouts enlarged with and converted to full traffic signal control.

8.2.6 The presence of proposed assets provided elsewhere and currently on the A2 means that the maintainers are familiar with this kind of maintenance access arrangement, and as such any maintenance required as part of this project should be relatively straightforward. The A2 Bean and Ebbsfleet scheme has been assessed in accordance with the guidance in IAN191/16 as having predominantly Type A features with one Type B feature. The project has therefore been categorised as requiring a Type A SMS (Safety Management System), which equates to a basic or 'business as usual' level of safety management. This decision is documented in the Safety Plan for the scheme, reference HA543917-HHJV-GEN-PCF-0004.

9 Summary of Technology and Maintenance Assessment

9.1 Implications for the requirement for additional road safety technology on the completed scheme

9.1.1 At this stage in the design no enhancement to the existing technology provision of the A2 is included within the Short List Options. The operating regime is self-determining through conventional merges and diverges and normal interchange manoeuvres. The technology requirements for the Proposed scheme would be limited to:

- Relocation of existing technology assets impacted by the new junction layouts
- Provision of traffic counter/detector loops at the new junction layouts
- Traffic signal installations possible with SCOOT type operation for closely located sets of signals. As required these installations would also have feed-back to the Highways England and KCC control centres. Agreement with KCC on the operation of traffic signals would be required
- As part of the installation of traffic signals provision of CCTV systems to give adequate coverage for the operation of all signal controlled junctions

9.1.2 At the Bean Junction the options would result in the need to relocate existing final and confirmatory sign and signal gantries on both the eastbound and westbound carriageways. Departures from standard occur due to the retention of existing gantries for the longitudinal position of gantries outside of required tolerances to TD 46/05 where options result in changes to the existing diverge layout and positions . The existing sign and signal gantries at the Ebbsfleet Junction would be retained, though changes in the direction signing would be required.

9.1.3 At the Bean Junction modifications to the existing junction layout would impact existing local ducting and cabling, traffic count loops, road side cabinets and the existing CCTV mast. Appropriate technology assets at the junction would therefore need to be relocated. During construction of this junction, an interrupter cable would need to be installed to bypass the whole infrastructure around this junction to allow it to proceed unimpeded.

9.1.4 At the Ebbsfleet Junction existing post mounted signals at the entry slips would need to be relocated including any associated road side cabinets. Existing traffic count loops would also be affected.

9.2 Maintenance and Repair Assessment of the Completed Scheme

9.2.1 The scheme design has been prepared in accordance with:

- The Design Manual for Roads and Bridges (DMRB)
- IAN 69/15 Designing for Maintenance
- IAN191/16 Safety Governance for Highways England
- Manual of Contract Documents for Highway Works (MCHW)

9.2.2 For further details refer to the Maintenance and Repair Strategy Statement (MRSS), reference HA543917-HHJV-GEN-PCF-0034.

9.2.3 Engagement with Area 4, KCC has been undertaken through Stage 1 and Stage 2 to support the design stages to ensure the final scheme complies with the Construction (Design and Management) (CDM) Regulations and is designed for maintenance operations.

9.2.4 The Short List Options consist of civil infrastructure and technology works and would require comprehensive monitoring, inspection and maintenance plans to be developed to maintain the service for their expected design life and beyond. There are no specific maintenance operations or access restrictions that are considered will be an issue with respect to any of the options for the completed scheme.

9.2.5 Given the timescales involved with the project, it is likely that the use of remote monitoring of roadside equipment will have become more commonplace by the time the scheme is implemented. Such systems have the potential to reduce the need for roadside working by providing greater fault

diagnosis and fix capabilities to remote operators. Use of these systems should be explored as part of future design phases of the project in order to minimise the need to roadside maintenance visits.

9.2.6 To minimise maintenance access restrictions it may be possible to place technology equipment such as control boxes and electrical equipment provision such that it can be accessed from outside of the highway boundary. To enable this arrangement, one issue that would need to be addressed would be the responsibility for maintenance of the soft estate around cabinet and or gantry access locations. Area maintainers have a remit to undertake grass cutting and control of vegetation on the highway estate, and to allow maintenance.

9.2.7 Access to related infrastructure technology and equipment may require road space booking and permit to work systems for maintenance access, together with night-time working to avoid issues arising from congestion.

9.2.8 The presence of existing similar control measures elsewhere on the A2 means that the local technology maintainers are familiar with this kind of maintenance access arrangement, and as such any maintenance required as part of this project should be relatively straightforward.

A2 Bean Junction

9.2.9 Short List Options to A2 Bean Junction comprises various options with changes to the carriageway layout around the B255 junction. Access to related infrastructure technology and equipment at this location, particularly in and around the new structures will require extensive closures and diversion arrangements, road space booking and permit to work systems for maintenance access, together with night-time working to avoid issues arising from congestion.

9.2.10 New access requirements to the Eastern Quarry along the A296 are anticipated to have little immediate impact on routine or planned maintenance activities, however increased high-load vehicles and routes through the area may impact upon other requirements for maintenance throughout the scheme, particularly in and around access/egress areas.

A2 Ebbsfleet Junction

9.2.11 New access requirements to the Ebbsfleet Green, Station Quarter South Development from this location are anticipated to have little immediate impact on routine or planned maintenance activities, however increased high-load vehicles and routes through the area may impact upon other requirements for maintenance throughout the scheme, particularly in and around access/egress areas.

Stage 3 Activities.

9.2.12 Further Engagement will be required with representatives from Highways England (Major Projects - MP, Operations Directorate - Senior User and RCC, Safety, Engineering and Standards Team), Kent County Council MSPs and NRTS in order to discuss the project concept, the emerging scheme design and implications on future maintenance tasks, and any future risks in relation to the maintenance and operations.

9.2.13 As the scheme is progressed further Highways England and Kent County Council will need to assess whether any equipment is deemed to be safety critical.

9.2.14 Table 25 summarises the description of work to be undertaken during Stage 3 for the safe operation and maintenance for the proposed A2 Bean and Ebbsfleet Junction Improvement option. The MRSS will be updated as the preliminary design of the scheme develops.

Table 25 - Safety Governance Activities to be undertaken during Stage 3

	Stage 3 Governance Activities
1	Consultation with key stakeholders to gather views and information on design, construction, and the long term safety operation and maintenance of the scheme's assets. This will include consultation with relevant operation and maintenance stakeholders (Operations Directorate, Traffic Officers, Area 4, KCC, NRTS, core Emergency Services responders, other projects for lessons learnt)
2	Preliminary Design of all assets including junctions, structures, earthworks, pavement, drainage, vehicle restraint systems, technology, lighting, signing, road markings.
3	Where lighting is currently in place, an assessment of whether it should be retained or removed will be undertaken and is subject to Highway England's endorsement.

	Stage 3 Governance Activities
4	The possibility of accessing any equipment from off network will be considered by the technology and infrastructure design work stream in liaison with the relevant Area 4 and KCC.
5	Diversion route options will be developed for emergency situations.
6	Review of Layout and connectivity arrangements for Non-Motorised Users.
7	Preparation for Statutory Procedures and Powers.
8	Maintenance activities will be identified, which will include specific risks, anticipated tasks and their frequency, the preferred means of safe access and egress to the workplace, the traffic management measures required and a suggested safe method of work.
9	Develop procurement strategy for detailed design, construction, operation and maintenance.
10	A clear demarcation of operations will be required which will need to be included within a detailed local operating agreement (DLOA) to be determined as the scheme develops for the new junction layout
11	For Winter Maintenance activities liaison with Area 4 and KCC is required to determine any additional measures required to be introduced to ensure comprehensive coverage

10 Stage 1 Summary of Environmental Assessment and environmental design

10.1 Noise and Vibration

Comparison of options

10.1.1 For Route Options B03E01b, B04bE01b and B05E01b, at the Stage 1 assessment there were no significant or distinguishable differences in the results of the assessment across the three options.

10.1.2 The noise assessment has been re-assessed at Stage 2, for B05E01b, based on updated traffic modelling (refer to Section 14).

Mitigation

10.1.3 For stage 1 it was not feasible to consider the implementation and detailed design of mitigation measures for all of the route options considered. As such mitigation and enhancement measures associated with the Scheme are not considered within the scope of the Stage 1 assessment.

10.1.4 Following the selection of a proposed Route Option, consideration will be given to mitigation measures including, but not limited too; low noise surfacing and acoustic barriers. Where necessary these measures would be assessed and as appropriate incorporated into the development design phase.

10.2 Air Quality

Comparison of options

10.2.1 For the three options considered at Stage 1 (B03E01b, B04bE01b and B05E01b), no NO2 or PM10 concentrations were predicted to exceed the AQS Objectives at any of the worst-case receptors modelled.

10.2.2 The option which resulted in the greatest number of receptors predicted to experience a deterioration in air quality was B03E01b (13 deteriorating receptors for B03E01b, 8 for B04bE01b and 11 for B05E01b). B05E01b had the largest number of receptors with an improvement in air quality (15 improving receptors for B03E01b, 11 for B04bE01b and 16 for B05E01b).

10.2.3 The air quality assessment has been re-assessed at Stage 2, for B05E01b, based on updated traffic modelling (refer to Section 14).

Mitigation

10.2.4 In terms of construction dust, best practice mitigation measures, would minimise any construction dust effects. These would be included in the Construction Environmental Management Plan (CEMP) prior to construction of the Option that is progressed. A full dust construction impact assessment was not undertaken at Stage 1.

10.2.5 No exceedances have been predicted at Stage 1, and air quality concentrations were generally well below the air quality objective for the opening year of 2025 (refer to EAR Stage 1: Section 7.9). As such, no mitigation measures for the operational phase of the Scheme were proposed at Stage 1.

10.3 Landscape & Visual

Comparison of options

10.3.1 Option B03E01b would incur significant adverse effects on landscape character area Darenth Wood and Bean Woods, significance adverse effect on Bean Village, residents of North Bean and Bean Farm, and significant adverse effects on residents of Hope and Ightham Cottages and Bean House. For these reasons it is the least preferred option from a landscape and townscape perspective.

10.3.2 Option B04bE01b would incur significant adverse effects on landscape character area Darenth Wood and Bean Woods, a significant adverse effect on Bean Village, residents of North Bean and Bean Farm, and significant adverse effects on residents of Hope Cottages and Bean House.

10.3.3 Option B05E01b would incur significant adverse effects on Hope Cottages but overall the scheme impact would be slight adverse.

Mitigation

10.3.4 It has been assumed for Stage 1 that a reasonable level of mitigation would be in place as part of the

Scheme, including the following:

- Developing a sensitively routed and well-designed Scheme in line with DMRB Good Roads Guide to ensure good fit with the scale and character of the landscape and townscape resources.
- Providing embankment planting wherever possible and match adjacent vegetation.
- Replanting of woodland edges.
- Providing screening with vegetation or environmental barriers to help screen the Scheme in local views.

10.4 Cultural Heritage

Comparison of options

10.4.1 There is a loss of ancient woodland at Darenth Wood SSSI with Option B03E01b. Option B03E01b has the most adverse impact due to the permanent effects predicted on the scheduled monument at Darenth Wood. All three options would incur a permanent impact on potentially national significant sites.

Mitigation

10.4.2 It may be possible to mitigate the impacts of the scheme options to the setting of heritage assets through design measures to reduce visual intrusion such as tree planting or the installation of earthwork barriers. Direct physical impacts can also be mitigated through realignment of scheme options resulting in 'preservation in-situ' or through 'preservation by record' (historic building recording or archaeological excavation) prior to construction works commencing. The impacts to Darenth Wood SSSI could be reduced through design to minimise the impact.

10.5 Ecology and Nature Conservation

Comparison of options

10.5.1 Option B03E01b has the most adverse predicted impact incurring a loss of Ancient Woodland which is categorised as an irreplaceable resource. It should be noted that loss of ancient woodland will also occur with Option B04bE01b but it will not be as extensive. All three options will incur the loss of hazel dormouse habitat and potential loss of bat roosts.

Mitigation

10.5.2 All design and construction work would be carried out in accordance with a number of generic mitigation measures and follow best practice guidelines that would prevent damage, or loss to ecological resources. Generic measures would include:

- Adverse impacts on ecological resources would be avoided where possible. Detailed design of the selected option would aim to minimise landtake and habitat loss.
- The road lighting design would aim to minimise light spillage away from the road.
- An Ecological Clerk of Works (ECoW) would be appointed.
- Timing of site clearance works would be programmed to avoid the most sensitive seasons.

10.6 Road Drainage and the Water Environment

Comparison of options

10.6.1 There will be no significant effects to the surface water quality or flood risk attributes of surface waterbodies from any of the Short Listed options.

10.6.2 Potential adverse impacts to groundwater quality could occur due to proposed continued use of a drainage water infiltration ditch which partly lies on a SPZ1 at Bean junction. However, pollution control measures would be added if not already in place. Additional mitigation may be required and future consultation would be used to inform the design of appropriate mitigation measures, which would serve to reduce this level of significance from large adverse to neutral as the design develops. These potential impacts are present for each of the three options B03E01b, B04bE01b and B05E01b.

10.6.3 Mitigation

10.6.4 All design, construction and operation work would be carried out in accordance with a number of generic mitigation measures and follow best practice, guidelines, including DMRB, that would prevent damage, or loss to the water environment and prevent harm to human health. Full details of mitigation proposals are presented in the Stage 1 EAR (section 10.6).

10.6.5 Mitigation would include the following:

- The principal aquifer is an irreplaceable resource. Mitigation would involve addition of pollution controls (if not already in place), reducing discharge volumes and/or other mitigation to be agreed with the Environment Agency at a later Stage once further surveys and assessments have been undertaken.

10.7 Physical Activity

10.7.1 Changes in the number of pedestrians/cyclists/equestrians or their average journey times are anticipated to be insignificant, however this has not been considered in detail at this stage and will be considered in further detail at Stage 3.

10.8 Journey Quality

10.8.1 Overall, journey quality is expected to improve as a result of the Scheme. However this has not been considered in detail at this stage and will be considered in further detail at Stage 3.

10.9 People and Communities

Comparison of options

10.9.1 Option B03E01b would result in demolition of residential properties at Hope Cottages and agricultural land would be required for the Scheme. For Option B04bE01b, buildings and land at the Spirits Rest Horse Sanctuary would be required, there would be agricultural land-take, and a Public Right of Way would be permanently severed. In the case of Option B05E01b, residential properties at Ightham Cottages would be demolished and buildings and land at the Spirit's Rest Horse Sanctuary would be required. Vehicle travellers are anticipated to experience positive effects, overall, in the case of all three Scheme Options. There are expected to be Major Adverse permanent effects resulting from all three options, with Options B03E01b and B05E01b having the lowest option assessment scores - primarily as a result of demolition of residential properties.

Mitigation

10.9.2 Compensation arrangements in accordance with the National Compensation Code.

11 Option Presented at Public Consultation

11.1 Summary of Stage 1 Appraisal

11.1.1 Following the sifting process outlined in Section 6.1 to 6.4, the short-list options were appraised against the following key Client Scheme Requirements (refer to Section 1.1.2):

- Support economic development and housing growth in Kent Thameside
- Minimise the impact of developments on the performance of the A2 mainline
- Achieve a BCR of at least 2.0
- Minimise environmental impact
- Reduce accident rates for all users
- Integrate with the wider strategic objectives of accessibility within Kent Thameside.

11.1.2 The performance of the shortlisted options was appraised against the project objectives (refer to Section 17 of the Technical Appraisal Report (HA543917-HHJV-GEN-PCF-005).

11.1.3 Option B04bE01b was recommended not to be taken forward to public consultation because, while it did not require the acquisition of any residential properties, it had the poorest overall performance against the assessment criteria and would have an impact on the Thrift ancient woodland. It provided very low value for money (with a BCR of less than 1.0). The cost of Bean Option 4b with Ebbsfleet Option 1b was £143m which exceeded the scheme budget.

11.1.4 Option B03E01b was recommended not to be taken forward to public consultation because it would have an impact on Darenth Wood SSSI ancient woodland and did not provide any additional significant benefit compared to Option B05E01b whilst costing an additional £20m. The option also required the acquisition of three properties and impacted on a further three. It provided low value for money (with a BCR of less than 1.7). The cost of Bean Option 3 with Ebbsfleet Option 1b was £145m which exceeded the scheme budget

11.1.5 While it was recognised that Option B05E01b required the demolition of Ightham Cottages and the acquisition of assets at the Spirits Rest Horse Sanctuary, this Option had the best performance against the Scheme Objectives and against the majority of the appraisal factors and hence a recommendation was made, which was accepted, that this Option be taken forward to public consultation.

11.1.6 The consultation materials and the supporting technical reports that were made available at the Public Consultation clearly set out the rationale for having a single option in the consultation.

11.2 Summary of Stage 1 Appraisal

11.2.1 The results of the Stage 1 appraisal for the identified Short List Options at Bean (each in combination with the single option at Ebbsfleet) against the specific Scheme Objectives and the various appraisal factors are as set out in Table 26 below.

Table 26 - Summary of Stage 1 Option Appraisal

	Option 3	Option 4b	Option 5
Description	Replaces the existing double roundabout layout with a single large traffic signal controlled gyratory with two structures crossing the A2, the existing Bean Road Overbridge and a new bridge crossing located to the west.	Provides a redesigned dumbbell arrangement comprising two new roundabouts located either side of the A2. A new bridge crossing of the A2 is provided on the new link road and the existing Bean Road Overbridge is demolished.	Retains the existing junction layout but with the existing roundabouts enlarged and converted to full traffic signal control. A new bridge over the A2 for southbound traffic is provided to the east of the existing Bean Road Overbridge, retained for northbound traffic.
Performance Against Scheme Objectives			
Support Economic Development	Provides additional capacity at junctions		
Reduction in average delay per vehicle over a 12 hour period by 2041	0.1 minutes	0.075 minutes	0.125 minutes
Minimise the impact on the A2 mainline Congestion by 2041	Little difference in terms of journey times along the A2 and no blocking back onto the A2 mainline from the junctions		
BCR Excluding Wider Economic Benefits	1.4	0.6	1.7
BCR Including Wider Economic Benefits	1.7	0.8	2.1
Minimise Environmental Impact	(see below for specific appraisal factors)		
Safety Reduction in KSI accidents over 60 year period	25.1	5.2	11.5
Integration within Kent Thameside	Improved integration and accessibility		
Performance Against Specific Appraisal Factors			
Construction Impact	Medium	Medium	Medium
Maintenance assessment	Similar impact	Similar impact	Similar impact
Noise impact	Slightly beneficial	Slightly beneficial	Slightly beneficial
Air Quality impact	Unlikely to lead to a significant impact		
Greenhouse gases	Positive impact	Positive impact	Positive impact
Landscape impact	Moderate adverse	Moderate adverse	Slight adverse
Townscape impact	Moderate adverse	Moderate adverse	Slight adverse
Historic environment	Large adverse	Moderate adverse	Slight adverse

Biodiversity	Large adverse	Moderate adverse	Slight to moderate adverse
Water environment	Moderate adverse	Moderate adverse	Moderate adverse
Wider Economic Benefits	£22m	£12.4	£22m
Journey time savings	£123.2m	£75.5m	£129.7m
Physical activity	Neutral	Slight adverse	Neutral
Journey quality	Moderate beneficial	Moderate beneficial	Moderate beneficial
Land take – community	Negligible Adverse	Moderate Adverse	Negligible Adverse
Land take – private assets	Major Adverse [1]	Moderate Adverse [2]	Major Adverse [3]
Land take – development land	Negligible Adverse	Negligible Adverse	Negligible Adverse
Land take – agricultural land	Minor Adverse	Minor Adverse	Negligible Adverse
Scheme Cost (Most likely estimate)	£145m	£143m	£125m

12 Summary of Non-Statutory Public Consultation

12.1 Overview of Public Consultation

12.1.1 The A2 Bean and Ebbsfleet Junction Improvements Public Consultation ran for six weeks between 18th January 2017 and 1st March 2017. The consultation involved public exhibitions and presentations around Dartford and Gravesend, a website with information about the project, and information was delivered to homes in the area**.**

12.1.2 Members of the public and organisations were invited to comment on a variety of aspects of the project, with documentation and questions covering the junction improvements at Bean, the junction improvements at Ebbsfleet, and the scheme overall (see Appendix A for the consultation questionnaire and Leaflet).

12.1.3 Participants could submit their responses and queries in the following ways:

- Online – through an online questionnaire
- By email – via the scheme email address: A2BeanandEbbsfleetJunctionsImprovements@highwaysengland.co.uk
- Freepost – by sending letters or the paper questionnaire to the scheme Freepost address: Freepost A2 Bean & Ebbsfleet junction improvements
- Telephone – by calling the Highways England 24 hour Customer Contact (CCC) number 0300 123 5000

12.1.4 All responses to the consultation were processed and assigned a unique reference number and response type, and recorded in a bespoke public consultation database.

12.1.5 To analyse the responses, a coding framework was developed. The coding process enabled all responses to be indexed according to the issues raised by respondents, and enabled a detailed summary of the content by means of the Public Consultation Report (HA543917-HHJV-GEN-PCF-0033)**.**

12.2 Consultation Publicity

12.2.1 The consultation was publicised in the following ways:

- Online: Through a dedicated page on the Highways England website (http://roads.highways.gov.uk/projects/a2-bean-and-ebbsfleet-junction-improvements)
- Letter drop: Letters were distributed to 74,219 households in the area surrounding the scheme.
- Poster distribution: A poster campaign at Bluewater Shopping Centre was visible throughout the consultation, and further posters were distributed around Dartford and Northfleet stations towards the end of the consultation period.
- Brochure collection points: Consultation brochures and questionnaires were available at several community venues in the local area.
- Stakeholder promotional activity: Several organisations promoted the consultation across their websites and social media platforms. These organisations included Ebbsfleet Development Corporation, Swanscombe and Greenhithe Town Council, Dartford and Gravesham Borough Councils, Kent County Council, and Bean Residents Association.
- Media events: Highways England representatives were interviewed about the scheme and the consultation process by BBC Radio Kent and ITV Meridian. The consultation was also covered by the Gravesend Messenger (local newspaper).

12.2.2 Five Public Information Events (PIEs) were held during the course of the consultation period. Two events were held in January at Bean Youth and Community Centre, High Street, Bean, DA2 8AS. Three further events were held across January and February at Eastgate, 141 Springhead Pkwy, Gravesend, DA11 8AD. A stakeholder event for MPs, MEPs and local government members was held in advance of the first public event from 14.30pm on Wednesday 18th January. 9 local

councillors attended. These events were exhibition-style, allowing people to drop in at any time and view the information and ask questions of project team representatives. As well as exhibition boards giving information about the scheme, a video visualisation was played at the consultation events.

12.2.3 The visualisation was also available on the scheme website. There was a total of 274 visitors across the five events.

12.3 Stakeholder meetings

12.3.1 Throughout the consultation period, meetings were held with various stakeholders to provide information about the scheme and to respond to their questions. Meetings were held with Bean Residents Association, Bluewater Retail Partnership, Bluewater Community Forum, Swanscombe and Greenhithe Town Council, and affected landowners.

12.4 Consultation responses

12.4.1 A total of 169 responses to the consultation were received. For an analysis of the consultation responses refer to Table 27.

Table 27 – Analysis of Consultation responses

Response Type	Count
Online questionnaire	84
Paper questionnaire	47
Email or letter	36
Phone (Highways England Customer Care number)	2
Total	169

12.5 Summary of responses

Key issues of concern

12.5.1 In response to the closed question aimed at determining the issues of concern to the public (Question 1), four issues had the highest number of responses. These were:

- Turning onto/off the A2 at Bean
- Journey times around Bean junction
- Road safety at both junctions
- Air quality at both junctions

Response to the overall scheme

12.5.2 In response to the open question on the overall scheme (Question 10), there were a number of recurring concerns from members of the public, namely:

- The need to design for the future and the significant development taking place and planned for the area
- The importance of implementing the scheme as soon as possible
- Traffic forecasting and the peak hours used
- The exclusion of Swanscombe Theme Park from the assessment
- The proposal to install traffic signals at the roundabouts
- The provision for non-motorised users
- The impact on the local community during construction, particularly with regard to noise and air quality

12.5.3 Many of the stakeholders who responded to the consultation agreed that there is a clear need for the improvements. They also noted similar concerns to members of the public, namely the exclusion of Swanscombe Theme Park from the assessment; the traffic forecasting and the peak hours used; and

the provision for non-motorised users.

Response to the public consultation process

12.5.4 In general, respondents commented that they had found the consultation materials and the consultation events helpful in answering/addressing questions.

12.5.5 The greatest concern expressed was the fact that the consultation only included a single option at each junction and hence there was a view that a decision had already been made.

Response to the proposals at Bean Junction

12.5.6 Of the 129 respondents to the question about the extent to which they were in agreement with the proposals at Bean (Question 4a), 66 noted that they either strongly agreed or agreed with the proposals, while 44 either strongly disagreed or disagreed with the proposals. While the majority of respondents recognised the need for the scheme, some also raised concerns that the lowest cost solution is being promoted at the exclusion of more suitable options. Other areas of concerns were as follows:

- The loss of Ightham Cottages and the Spirits Rest Horse Sanctuary
- The proposed traffic signals, from the perspective of both traffic flow and air quality
- The peak periods included in the traffic model, given the local situation presented by Bluewater
- The exclusion of the Swanscombe Theme Park from the assessment
- The removal of the slip road from the B255 to the A296
- The need for clear signage at the junctions
- Noise and air quality

12.5.7 There was general consensus between members of the general public and stakeholders. Many stakeholders recognised the need for improvement at the junction, but some raised concerns that Option 5 is not a complete solution. Other recurring themes in responses from stakeholders were similar to those raised by stakeholders, namely, concern over the loss of Ightham Cottages and the Spirits Rest Horse Sanctuary; the use of traffic signals; and the removal of the link from the B255 to the A296.

12.5.8 A number of alternatives were put forward by the public as follows:

- Free flow junctions instead of using traffic signals on the roundabouts
- Retaining the link from the B255 to the A296 and then to the A2 eastbound
- Separating local traffic from Bluewater and A2 traffic
- Demolishing the existing bridge over the A2 and building a new bridge that would allow for widening of the A2

12.5.9 Two of the stakeholders proposed the following alternatives:

- A more free-flowing design with a reduced number of traffic signals
- A scheme adopting some elements of Option 3 into Option 5, particularly the slip roads south of the A2 in Option 3 as they are straighter and therefore reduce the need for vehicles to slow down as much as they do currently. They say this would also prevent large vehicles from overrunning the centre line as they follow the sharp radius of the on slip that is retained for Option 5.

12.5.10 It was requested by local residents whether the proposed northern roundabout could be moved further westwards to avoid the demolition of Ightham Cottages.

Responses to the proposals at Ebbsfleet junction

12.5.11 Of the 127 respondents to the question on to what extent they were in agreement with the proposals at Ebbsfleet (Question 7a), 63 noted that they either strongly agreed or agreed with the proposals, while 27 either strongly disagreed or disagreed with the proposals. However, there was less certainty (in comparison to the responses for Bean junction) among respondents that this junction needs any improvement. Recurring themes raised included:

- Concern over the proposed introduction of the traffic signals
- Concern over the lack of access to Swanscombe Theme Park
- Concern over the provision for non-motorised users
- Concern over the suitability of existing signage
- A preference for local roads that are not impacted by A2 traffic
- Reconsideration of access to existing roads such as Park Road
- Concerns over air quality.

12.5.12 There was general consensus between members of the general public and stakeholders regarding the Ebbsfleet Junction proposals, although on balance stakeholders accept the need to improve the junction more readily than members of the public. Recurring themes were similar to those raised by the public, including reconsideration of access to existing roads such as Park Road, and concern over the lack of consideration of Swanscombe Theme Park. Some stakeholders encouraged Highways England to come to an understanding with the developer for Swanscombe Theme Park as soon as possible due the volume of extra traffic that would be expected if it proceeds.

12.5.13 Alternatives proposed by the public to the Ebbsfleet Junction proposals were as follows:

- Use of free-flow junctions instead of traffic signals
- Combine the two roundabouts into one
- Encourage free or cheap parking at local stations to encourage public transport use

12.5.14 No alternatives were put forward by stakeholders other than consideration for a more free-flowing junction by one stakeholder.

13 Stage 2 Buildability Review (Option B05E01b)

13.1.1 During Stage 1, a buildability review and report was produced in November 2015 for current Long List options. The report highlighted the implications of widening the existing Bean Bridge and lead to the development of Bean Option 5 to overcome the traffic issues. During Stage 2, contractor support was obtained to undertake an additional review of the buildability of Bean Option 5 and to produce a high level construction programme.

Buildability Review

13.1.2 A buildability review and report was completed in May 2017 for Bean Option 5 combined with Ebbsfleet Option 1 junction improvements. The scope of the Buildability Report was as follows and assumes that Bean and Ebbsfleet junction improvements would be constructed under the same contract:

- Identify key constraints and any buildability or phasing issues
- Identify key impacts on statutory undertakers' equipment, any protection measures required and key utility diversions required
- List any advance works required and early/timely surveys
- List the number of carriageway closures for example for the construction of the new southbound overbridge at Bean Junction
- Identify any areas of land required for construction, including identification of areas for construction compounds and soil storage
- Identify any opportunities such as reduction in construction period. For example, whether it would be better to construct the junctions consecutively
- Outline the effect on the public of the proposed phasing including residents and NMUs
- Prepare and update outline construction programmes
- Traffic Management (TM) planning for outline construction programmes including consideration of TM and phasing strategy

Summary of Contractor's Buildability Report

13.1.3 Constructing Bean Option 5 at the same time as Ebbsfleet Option 1 will give savings in terms of general overheads to the project by using shared resources. The practical management of the two junction improvements carried out together will require careful planning of road closures and lane restrictions to ensure any delays to the traveling public are minimised. Since both junctions are in close proximity to each other, during temporary traffic management each junction becomes the diversion route if the other junction requires off peak closures.

13.1.4 The general principle of the programme is to build the new overbridge during the first year while removing any constraints for the construction of the new enlarged roundabouts in the second year. Construction constraints are the required service diversions and any environmental constraints which cannot be removed before construction starts. If a March start is planned, and dormice are present, then the winter period before construction starts will be required for additional ecological survey works to enable relocation during the optimum spring period.

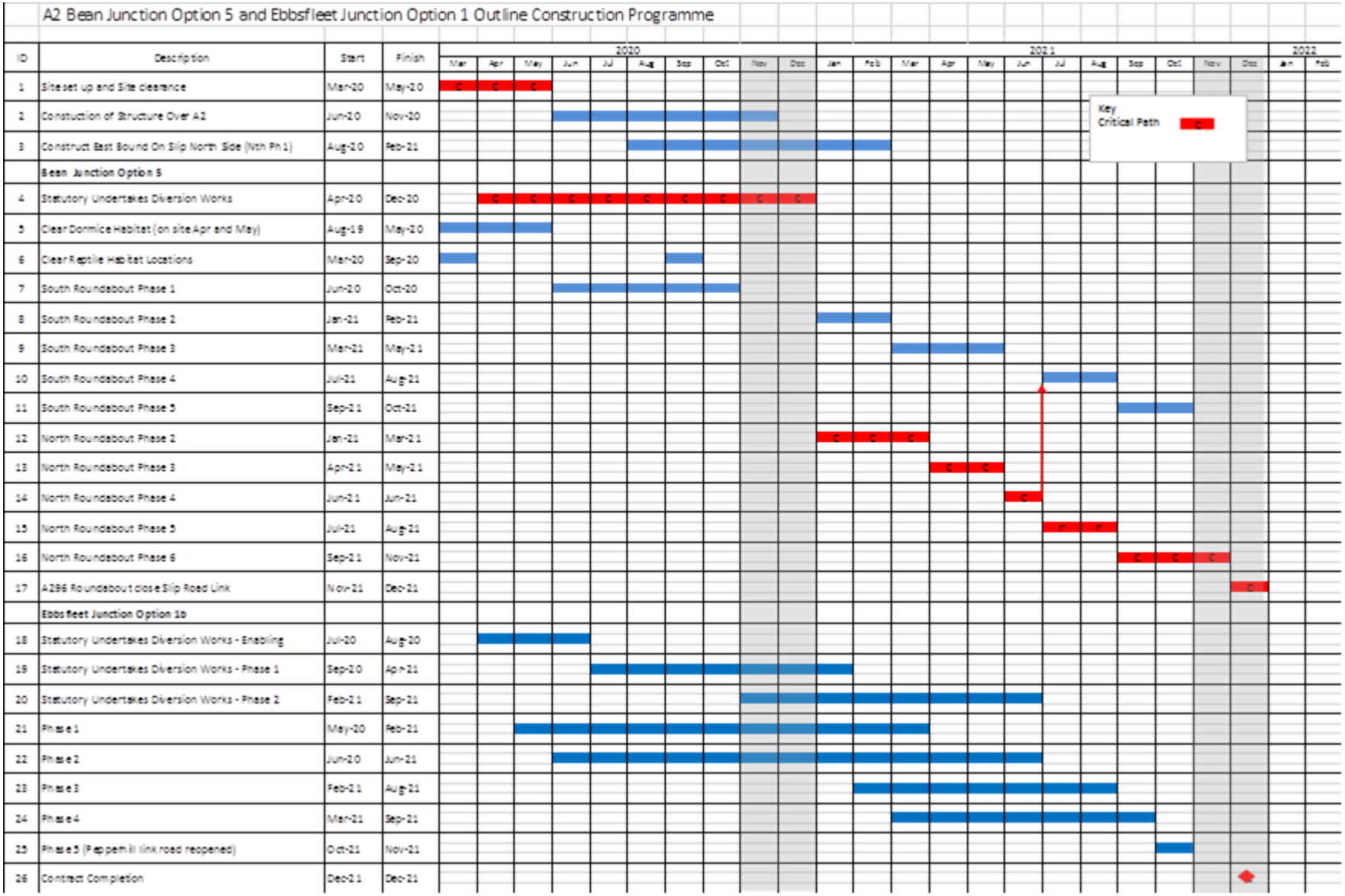
13.1.5 Through liaison with Bluewater Retail Group, it has been suggested that an approximate 2 month embargo period is required around Bean Junction, from the end of the first week of November to the end of the first week in January for the increased traffic expected over the Christmas period.

13.1.6 The outline construction programme splits into two phases separated by the 2 month embargo and provides a total duration of approximately 22 months. The overall programme makes full use of two summer seasons and is only constrained by one November - January embargo. During the embargo period the contractor will construct offline works and recommends that traffic management could be in use with no reduction in lane availability. Construction work has recently been undertaken in a similar environment close to Lakeside and the Trafford Centre. Refer to Figure 18 for the outline construction programme.

Figure 18 - Bean Option 5 combined with Ebbsfleet Option 1 Junction improvements Outline Construction Programme

A2 Bean Junction Option 5 and Ebbsfleet Junction Option 1 Outline Construction Programme

ID	Description	Start	Finish
1	Site set up and Site clearance	Mar-20	May-20
2	Constuction of Structure Over A2	Jun-20	Nov-20
3	Construct East Bound On Slip North Side (Nth Ph1)	Aug-20	Feb-21
	Bean Junction Option 5		
4	Statutory Undertakes Diversion Works	Apr-20	Dec-20
5	Clear Dormice Habitat (on site Apr and May)	Aug-19	May-20
6	Clear Reptile Habitat Locations	Mar-20	Sep-20
7	South Roundabout Phase 1	Jun-20	Oct-20
8	South Roundabout Phase 2	Jan-21	Feb-21
9	South Roundabout Phase 3	Mar-21	May-21
10	South Roundabout Phase 4	Jul-21	Aug-21
11	South Roundabout Phase 5	Sep-21	Oct-21
12	North Roundabout Phase 2	Jan-21	Mar-21
13	North Roundabout Phase 3	Apr-21	May-21
14	North Roundabout Phase 4	Jun-21	Jun-21
15	North Roundabout Phase 5	Jul-21	Aug-21
16	North Roundabout Phase 6	Sep-21	Nov-21
17	A296 Roundabout close Slip Road Link	Nov-21	Dec-21
	Ebbsfleet Junction Option 1b		
18	Statutory Undertakes Diversion Works - Enabling	Jul-20	Aug-20
19	Statutory Undertakes Diversion Works - Phase 1	Sep-20	Apr-21
20	Statutory Undertakes Diversion Works - Phase 2	Feb-21	Sep-21
21	Phase 1	May-20	Feb-21
22	Phase 2	Jun-20	Jun-21
23	Phase 3	Feb-21	Aug-21
24	Phase 4	Mar-21	Sep-21
25	Phase 5 (Peppermill link road reopened)	Oct-21	Nov-21
26	Contract Completion	Dec-21	Dec-21



13.1.7 The contractor has carried out a buildability review of the current outline design and has provided a recommendation for the use of retaining walls on the northern side of the new eastbound onslip onto the A2 at Bean Junction, to minimise the construction movements and associated works required for earthworks. The two retaining methods that could be utilised are standard sheet piles or a concrete piled wall with a pre-cast facing (both previously used on the M25).

13.1.8 During the preliminary and detailed design phase, designing the scheme to reduce service diversions is key to keeping the construction programme under two years. Any service diversions which are required should be diverted away from the scheme if possible so they can be completed during the first year while the new bridge is under construction.

13.1.9 The review has assumed the existing central pylon at the existing northern roundabout at Bean Junctions will remain, and that if additional height clearance is required, the existing cables could be lifted by removing some of the existing spacers on the drop cables or by jacking up the pylon.

13.1.10 To remove any programme constraints due to the existing high pressure gas main diversion running through the works at Ebbsfleet Junction, the buildability review recommends diverting the 12" gas main to the west of the site along the route of the existing water mains and to connect to the existing 36" gas main on the B296. This would remove the constraint during construction of working around the gas main and installing the difficult cross carriageway ducts while maintaining traffic flows.

13.1.11 As there are currently no confirmed modifications planned for the central reservation of the existing A2, three narrow lanes should be maintained in each direction. In addition, as this section of the A2 has a tidal traffic flow, off peak working in an eastbound direction in the morning followed by off peak on the westbound carriageway in the evening should be acceptable and has successfully been used previously. It is assumed that the minimum speed limit through the temporary traffic management on the A2 is to be 50mph.

13.1.12 All existing NMU routes and access to properties and businesses should be retained during the construction period.

13.1.13 Table 28 provides a summary of the number of road closures required on the A2 and local authority maintained roads.

Table 28 - Summary of Temporary Road Closures during the construction Period.

	A2	Slip Road under new bridge	Local Authority Roads
Full overnight closures	6 nights (2+2+2)	3 nights (1+1+1)	2 nights each for tie in works

13.2 Project Delivery Programme

13.2.1 The buildability review for Bean Option 5 combined with Ebbsfleet Option 1, provided confirmation that the construction period could be completed within the current overall delivery programme. Key deliverable dates are summarised in Table 29.

Table 29 - Summary of Key Project Deliverable Dates (at 1/05/2017)

Key activity:	Date
SGAR 2	July 2017
Public Consultation on Options	Jan-Mar 2017
Preferred scheme announcement (end of Options phase)	Aug 2017
Statutory Public Consultation	Oct 2017 – Feb 2018
SGAR 3	April 2018
DCO Application	July 2018
Commence detailed design	July 2018

SofS Decision on DCO	Autumn 2019
Start of construction	FY 2019/20
Open to Traffic	FY 2022/23

13.3 Stage 2 Options Estimate

13.3.1 A PCF Stage 2 'Refined' estimate was prepared by the Highways England Commercial Team in May 2017. This estimate is a refresh of the last approved PCF Stage 1 estimate produced in June 2016. Refer to Table 30 for a comparison of the Stage 1 and Stage 2 Option Estimates. Key updated information updated in the Stage 2 estimate includes:

- Updated Risk Register
- A re-base from the estimate produced last year with a revised base year changed from January 2014 to January 2016
- C3 estimates received from the Statutory Undertakers
- Revised land costs received from the District Valuer
- Includes Stage 2 scheme development work such as assumptions on environmental mitigation measures including landscaping works and lengths of noise barriers

Table 30 – Stage 1 / Stage 2 Option Estimates

	Ebbsfleet Option 1		
	Bean Option 3	Bean Option 4	Bean Option 5
Stage 1 Cost**	£145m	£143m	£124m
Stage 2 Cost**	**£143.6m**	**£141.4m**	**£127.6m**

** The costs provided are the 'most likely estimates' without Portfolio Risk Adjustment.

13.3.2 The Stage 2 estimate for Bean Options 3 and 4 (with Ebbsfleet Option 1) is a little lower than the Stage 1 estimate on account of the re-basing of the costs to 2016. For Bean Option 5, with Ebbsfeet Option 1, there has been a similar reduction due to the re-basing of costs but this has been offset by an increase in the expected costs of works to statutory utility provider's apparatus. For the Stage 1 estimate, utility costs were calculated by the Highways England Commercial Team. In Stage 2, the C3 estimates received from the Statutory Undertakers were in excess of the values used for the Stage 1 estimate. The costs for the relocation and protection statutory works required for Option 5 are higher compared to Bean Options 3 and 4.

14 Stage 2 Summary of Environmental Assessment and environmental design

14.1 Summary of Environmental Assessment and environmental design

14.1.1 For the full assessment of the short-listed options (B03E01b, B04E01b and B05E01b), refer to the Stage 1 EAR. Table 12-1 of the Stage 1 EAR provides the overall summary table and option scores for each topic.

14.1.2 The relevant Stage 2 EAR information for the Proposed Scheme (B05E01b) is summarised below.

14.1.3 Further detailed assessment work will be undertaken in Stage 3, together with further detailed scheme specific mitigation, required to minimise the impact on the environment.

14.2 Noise and Vibration

14.2.1 In the short term 4 receptors are predicted to suffer from an adverse increase in Road Traffic Noise of more than 1dB, this is classed as Minor Adverse. The dwellings are spread across the study area, with the majority being located in southern Bean. There are 6 receptors predicted to benefit from a decrease in Road Traffic Noise in excess of 1dB, this is classed as a Minor Beneficial.

14.2.2 In the long term 3 receptors are predicted to suffer from an adverse increase in Road Traffic Noise of more than 3dB, this is classed as Minor Adverse. There are 28 receptors predicted to benefit from a decrease in Road Traffic Noise in excess of 3dB, this is classed as a Minor Beneficial.

Mitigation

14.2.3 It is assumed that all new roads and all roads in the future year with speeds above 75kph will be surfaced with low noise surfacing therefore minimising the tyre noise.

14.2.4 It may also be prudent to implement noise barriers within later stages of the design in order to protect certain groups of receptors. However, this will be concluded in later stages of the assessment process.

14.3 Air Quality

14.3.1 Operational air quality impacts have been predicted at worst-case receptors using the DMRB air quality model. No exceedances of NO_2 or PM_{10} AQS objectives are predicted at worst-case receptors in the opening year Do-Minimum and Do-Something scenario. Additionally, there are no receptors in exceedance which increase in concentration as a result of the Proposed Scheme. All 'with Scheme' concentrations at receptors are well below the annual mean AQS objectives for NO_2 and PM_{10}. 11 receptors would have an increase or no change in pollutant concentrations with the Proposed Scheme, and 9 receptors would have a decrease with the Proposed Scheme, this includes R5 which would be removed with the Proposed Scheme in place. The Proposed Scheme is therefore not likely to lead to a significant impact on local air quality.

14.3.2 The Proposed Scheme is also not expected to impact on compliance with the EU Directive, as NO_2 concentrations from the Defra PCM model are expected to be well below the EU limit value across the study area, in the Proposed Scheme opening year. Therefore, in line with the NN NPS, air quality would not require substantive weight to be attached in relation to whether the Proposed Scheme would receive consent.

Mitigation

14.3.3 Operational Phase: At this stage mitigation is unlikely as no significant impacts are predicted. The assessment would be further refined at future stages to incorporate updated traffic data.

14.4 Landscape & Visual

14.4.1 The Proposed Scheme (B05E01) would incur potentially significant adverse effects on Hope Cottages but overall the Scheme impact would be slight adverse.

Mitigation

14.4.2 Full mitigation measures for the scheme are detailed within the EAR. Proposed mitigation includes the following for Bean Junction:

- Providing screening with environmental barriers in front of Hope Cottages
- Providing planting for screening on all centres of roundabouts at Bean Junction
- Keeping sightlines west of Bean Lane North to a minimum to increase area for vegetation screening
- Keeping footprint of embankments on the north-western side of the bridge to a minimum

14.5 Cultural Heritage

14.5.1 B05E01 would result in potentially nationally significant sites permanently affected. These sites relate to the Roman settlement at Springfield and include a burial ground and a landing stage and other settlement activity such as a temple, kiln, courtyard and well. The effects could be mitigated by excavation and reduced over time with planting or fencing.

Mitigation

14.5.2 Full mitigation measures for the scheme are details within the EAR. Mitigation proposed includes:

- It may be possible to mitigate the impact on SM1 (Medieval woodland boundary in Darenth Wood) through the construction of a revetment wall.
- Impacts on the listed buildings could be mitigated by screening views to and from the listed buildings with fencing or planting. Fencing or planting could also be used to mitigate impacts on the other scheduled monuments within the study area.
- Impacts on buried archaeological remains could be mitigated through archaeological recording either by archaeological excavation prior to construction or archaeological watching brief during construction.

14.6 Ecology and Nature Conservation

14.6.1 Loss of small area of high value hazel dormouse habitat. Localised loss or disturbance to other receptors, including possible loss of bat roosts. Overall there is a slight adverse impact.

Mitigation

14.6.2 Full mitigation measures for the scheme are details within the EAR. Mitigation proposed includes:

- Adverse impacts on ecological resources would be avoided where possible. Detailed design would aim to minimise landtake and habitat loss. This could include minor design amendments to avoid damage or loss to a valuable ecological feature and locating access tracks/haul roads and site compound/material storage areas outside of ecologically sensitive habitats.
- The road lighting design would aim to minimise light spillage away from the road.
- Hazel dormouse mitigation to include EPSL licence, habitat manipulation and/or a translocation of individuals and compensatory habitat planting and landscape planting reinstated.
- Bats, if found, would require mitigation and could include construction of artificial roosts.

14.7 Road Drainage and the Water Environment

14.7.1 There will be no significant effects to the surface water quality or flood risk attributes of surface waterbodies as a result of the proposal. Effects are considered to range from neutral to moderately beneficial.

14.7.2 Potential adverse impacts to groundwater quality could occur due to proposed continued use of a drainage water infiltration ditch which partly lies on a SPZ1 at Bean junction. However, pollution control measures would be added if not already in place. Additional mitigation may be required and future consultation would be used to inform the design of appropriate mitigation measures.

Mitigation

14.7.3 All design, construction and operation work would be carried out in accordance with a number of generic mitigation measures and follow best practice, guidelines, including DMRB, that would prevent damage, or loss to the water environment and prevent harm to human health. Full details of mitigation proposals are presented in the Stage 2 EAR (section 10.6).

14.7.4 Mitigation would include:

- The principal aquifer is an irreplaceable resource. Mitigation would involve addition of pollution controls (if not already in place), reducing discharge volumes and/or other mitigation to be agreed with the Environment Agency at Stage 3 once further surveys and assessments have been undertaken.
- When considering road runoff, discharges from roads must not lead to deterioration in the Water Framework Directive classification status of the receiving surface or groundwater as determined in the relevant River Basin Management Plan (Ref 10-7). A quantitative appraisal of Spillage Risk will be carried out during Stage 3 using the Water Risk Assessment Tool ("HAWRAT"). This assessment will be undertaken for all new outfalls and any existing outfalls that are affected by the Proposed Scheme.
- The drainage design will be such that operation of the drainage system will result in minimum adverse impacts to the receiving water environment, whether through pollution, development of sink holes or increased flood risk. This will be achieved by the design including for the provision of attenuation and treatment/spillage control devices.

14.8 Physical Activity

14.8.1 Changes in the number of pedestrians/cyclists/equestrians or their average journey times are anticipated to be insignificant, however this has not been considered in detail at this stage and will be considered in further detail at Stage 3.

14.9 Journey Quality

14.9.1 Overall, journey quality is expected to improve as a result of the Scheme. However, this has not been considered in detail at this stage and will be considered in further detail at Stage 3.

14.10 People and Communities

14.10.1 With the demolition of 1-11 Ightham cottages, the right to compensation and methods and / or procedures for assessing appropriate levels of such, would be identified in relation to the National Compensation Code.

14.10.2 Local residents and businesses in close proximity to the Proposed Scheme may experience changes in amenity from changes in air quality, visual amenity and noise and vibration.

14.10.3 The design of the project inherently addresses the need to reduce driver stress and frustration associated with congestion and poor journey time reliability. The Proposed Scheme would be designed to current standards in order to contribute to an enhanced road user experience.

14.10.4 In the case of the Proposed Scheme, residential properties at Ightham Cottages would be demolished and buildings and land at the Spirit's Rest Horse Sanctuary would be required. Road users are anticipated to experience positive effects, overall when taking into account drivers stress. There are expected to be Major Adverse permanent effects resulting from B05E01, primarily as a result of demolition of residential properties.

15 Stage 2 Summary of Traffic & Economic Assessment

15.1 Summary of Stage 2 Traffic and Economic Assessment

15.1.1 For the Stage 2 traffic and economic appraisal, the Stage 1 highway assignment model and variable demand models were updated in order to provide a higher level of analytical assurance for the Stage 2 appraisals. The changes involved:

- rebasing the model to 2014 using 2014 TRADS count data as well as the observed data collected in 2014
- recalibrating the variable demand model to a 2014 base year.

15.1.2 Apart from the extraction of relevant TRADS data for the rebasing of the assignment model, no more traffic data was collected for developing the Stage 2 highways assignment model.

15.1.3 The Stage 2 Local Model Validation Report (HHJV Doc. Ref. 008-UA007244-UT22R-02) documents the development of the Stage 2 assignment and variable demand models.

15.1.4 In addition to updating the traffic models, the Uncertainty Log was updated to account for the latest information available on proposed land use developments and road network capacity changes elsewhere on the motorway and local road network. The Stage 2 A2BE Stakeholder Uncertainty Log Consultation can be referred to in 0058-UA007244-UT22TN-02 Stage 2 A2BE Uncertainty Log.

15.1.5 A summary of the planned development classified as “near certain” or “more than likely” is summarised at a Local Authority level and included in the Core Scenario is provided in Table 31 .In view of the continuing uncertainty regarding Paramount Park, this development was still excluded in the Stage 2 forecasting.

Table 31 - Core Scenario Future Development

Borough	Dwellings	GFA (m2)
Dartford	15,949	829,877
Gravesham	4,086	237,430
Total	20,035	1,067,307

15.1.6 The following sections describe the impact of those changes in terms of the Stage 2 traffic forecasts and the economic and junction operational assessments.

15.2 Updated Traffic Forecasts

15.2.1 Stage 2 traffic forecasts were prepared based on NTEM v6.2 and the NationalTransport Model (for freight) for the following modelled years:

- 2023 – A2BE Year of Opening;
- 2025 – LTC Year of Opening, a major step change in supply;
- 2032 – A2BE Interim year; and
- 2038 – A2BE Design Year.

15.2.2 As for Stage 1, forecast assignments were run for the following three time periods:

- Morning Peak Hour (08:00-09:00).
- An average Inter-Peak Hour (10:00-16:00).
- Evening Peak Hour (17:00-18:00).

15.2.3 Modelling local and national uncertainties was undertaken during Stage 2 by modelling an envelope of pessimistic/low growth, core/central growth and optimistic/high growth, as follows: -

- The **Core Scenario** includes local developments that are categorised as near certain and

more than likely and central national growth based on NTEM.

- The **Optimistic/High** growth scenario additionally includes developments that are categorised as reasonably foreseeable and high national growth based on NTEM.
- The **Pessimistic/Low** scenario includes only those developments that are categorised as near certain and low national growth based on NTEM
- The **national uncertainty** in traffic modelling, including Low and High Growths, was forecast by producing a range about the core forecast of ±2.5% for forecasts one year ahead, rising with the square root of the number of years to ±15% for forecasts 36 years ahead as laid out in WebTAG.

15.2.4 The post VDM highway demand for the morning, inter-peak and evening peak for the strategic model and the cordon model for modelled years 2023, 2025, 2032 & 2038 are shown in Table 32 to Table 43 for the Without Scheme Core Scenario (Central Growth).

Table 32 - Core Scenario (Central Growth) 2023 &2025 Without Scheme Post VDM Demand: Morning Peak

User Class	2014	2023	% Change from 2014	Annual Growth Rate	2025	% Change from 2014	Annual Growth Rate
Car/LGV	1,440,081	1,626,398	12.9%	1.4%	1,648,484	14.5%	1.3%
HGV	141,206	175,349	24.2%	2.7%	182,816	29.5%	2.7%
Total	1,581,287	1,801,747	13.9%	1.5%	1,831,300	15.8%	1.4%

Table 33 - Core Scenario (Central Growth) 2023 & 2025 Without Scheme Post VDM Demand: Inter Peak

User Class	2014	2023	% Change from 2014	Annual Growth Rate	2025	% Change from 2014	Annual Growth Rate
Car/LGV	1,136,421	1,309,790	15.3%	1.7%	1,332,864	17.3%	1.6%
HGV	142,990	177,559	24.2%	2.7%	185,120	29.5%	2.7%
Total	1,279,411	1,487,349	16.3%	1.8%	1,517,984	18.6%	1.7%

Table 34 - Core Scenario (Central Growth) 2023 & 2025 Without Scheme Post VDM Demand: Evening Peak

User Class	2014	2023	% Change from 2014	Annual Growth Rate	2025	% Change from 2014	Annual Growth Rate
Car/LGV	1,449,072	1,638,430	13.1%	1.5%	1,660,960	14.6%	1.3%
HGV	144,900	179,977	24.2%	2.7%	187,641	29.5%	2.7%
Total	1,593,972	1,818,407	14.1%	1.6%	1,848,600	16.0%	1.5%

Table 35 - Core Scenario (Central Growth) 2032 &2038 Without Scheme Post VDM Demand: Morning Peak

User Class	2014	2032	% Change from 2014	Annual Growth Rate	2038	% Change from 2014	Annual Growth Rate
Car/LGV	1,440,081	1,357,313	-5.7%	-0.3%	1,422,037	-1.3%	-0.1%
HGV	141,206	211,245	49.6%	2.8%	233,222	65.2%	2.7%
Total	1,581,287	1,568,558	-0.8%	0.0%	1,655,260	4.7%	0.2%

Table 36 - Core Scenario (Central Growth) 2032 & 2038 Without Scheme Post VDM Demand: Inter Peak

User Class	2014	2032	% Change from 2014	Annual Growth Rate	2038	% Change from 2014	Annual Growth Rate
Car/LGV	1,136,421	1,416,421	24.6%	1.4%	1,474,818	29.8%	1.2%
HGV	142,990	211,245	47.7%	2.7%	233,222	63.1%	2.6%
Total	1,279,411	1,627,666	27.2%	1.5%	1,708,040	33.5%	1.4%

Table 37 - Core Scenario (Central Growth) 2032 & 2038 Without Scheme Post VDM Demand: Evening Peak

User Class	2014	2032	% Change from 2014	Annual Growth Rate	2038	% Change from 2014	Annual Growth Rate
Car/LGV	1,440,081	1,740,015	20.8%	1.2%	1,796,092	24.7%	1.0%
HGV	141,206	214,122	51.6%	2.9%	236,398	67.4%	2.8%
Total	1,581,287	1,954,137	23.6%	1.3%	2,032,491	28.5%	1.2%

Table 38 - Core Scenario (Central Growth) 2023 & 2025 Without Scheme Post VDM Demand: Morning Peak (Cordon Model)

User Class	2014	2023	% Change from 2014	Annual Growth Rate	2025	% Change from 2014	Annual Growth Rate
Car/LGV	43,207	54,247	25.6%	2.8%	54,860	27.0%	2.5%
HGV	3,926	4,859	23.8%	2.6%	4,893	24.6%	2.2%
Total	47,132	59,105	25.4%	2.8%	59,753	26.8%	2.4%

Table 39 - Core Scenario (Central Growth) 2023 & 2025 Without Scheme Post VDM Demand: Inter Peak (Cordon Model)

User Class	2014	2023	% Change from 2014	Annual Growth Rate	2025	% Change from 2014	Annual Growth Rate
Car/LGV	32,950	42,499	29.0%	3.2%	42,688	29.6%	2.7%
HGV	3,727	4,625	24.1%	2.7%	4,666	25.2%	2.3%
Total	36,677	47,123	28.5%	3.2%	47,354	29.1%	2.6%

Table 40 - Core Scenario (Central Growth) 2023 & 2025 Without Scheme Post VDM Demand: Afternoon Peak (Cordon Model)

User Class	2014	2023	% Change from 2014	Annual Growth Rate	2025	% Change from 2014	Annual Growth Rate
Car/LGV	45,692	57,265	25.3%	2.8%	58,467	28.0%	2.5%
HGV	5,159	6,422	24.5%	2.7%	6,381	23.7%	2.2%
Total	50,851	63,687	25.2%	2.8%	64,848	27.5%	2.5%

Table 41 - Core Scenario (Central Growth) 2032 & 2038 Without Scheme Post VDM Demand: Morning Peak (Cordon Model)

User Class	2014	2032	% Change from 2014	Annual Growth Rate	2038	% Change from 2014	Annual Growth Rate
Car/LGV	43,207	58,573	35.6%	2.0%	59,478	37.7%	1.6%
HGV	3,926	5,548	41.3%	2.3%	6,090	55.1%	2.3%
Total	47,132	64,121	36.0%	2.0%	65,568	39.1%	1.6%

Table 42 - Core Scenario (Central Growth) 2032 & 2038 Without Scheme Post VDM Demand: Inter Peak (Cordon Model)

User Class	2014	2032	% Change from 2014	Annual Growth Rate	2038	% Change from 2014	Annual Growth Rate
Car/LGV	32,950	47,730	44.9%	2.5%	49,770	51.0%	2.1%
HGV	3,727	5,298	42.2%	2.3%	5,848	56.9%	2.4%
Total	36,677	53,028	44.6%	2.5%	55,618	51.6%	2.2%

Table 43 - Core Scenario (Central Growth) 2032 & 2038 Without Scheme Post VDM Demand: Afternoon Peak (Cordon Model)

User Class	2014	2032	% Change from 2014	Annual Growth Rate	2038	% Change from 2014	Annual Growth Rate
Car/LGV	45,692	62,473	36.7%	2.0%	63,994	40.1%	1.7%
HGV	5,159	7,252	40.6%	2.3%	8,013	55.3%	2.3%
Total	50,851	69,726	37.1%	2.1%	72,008	41.6%	1.7%

15.2.5 Further details of the traffic forecasting process and the results of the forecasting can be found in the Stage 2 Traffic Forecasting Report (HHJV Doc Ref. 0009-UA007244-UT22R Stage 2 A2BE Traffic Forecasting Report.

15.3 Operational Modelling

15.3.1 To ensure that the proposed junction layouts remained feasible at Stage 2 in terms of network capacity and safe operation, more detailed traffic modelling analyses were undertaken using local junction models and a microsimulation model that covered both junctions, the A2 mainline and the adjacent road network.

15.3.2 Two time periods were developed for a typical weekday:

- AM peak from 08:00 to 09:00 hours
- PM peak from 17:00 to 18:00 hours.

15.3.3 Traffic forecast flows were obtained from the A2BE Stage 2 Highway Assignment Model for 2038 and tested for Scheme Option B05E01b.

15.3.4 The results from the Without Scheme model demonstrate that without any improvements to the Bean and Ebbsfleet junctions the morning and evening peak periods would experience unacceptable levels of delay and congestion in the design year 2038. The modelling indicates that blocking back onto A2 mainline would occur at Bean junction in the morning period causing safety issues and flow breakdown on the mainline. Furthermore, the Bean and Ebbsfleet junctions do not provide sufficient capacity for the local traffic to access the strategic road network in the evening peak, with extensive queueing and delays on the B255 and B2260, respectively.

15.3.5 In the With Scheme scenario in 2038, based on the forecast traffic flows for the Core Scenario and the high growth scenario, each of the options were seen to operate without blocking back onto the mainline on the off-slips at each junction in the morning and inter-peak time periods, but blocking back was shown to occur in the evening peak period on the eastbound off-slip at Ebbsfleet. The reason for this occurring in the With Scheme scenario but not the Without Scheme scenario is because eastbound traffic is able to flow more freely because of the Bean junction improvements and hence allows more traffic to reach the Ebbsfleet slip road.

15.3.6 Initial work in looking at this safety concern suggests there is enough scope to modify the lane arrangement and traffic signal control at the top of the eastbound off slip road to prevent the blocking back onto the mainline which will be addressed in a subsequent Design Freeze (PCF Stage 3). Initial work suggests this safety concern can be addressed.

15.3.7 The Stage 2 Operational Modelling results can be referred to in more detail in HHJV Document Reference 0067-UA007244-UT22TN-01 Stage 2 A2BE Operational Modelling Report.

15.4 Economic Assessment

15.4.1 The preferred option was appraised using a number of criteria, among them its economic performance in terms of its benefits and costs. This element established whether this option would provide value for money and therefore formed an important component of the overall appraisal.

15.4.2 The tools used to arrive at the Initial Benefit-Cost Ratio (BCR) for Stage 2 were:

- the Department for Transport (DfT)'s Transport Users Benefit Appraisal (TUBA) tool (v1.9.7) which calculates transport user benefits, plus changes in charging revenues and indirect taxation and the economic impact of changes in greenhouse gas emissions;
- the DfT's Cost Benefit Analysis computer program (COBALT) for estimating accident costs and benefits;
- approaches set out in the DfT's WebTAG Unit A3 Environmental Impact Appraisal to calculate noise and greenhouse gas benefits and to report the results in the corresponding worksheets; and
- a spreadsheet approach to convert the scheme cost estimate, provided by Highways England's cost consultants, to values appropriate for appraisal purposes.

15.4.3 After producing the Initial BCR, an appraisal was made of the journey time variability benefits from the scheme, using the DfT's MyRIAD software.

15.4.4 Additionally, an appraisal had been made at Stage 1 of the Wider Economic Benefits (WEBs) of the proposed scheme, which largely reflected its impact on the productivity and output of commerce and industry arising from the improved accessibility provided by the scheme.

15.4.5 The MyRIAD benefits and the Stage 1 WEBs benefits were added to the data used to produce the

initial BCR. This had the effect of increasing appreciably the benefits captured by the appraisal, with the results expressed as Adjusted BCRs.

15.4.6 The investment cost of scheme (Option 5), on a market price basis, is £84.8m. Lifetime non-traffic related maintenance costs have been calculated as £0.5m.

15.4.7 It has been advised that a developer contribution element totalling £25m is available for the scheme. It was assumed that this sum will be made available in stages between 2017 and 2025 and that it will be paid in current prices and in resource cost terms.

15.4.8 Further details of the Stage 2 Economic Assessment can be found in the Stage 2 Economic Assessment Report (HHJV Doc Ref: 0010-UA007244-UT22R Stage 2 A2BE Economic Appraisal Report).

Results (Core Scenario)

15.4.9 The TEE benefits are shown on Table 44. Table 45 shows the Public Accounts.The results of the economic appraisal for the scheme, including both user and wider economic benefits, are described below and presented in Table 47. All estimates of monetary benefits and costs are expressed in 2010 prices and discounted to 2010.

TEE Benefits

15.4.10 The user and provider benefits for the options considered are reported in the TEE tables. Table 44 presents these benefits and distinguishes between the benefits to business users and to consumers.

Table 44 - User and Provider Benefits (£ PVB in 2010 prices, discounted to 2010)

£bn PVB 2010 prices		Option 5
Commuting	Travel time	£24,165,585
	VOC	£528,149
	Charges	£0
	Construction delays	-£1,043,383
	Subtotal	£23,650,351
Other consumers	Travel time	£70,335,146
	VOC	£25,883
	Charges	£0
	Construction delays	-£4,798,729
	Subtotal	£65,562,300
Business	Travel time	£49,041,831
	VOC	£2,699,672
	Charges	£0
	Construction delays	-£4,441,863
	Subtotal	£47,299,640
Other Business	Developer Contributions	-£15,120,808
	Net Business Impact	£32,178,832
Total		**£121,391,483**
Business user benefits as percentage of total user benefits		34.6%

VOC = vehicle operating costs

n/a = not appraised

The great majority of the benefits for all of the options are generated by travel time savings. The

business impact of the project represents a considerable proportion of the total user benefit, being 35% of the total. This proportion would however be considerably reduced if it were expressed in terms of overall benefit, because of the impact of the developer contribution.

PA Table Summary

15.4.11 Table 45 shows the effects of Option 5 on public finances, taking into account the impact on the broad transport budget after allowing for the developer contribution and changes in revenues. It also includes reductions in the broader indirect tax revenues which accrue to the government.

Table 45 - Public Accounts (PVC £ 2010 prices, discounted to 2010, except where shown)

EAR Scheme Descriptions	Option 5
Central Government Funding	
Most likely outturn costs at Q1 2016 prices (including inflation)	£127,600,000
Investment Costs (a)	£84,836,320
Developer Contribution (b)	-£15,120,808
Operating Costs (c)	£460,114
Net Central Government Impact (a+b+c)	£70,175,627
Revenues (d)	£0
Cost to Broad Transport Budget (a+b+c+d)	**£70,175,627**
Indirect Tax Revenue	**£1,548,974**

AMCB Table

15.4.12 The AMCB table combines results from the TEE tables and the PA tables supplemented by information on accidents and environmental effects. The results from the appraisal of the accident and monetised environmental impacts are set out in Table 46 below.

Table 46 - Analysis of Monetised Costs and Benefits

Option B05E01b	
Noise	£258,560
Greenhouse Gases	-£2,656,464
Accidents	£1,306,100
Economic Efficiency: Consumer Users (Commuting)	£23,650,351
Economic Efficiency: Consumer Users (Other)	£65,562,300
Economic Efficiency: Business Users and Providers	£32,178,832
Wider Public Finances (Indirect Taxation Revenues)	-£1,548,974
Present Value of Benefits (see notes) (PVB)	£118,750,705
Broad Transport Budget	£70,175,627
Present Value of Costs (see notes) (PVC)	£70,175,627
OVERALL IMPACTS	
Net Present Value (NPV)	£48,575,079
Benefit to Cost Ratio (BCR)	1.69

Note : This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Summary of Results

15.4.13 The initial benefit cost ratio (BCR) for the preferred solution is 1.7. This lies firmly in the medium value for money category.

15.4.14 Wider economic benefits (WEBs) at Stage 1 were only calculated for Option 5, and it was agreed that these results should be carried forward to the Stage 2 appraisal. They, together with Travel Time Variability (TTV) benefits, total £32.7mm and increase total benefits to £154.5m, which reduces after allowing for developer contributions to £122.0m. This represents a 24% increase in the initial, pre-developer contribution, benefit.

15.4.15 Table 47 also shows that the adjusted BCR for Option 5 is 2.2, which brings it comfortably into the high value for money category.

Table 47 - Summary of Economic Results for Option 5 (£m 2010 Prices, discounted to 2010)

Option at Ebbsfleet		Option 1b
Option at Bean		Option 5
Excluding WEBs	PVB (£m)*	118.75
	PVC (£m)	70.18
	NPV (£m)	48.58
	Initial BCR	**1.69**
Including WEBs (1)	WEBs (£m)	22.49
Including MyRIAD Benefits	Delay and TTV (£m)	10.19
	PVB (£m)	151.43
	NPV (£m)	81.25
	Adjusted BCR	**2.16**

Results (Sensitivity Testing of Alternative Growth Scenarios)

15.4.16 A sensitivity test was undertaken using Low and High growth in the SATURN modelling to carry out further runs using TUBA 1.9.7. No attempt was made to carry out any of the other benefit modelling processes for alternative growth scenarios. These tests are reported in Table 48.

Table 48 - Summary of Economic Results for A2 Bean Option 5 under Alternative Growth Options

		Option 5		
Growth Forecast		Low	Central	High
Excluding WEBS	PVB	35.60	118.75	136.99
	PVC	70.18	70.18	70.18
	NPV	-34.58	48.58	66.81
	Initial BCR	**0.51**	**1.69**	**1.95**
Including WEBs and TTV Benefits	WEBs	22.49	22.49	22.49
	TTV	10.19	10.19	10.19
	PVB	68.28	151.43	169.97
	NPV	-1.90	81.25	99.49
	Adjusted BCR	**0.97**	**2.16**	**2.42**
WEBs as % of total benefits		32.9%	14.9%	13.2%

15.4.17 This analysis shows that in the event of low growth the scheme would only just offer low value for money. On the other hand, the high growth assumption brings the scheme further into the high value for money category.

Use of TUBA 1.9.8 interim

15.4.18 A further sensitivity test was undertaken using the interim release of TUBA 1.9.8. While TUBA 1.9.7 uses value of time parameter values from the July 2016 WebTAG Data Book, the more recent version uses data from the anticipated November 2016 release (v1.6). TUBA 1.9.8 also has the capability of varying business travel time values by distance. This test is reported in Table 49.

Table 49 - Sensitivity Test using TUBA 1.9.8

		Option 5 with Central Growth	
TUBA Version		TUBA v1.9.7	TUBA v1.9.8i
Excluding WEBS	PVB	118.75	99.02
	PVC	70.18	70.18
	NPV	48.58	28.84
	Initial BCR	**1.69**	**1.41**
Including WEBs and TTV Benefits	WEBs	22.49	22.49
	TTV	10.19	10.19
	PVB	151.43	131.70
	NPV	81.25	61.52
	Adjusted BCR	**2.16**	**1.88**
WEBs as % of total benefits		14.9%	17.1%

15.4.19 The result of this test is to reduce the reported BCRs. The initial BCR now falls just into the low value for money category, and the adjusted BCR now lies towards the top of the medium BCR range.

16 Stage 2 Appraisal Summary Table

16.1 Appraisal Summary Tables

16.1.1 The Stage 2 Appraisal Summary Table is located in Appendix B.

17 Conclusions

17.1 Conclusions

17.1.1 Improvements to the Bean and Ebbsfleet Junctions on the A2 are considered necessary to support the level of development proposed for Kent Thameside. Without improvements to these junctions, significant future traffic congestion will result which will have an adverse impact on the operation of the A2 and will be a constraint on economic development and housing growth in the area.

17.1.2 The schemes are committed within the Road Investment Strategy, subject to 'other contributions'.

17.1.3 Third Party Funding is planned to be sourced from Developer S106 contributions via STIPS from Ebbsfleet Garden City development (£25m) and Ebbsfleet Development Corporation (EDC) via Ebbsfleet central development (£20m). EDC will underwrite both sources of funding via funding from the DCLG which has been approved by Treasury.

17.1.4 The key scheme objectives captured in the Client Scheme Requirements are to:

- Support economic development and housing growth in Kent Thameside
- Minimise the impact of developments on the performance of the A2 mainline
- Achieve a BCR of at least 2.0
- Minimise environmental impact
- Reduce accident rates for all users
- Integrate with the wider strategic objectives of accessibility within Kent Thameside

17.1.5 Following consideration of the objectives set out above and a close examination of the full range of existing conditions, a number of options for the improvement of the junctions were identified and sifted, resulting in an accepted recommendation that three options at Bean and one option at Ebbsfleet be taken forward for further appraisal. These were Bean Options 3, 4 and 5 and Ebbsfleet Option 1. Appraisal was undertaken for each of the Bean options in conjunction with Ebbsfleet Option 1b (i.e. B03E01b, B04bE01b and B05E01b).

17.1.6 The results of the Stage 1 appraisal for the identified Short List Options at Bean (each in combination with the single option at Ebbsfleet) against the specific Scheme Objectives and the various appraisal factors was reported in the TAR (See Table 33 in Section 17 – Recommendation and Conclusion.) and summarised in Section 11.2 Table 26 above.

17.1.7 Option B05E01b had the best performance against the Scheme Objectives and against the majority of the appraisal factors. It was therefore agreed that this single option would be taken forward as the Proposed Option to the non-statutory public consultation.

17.2 Project Team Response to the views expressed at the Consultation

Response to the consultation process

17.2.1 A concern expressed at the Public Consultation was the fact that the consultation only included a single option at each junction and hence there was a view that a decision had been made. While this position is understandable, the consultation materials and the supporting technical reports that were made available clearly set out the rationale for having a single option in the consultation.

Response to the overall scheme

17.2.2 The project team noted that there is clearly common ground between the concerns raised by the public and the project stakeholders on the overall scheme.

17.2.3 The traffic modelling for the project has followed national guidance but there are concerns locally that a major development, such as Bluewater, should be factored into the assessment, particularly when the peak traffic periods are at weekends and over the Christmas period. It may therefore be appropriate to consider more sensitivity testing during the development of the preliminary design in Stage 3, which could then be reported as part of the statutory consultation.

17.2.4 The exclusion of Swanscombe Theme Park from the assessment is a major concern and while the rationale for the exclusion is clear within the project team, this will require, subject to how the theme park scheme develops over the coming months, clearer explanation at the next consultation.

17.2.5 The use of traffic signals at the roundabouts is proposed and while a number of respondents can understand the rationale for this it is clearly a major concern for some members of the public and stakeholders. A greater emphasis on explaining the benefits of traffic signals will need to be made as the scheme progresses.

17.2.6 Provision for non-motorised users was a recurring theme and this will be developed during Stage 3. As discussed at the Value Management Workshop on 5 April 2017 and reported in the Value Management Workshop Report, (reference HA543917–HHJV-GEN-PCF-022-VMP), clear opportunities exist for a co-ordinated approach between Highways England and the local authorities in the area. These opportunities have been captured in the Project Risk Register.

17.2.7 Noise and air quality are concerns and the Stage 1 environmental assessment concluded that it was unlikely that the scheme would have a significantly detrimental impact on noise or air quality. Further modelling on noise and air quality assessment has been undertaken as part of Stage 2 and has concluded that it is unlikely that the scheme would have a significant detrimental impact on noise and air quality. It should be noted that the air and noise assessments will be further refined at future stages to incorporate updated traffic forecasts, the results of which directly influence the air quality and noise results. The separation of strictly local and A2 traffic, such as a local distributor road parallel and separate from the A2 would be beyond the scheme objectives and would require investment in excess of the available scheme budget

Response to the proposals at Bean junction

17.2.8 While elements of the proposed scheme are contentious, such as the acquisition of the Ightham Cottages, it is positive that more respondents agreed with the scheme than disagreed with the scheme.

17.2.9 The proposed scheme is the lowest cost scheme but it is not proposed solely on this basis. Option 5, in combination with Ebbsfleet Option 1, has the best performance against the wider scheme objectives.

17.2.10 Close collaboration between Highways England and the appropriate local authorities, working within their statutory remits, should seek to ensure that those affected by the scheme are treated with respect and that their cases be given proper consideration.

Bean alternative proposals suggested at the Public Consultation

17.2.11 Alternative layouts and considerations were put forward during the Public Consultation. The project team reviewed the proposals and it was concluded that Options put forward by the project team for appraisal during Stage 1 were the optimal layouts for each junction. Some suggested alternatives and the reasons behind their rejection are discussed in the paragraphs below.

17.2.12 It was requested whether the proposed northern roundabout could be moved further westwards to avoid the demolition of Ightham Cottages. It was concluded that a feasible layout could not be achieved for the required capacity to tie into the existing road layout because:

- To achieve the slip road layout to current standards would impact Darenth Wood and the scheduled ancient monument.
- It would require modifications or demolition of existing Wood Lane Overbridge.
- There would be sub standard vertical crest curve on approach to roundabout from B255 reducing sightlines.
- There would be sub standard connections between new and existing A2 overbridge to the Ightham Cottages roundabout.

17.2.13 The provision of free flow junctions and separating local traffic would require the development of a scheme that would be beyond the scheme objectives agreed and would far exceed the available scheme budget.

17.2.14 A scheme adopting some elements of Option 3 into Option 5, particularly the slip roads south of the A2 in Option 3 would involve significant redesign of the layout for the southern roundabout and is likely to require the following works:

- Significant modifications or demolition of existing Bean Lane overbridge
- Demolition of a number properties at Hope Cottages
- Additional landtake and earthworks

- Unacceptable traffic delays during construction

17.2.15 Provision for future widening of the A2 by demolishing the existing overbridge as part of this scheme would need to be considered by Highways England as part of a wider A2 route strategy as the costs involved would exceed the available scheme budget

17.2.16 The retention of the link between the B255 and the A296 is a matter that Highways England will consider during Stage 3, the preliminary design. This is likely to only include provision for straight ahead or straight ahead and right turning traffic as to include the left turn to the A2 eastbound would diminish the desired outcomes for the scheme, whereby the Bluewater and Dartford traffic streams accessing the A2 eastbound are separated. Refer to drawing reference HA543917-HHJV-GEN-ZZZZ-SK-D-0003, for an indicative B255 and A296 Junction Layout.

Response to the proposals at Ebbsfleet junction

17.2.17 More respondents agreed with the scheme at Ebbsfleet Junction than disagreed with the scheme. Given that there is currently less traffic congestion at Ebbsfleet than Bean, it is understandable that the public are less convinced by the need to improve the Ebbsfleet junction. However, the predicted traffic flows are such that improvements will be necessary.

17.2.18 The suggested amalgamation of the two roundabouts into a single roundabout was considered as part of the option development but resultied in unacceptable traffic delays due to the increased conflicting traffic movements.

17.3 Stage 2 Appraisal

17.3.1 The results of the Stage 2 appraisal for Option B05E01bs against the specific Scheme Objectives and the various appraisal factors are as set out in Table 50 below.

Table 50 - Summary of Stage 2 Option Appraisal

	Option 5
Description	Retains the existing junction layout but with the existing roundabouts enlarged and converted to full traffic signal control. A new bridge over the A2 for southbound traffic is provided to the east of the existing Bean Road Overbridge, retained for northbound traffic.
Performance Against Scheme Objectives	
Support Economic Development	Provides additional capacity at junctions
Minimise the impact on the A2 mainline Congestion by 2041	Little difference in terms of journey times along the A2 and no blocking back onto the A2 mainline from the junctions
BCR Excluding Wider Economic Benefits	1.7
BCR Including Wider Economic Benefits	2.2
Minimise Environmental Impact	(see below for specific appraisal factors)
Safety Reduction in accidents over 60 year period	45
Integration within Kent Thameside	Improved integration and accessibility, in conjunction with improvements to other projects (i.e NMU provision)

Performance Against Specific Appraisal Factors	
Maintenance assessment	Similar impact
Noise impact	Slight beneficial
Air Quality impact	Slight adverse
Landscape impact	Slight adverse
Townscape impact	Slight adverse
Historic environment	Slight to moderate adverse
Biodiversity	Slight to moderate adverse
Water environment	Neutral
Wider Economic Benefits	£22m
Journey time savings	£121.4m
Physical activity	Neutral
Journey quality	Moderate beneficial
Land take – community	Negligible Adverse
Land take – private assets	Major Adverse
Land take – development land	Negligible Adverse
Land take – agricultural land	Negligible Adverse
Scheme Cost (Most likely estimate)	£127.6m

17.3.2 A buildability review and report completed in May 2107 for Bean Option 5 combined with Ebbsfleet Option 1, has provided confirmation that if construction commences in March 2020, the scheme could be open to traffic by October 2022 as per the Client Scheme Requirements, which stated that the scheme should be open to traffic by the end of March 2023.

18 The Recommended Route

18.1 The Recommended Route

18.1.1 It is recommended that Option B05E01b is considered as the Preferred Option and taken forward to Preferred Route Announcement. This Option has the best performance against the Scheme Objectives and against the majority of the appraisal factors.

18.1.2 For a description of Option B05E01b refer to Table 51 and Table 52 below.

Table 51 - A2 Bean and Ebbsfleet Junction Improvements - Option 5

A2 Bean Junction Improvements - Option 5 Description
Dumb-bell arrangement retained in existing location. Roundabouts on either side of the A2 are enlarged and signal controlled.
Existing Bean Road Bridge is retained for N/B traffic. New bridge is constructed to the east for S/B traffic.
Existing westbound slip roads, to the south of the A2, are modified
Modified eastbound off-slip to A2 incorporates a dedicated left turn lane at the B255 roundabout.
Additional eastbound on-slip to A2 from Ightham Cottages roundabout. Retaining wall would be provided to avoid impact on existing pond.
Eastbound on-slip to A2 via A296 retained with revised merge.
Eastbound A2 carriageway converted to 4 lanes by removing the existing hard shoulder and using narrow lanes from the end of the new slip road to east of Swanscombe footbridge which is retained by continuing the narrow lanes through the structure.
B255 southbound link to A296 is closed. B255/A296 junction converted to 3 arm roundabout
Demolition of Ightham Cottages
See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0135-0137

Table 52 - A2 Bean and Ebbsfleet Junction Improvements - Option 1

A2 Ebbsfleet Junction Improvements - Option 1 Description
Retain two-roundabout junction layout
Retains the existing junction layout but with the existing roundabouts enlarged and signal controlled
The eastern roundabout is extended to the north with an additional arm to accommodate access to Station Quarter South development.
Access to Ebbsfleet Green development will be via the enlarged and signal controlled western roundabout
Link road between the roundabouts is widened from the existing single carriageway to dual carriageway.
Existing eastbound and westbound off-slips are retained
Eastbound on-slip widened to two lanes and separated from the one-way link road to Pepper Hill Junction. Slip road is realigned to enable the merge to be moved further west. Constraints are created by the existing Channel Tunnel Rail Link Tunnel, Pepper Hill Underbridge and soil nail retaining wall.
Eastbound off-slip widened at the approach to the roundabout with a dedicated signal controlled left turn lane.
See Drawing No. HA543917-HHJV-HGN-XXXX-DR-D-0135-0137

18.1.3 The Recommended Route described above achieves the key scheme objectives as set out below;

- Supports economic development and housing growth in Kent Thameside
- Minimises the impact of developments on the performance of the A2 mainline
- Achieves a BCR of at least 2.0
- Minimises environmental impact – noise and air quality assessments indicate that it is unlikely that the scheme would have a significant detrimental impact on noise and air quality
- Reduces accident rates for all users in line with Highways England targets
- Integrates with the wider strategic objectives of accessibility within Kent Thameside. For example, there are opportunities to work with stakeholders to improve and integrate NMU facilities.

18.2 Key Development Phase Activities

18.2.1 Close collaboration between Highways England and the residents of Ightham Cottages, the tenant of Spirits Rest Horse Sanctuary and any other affected land owners is to be continued to ensure that their cases are given proper consideration.

18.2.2 The retention of the link between the B255 and the A296 is a matter that Highways England will consider during Stage 3, the preliminary design. This is likely to only include provision for straight ahead or straight ahead and right turning traffic.

18.2.3 The exclusion of Swanscombe Theme Park from the assessment was a major concern received at the Public Consultation. Collaboration is required by Highways England and the Stage 3 consultant on the current status of the Swanscombe Theme Park Planning Application for inclusion in the traffic model.

18.2.4 The use of traffic signal at the roundabouts at the junction improvements is proposed and feedback received at the public consultation showed that it is clearly a major concern for some members of the public and stakeholders. A greater emphasis on explaining the benefits of traffic signals will need to be made as the scheme progresses.

18.2.5 The connectivity of NMU facilities with the existing network and Ebbsfleet Development Corporation need to be developed further. Clear opportunities exist for a co-ordinated approach between Highways England, local authorities and Ebbsfleet Development Corporation.

18.2.6 Opportunities should be developed further for a coherent strategy for all works in the area (e.g. A2 Route Strategy, combining routine network maintenance with road closures and future proofing new infrastructure (such as setting back new bridge abutments to allow for potential future A2 widening).

18.2.7 An IDC meeting was held on 18th July 2017. IDC approved an initial £1M of Highways England funding in order for the project to proceed until third party funding is in place. Liaison and ongoing discussions are being held between DCLG, Treasury, DfT and Highways England.

19 Confidential Consultation

19.1.1 Individual meetings were held between Highways England and the residents of Ightham Cottages, the tenant of Spirits Rest Horse Sanctuary and affected landowners during the Public Consultation period.

19.1.2 The scheme programme, the compensation and assistance available to residents of Ightham Cottages was discussed.

Appendix A – Public Consultation Leaflet and Questionnaire

highways england

A2 Bean and Ebbsfleet junction improvements

Public consultation

Have your say

18 January to 1 March 2017

A2 Bean and Ebbsfleet junction improvements

Public consultation

Have your say by completing the consultation questionnaire

Highways England is the government company responsible for operating and maintaining England's major A roads and motorways. Formerly known as the Highways Agency, we are also responsible for delivering improvements to the existing strategic road network.

This consultation will run for 6 weeks from **18 January to 1 March 2017.**

We look forward to hearing from you. Please read this document and provide your feedback. Details on back page.

A2 Bean and Ebbsfleet junctions

The A2 Bean and Ebbsfleet junctions are situated on the A2 trunk road, approximately 1.2 miles apart (2km) within north Kent.

- **The Bean junction** connects the A296 and B255, which provides access to the Bluewater regional shopping centre, to the A2 and the wider area and is particularly busy at weekends.
- **The Ebbsfleet junction** serves the wider area and Ebbsfleet International Rail Station, connects the A2 to the A2260 and will also provide access to the new and ongoing developments.

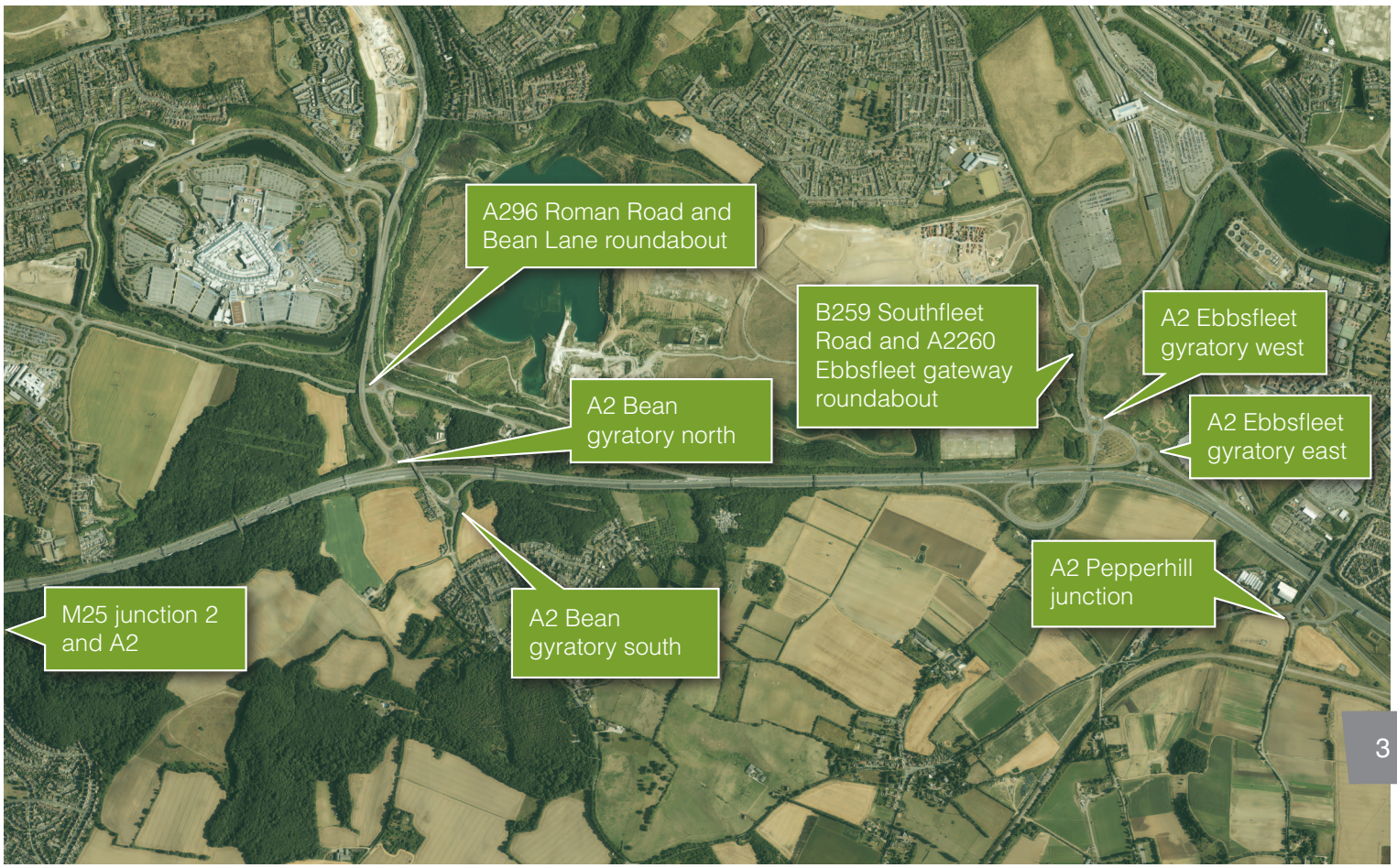
The need for a scheme

In the coming years the Bean and Ebbsfleet junctions will serve developments such as the Ebbsfleet Garden City development.

This development will create 15,000 new homes and more than 30,000 jobs could be created. (Source: Ebbsfleet Development Corporation).

Traffic modelling has indicated that without improvements to both junctions, the road network will become highly congested resulting in considerable delays and associated environmental issues.

- **The Bean junction** proposed development will result in traffic using the A2 Bean junction (including the A296) increasing by 50-60% during weekday and weekend peak periods by 2037 compared to 2014 traffic levels.
- **The Ebbsfleet junction** proposed development will result in traffic using the A2 Ebbsfleet junction increasing between 170 – 200% during weekday peak periods by 2037 compared to 2014 traffic levels.



Objectives of the scheme

The objectives were developed in conjunction with the Department for Transport (DfT) and local authorities.

They are to provide improvements at A2 Bean and A2 Ebbsfleet junctions to:

- Support the economic and housing growth proposed for the north Kent area, including Ebbsfleet Garden City
- Increase the capacity of the junctions and minimise the impact on the A2
- Improve journey times
- Improve road safety
- Minimise impact on the environment
- Provide value for money with a Benefit Cost Ratio (BCR) of at least 2:1. This means that for every £1 spent on the scheme at least £2 of economic benefit will be created.

Scheme details

Highways England has considered a number of options for both junctions. Following a detailed review of these proposals, Highways England has concluded that there is one option for each junction which meets the scheme objectives. Details of the proposal for each junction are as follows:

- The proposed Bean junction improvements broadly follow the existing road layout but with an additional bridge over the A2 adjacent to the existing bridge and a new slip road on to the A2 for eastbound traffic. It retains the existing junction layout but with the current roundabouts enlarged and converted to traffic signal control. A new bridge over the A2 for southbound traffic is provided to the east of the existing Bean Lane Overbridge, which is retained for northbound traffic.
- The proposed Ebbsfleet junction improvements broadly follow the existing road layout but with the existing roundabouts enlarged and with traffic signal control. Access is provided at the junctions to the new and ongoing developments. The link road between the roundabouts is widened from the existing single carriageway to a dual two lane carriageway. The existing eastbound and westbound slip roads from the A2 are retained. The eastbound and westbound slip roads to the A2 are widened.

The proposed scheme is being delivered by Highways England. It is funded by the Department for Transport with Section 106 contributions provided via the Kent Thameside Strategic Transport Programme and the Ebbsfleet Development Corporation. The Kent Thameside Strategic Transport Programme consists of seven improvement schemes (including the A2 Bean and Ebbsfleet junctions) that will be delivered as developer contributions come forward to Gravesham Borough Council, Dartford Borough Council and Ebbsfleet Development Corporation. The programme is administered by Kent County Council. The Ebbsfleet Development Corporation is the planning authority set up by Government to speed up delivery of up to 15,000 homes and create Ebbsfleet Garden City in north Kent.

Scheme benefits

These are as follows:

- Supports economic development, including jobs and housing growth in north Kent
- Increases capacity on the road network to accommodate future growth
- Smooths traffic and improves journey times at both junctions
- Increases capacity for all road users without endangering safety
- Improves safety for all road users
- Provides better facilities for non-motorised users (such as cyclists, pedestrians and equestrians)
- Provides better access to public transport

We want to hear your views

This consultation provides you with the opportunity to give your views on the proposed improvements to the Bean and Ebbsfleet junctions. Your feedback will assist us in planning and progressing the next stages of scheme development.

A2 Bean and Ebbsfleet junctions

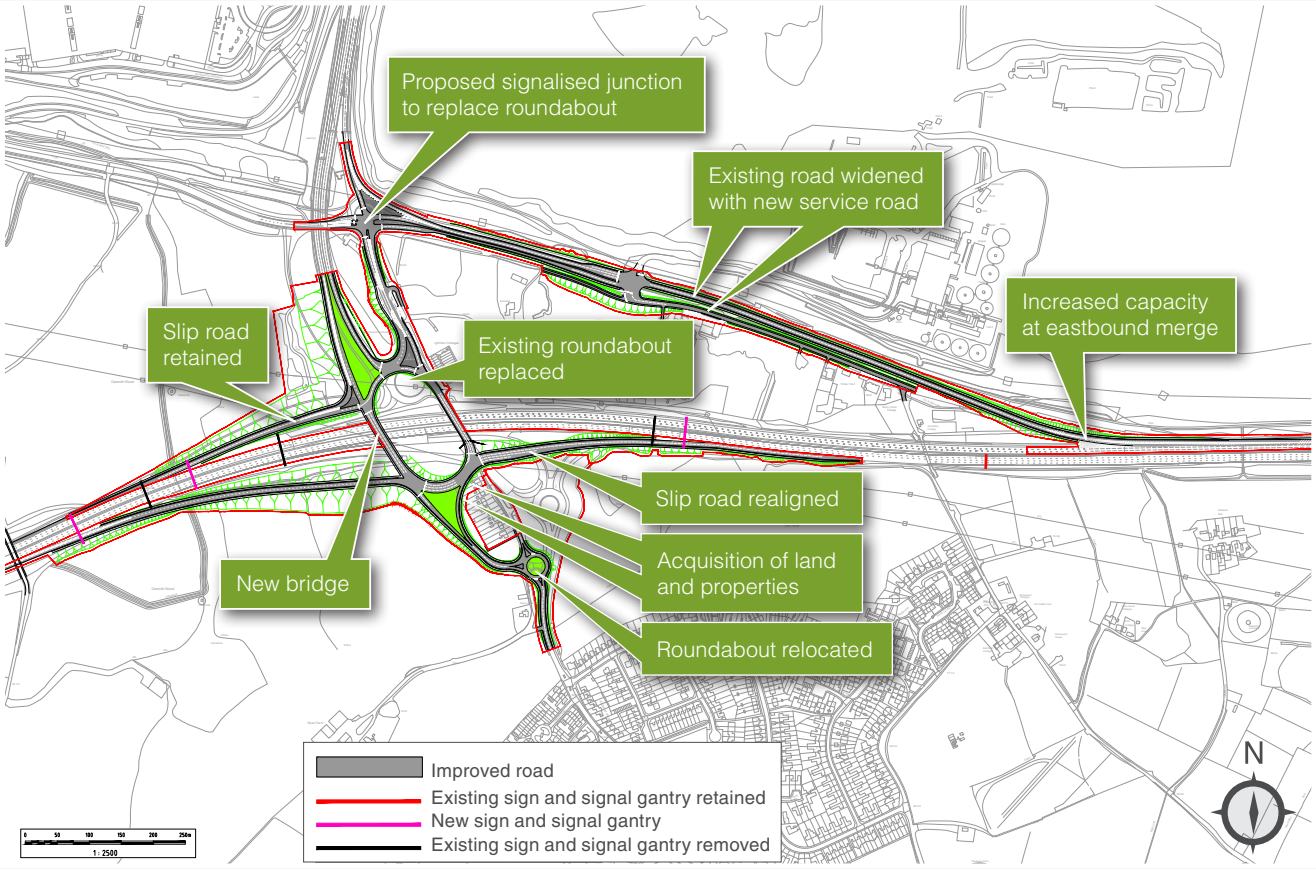
How we developed the options

A number of concept options were initially developed for both junctions. These were assessed against initial traffic forecasts, topography and environmental and physical constraints. This process resulted in a longlist of possible options, with 7 options at Bean and a single option at Ebbsfleet (Option 1b). The other concept options at Ebbsfleet were rejected as they did not provide adequate access to development areas or did not perform adequately in terms of traffic movements or did not fulfill the scheme objectives.

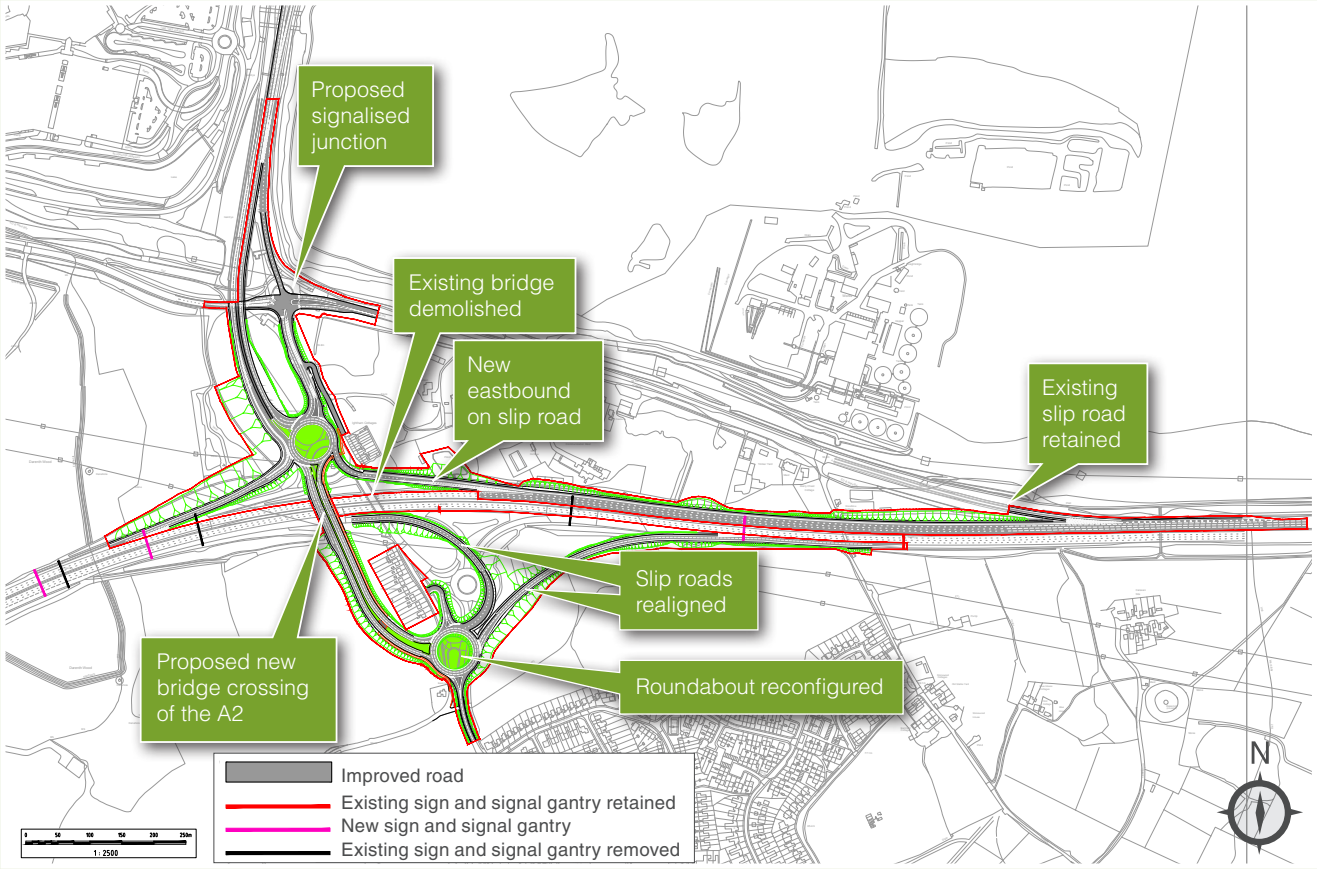
The longlist was then further assessed, culminating in a shortlist of 3 options at Bean (Options 3, 4b and 5) and the single option at Ebbsfleet. Some options on the longlist were rejected because on closer examination they did not perform well in terms of traffic movements or did not fulfill the scheme objectives.

Given the planned developments in the area, doing nothing at the 2 junctions would result in a huge increase in traffic and congestion and associated environmental problems at both junctions over the coming years.

The options on the shortlist have been appraised, resulting in a single option proposed for Bean (Option 5) and the single option proposed for Ebbsfleet (Option 1b).

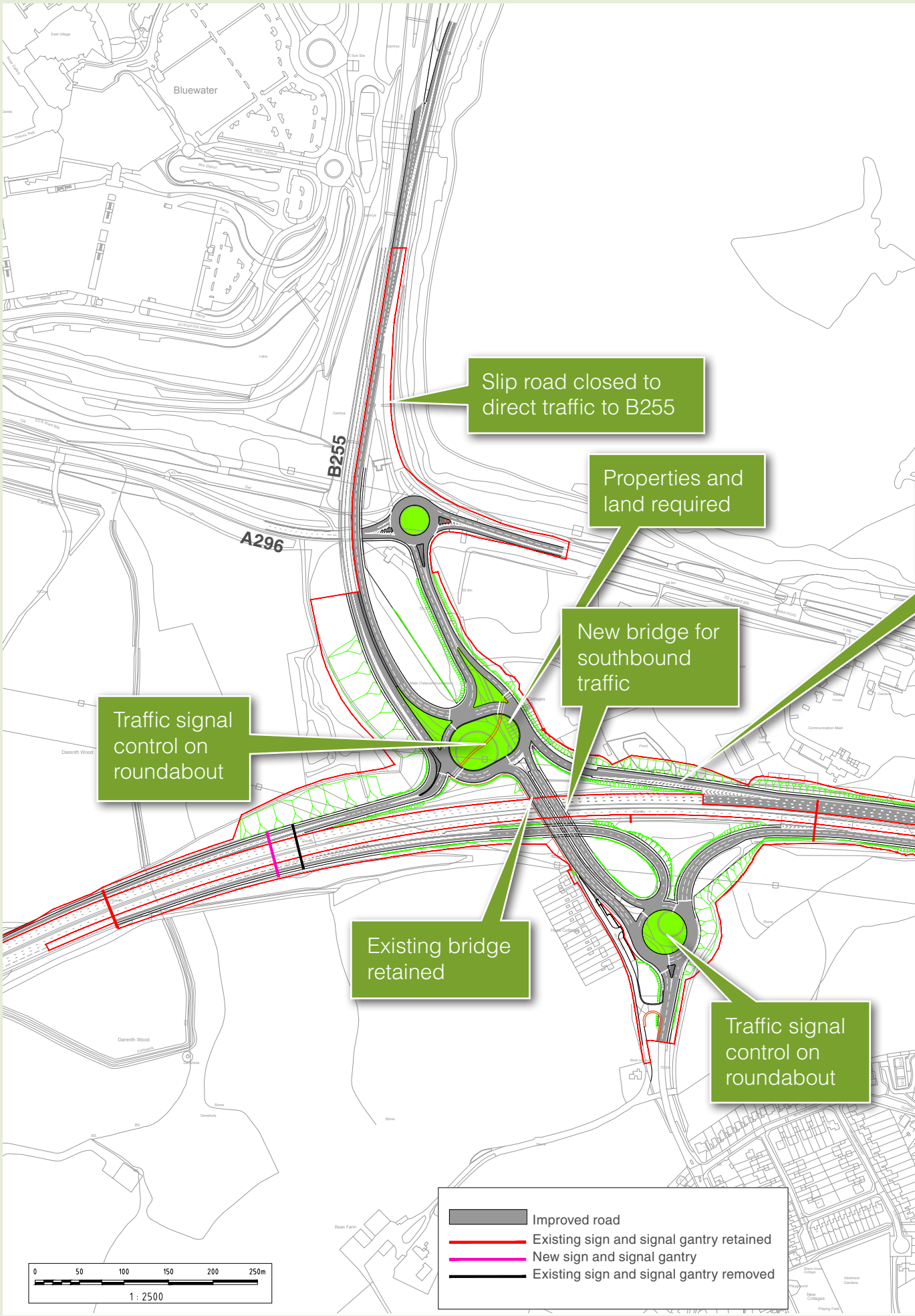


Bean Option 3 was rejected because it would have an impact on Darenth Wood SSSI ancient woodland and does not provide any additional significant benefit compared to Bean Option 5 whilst costing an additional £20m. The option also requires the acquisition of three properties and impacts on a further three. It provides low value for money with a BCR of less than 1.7:1. The cost of Bean Option 3 with Ebbsfleet Option 1b of £145m exceeds the scheme budget.



Bean Option 4b was rejected because, while it does not require the acquisition of any residential properties, it has the poorest overall performance against the assessment criteria and would have an impact on the Thrift ancient woodland. It provides very low value for money with a BCR of less than 1:1. The cost of Bean Option 4b with Ebbsfleet Option 1b is £143m which exceeds the scheme budget.

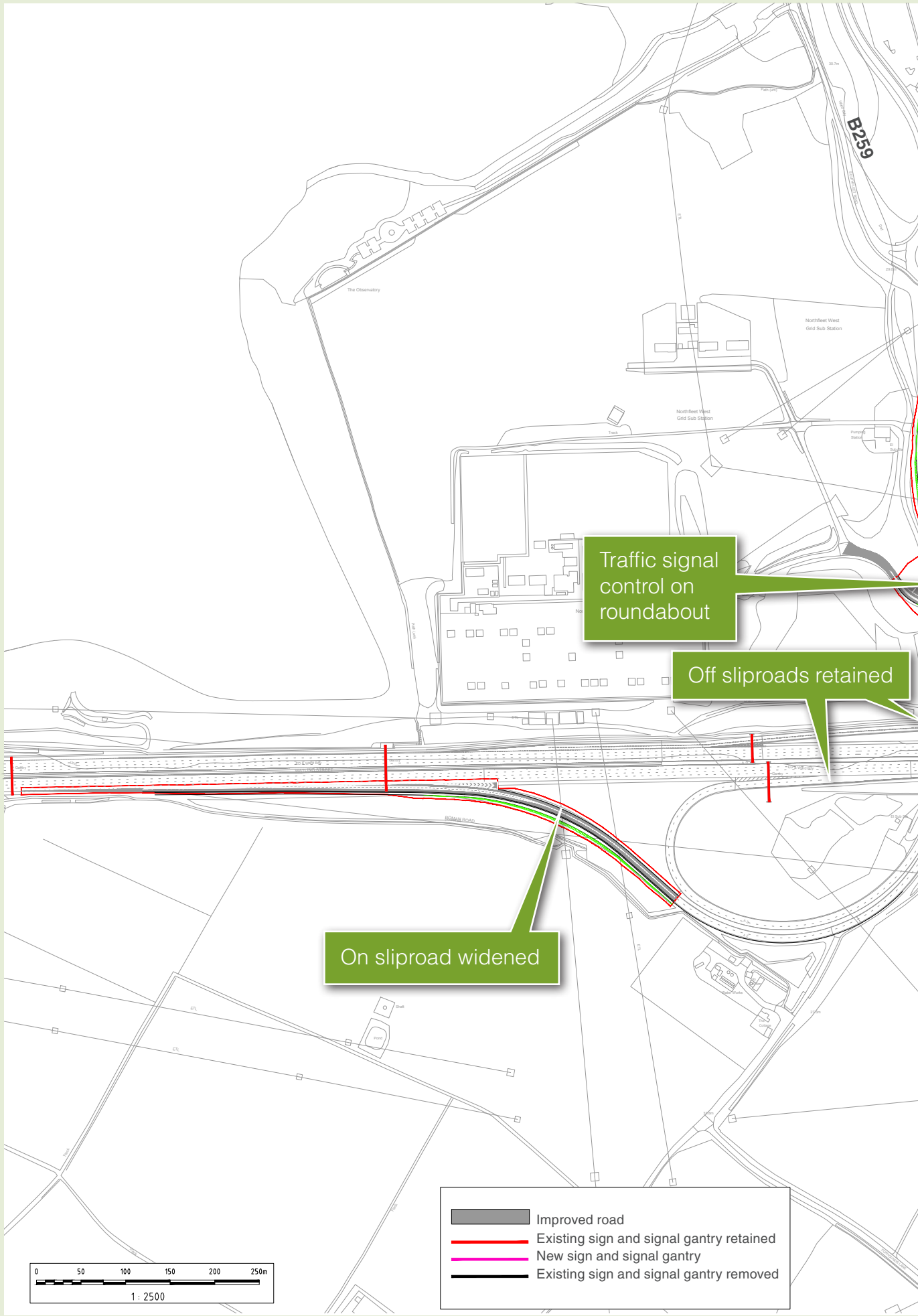
Option we want your views on



Bean junction Option 5

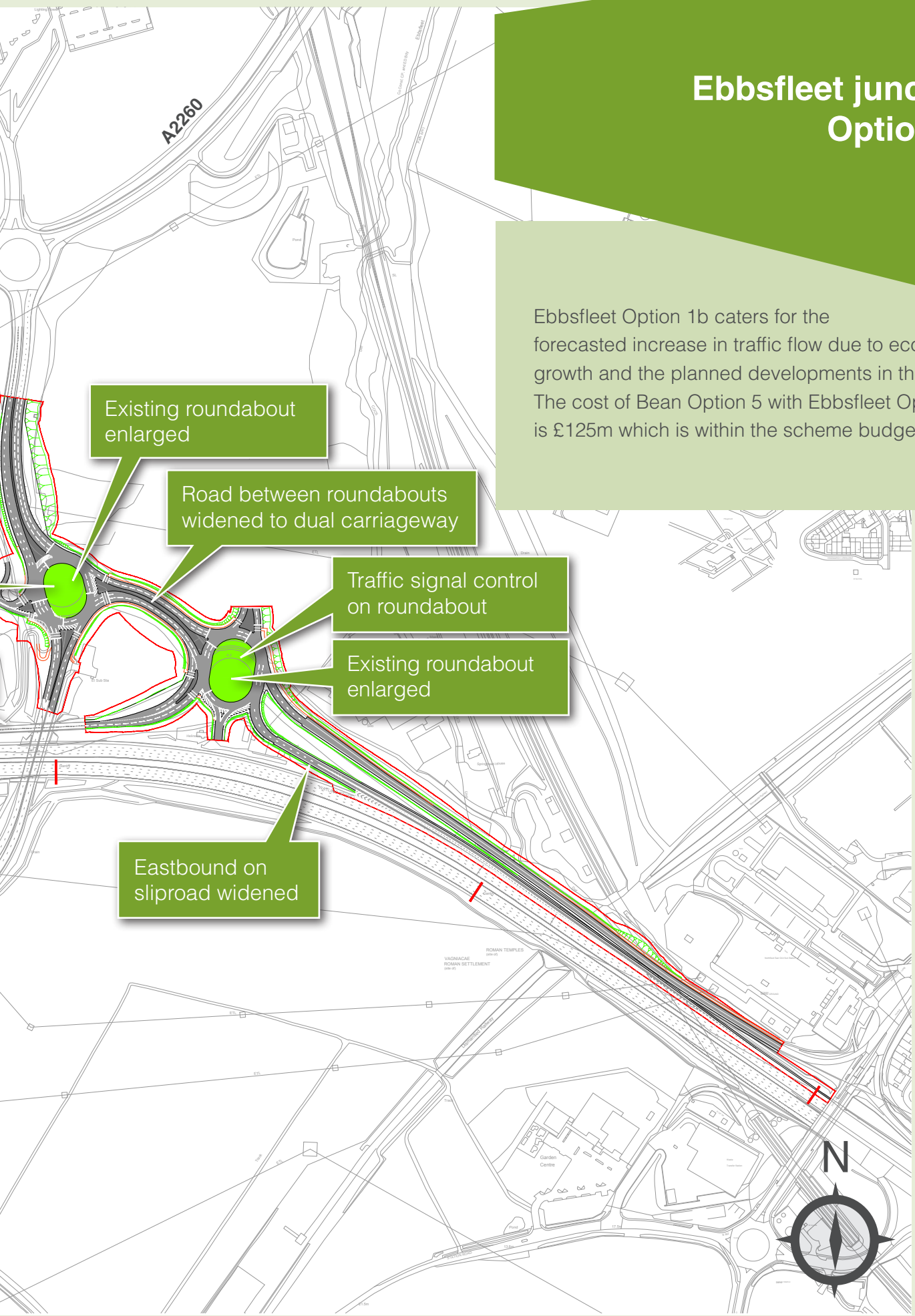
Bean Option 5 requires the acquisition of some land and properties but has the best overall performance of the shortlisted options against the assessment criteria. In particular it does not have any direct impact on the ancient woodland and has the greatest journey time savings. This option provides good value for money, with a BCR of 2.1:1.

Option we want your views on



Ebbsfleet junction Option 1b

Ebbsfleet Option 1b caters for the forecasted increase in traffic flow due to economic growth and the planned developments in the area. The cost of Bean Option 5 with Ebbsfleet Option 1b is £125m which is within the scheme budget.



The performance of the proposed Bean Option 5 with the proposed Ebbsfleet Option 1b is summarised in the table below:

Benefit and impacts of the proposed scheme	Bean Option 5 with Ebbsfleet Option 1b
Economic development	Wider economic benefit of £22m (an estimate of the beneficial knock on effects on business productivity and production resulting from the implementation of the scheme over a 60-year period).
Journey time savings	£129.7m The improvements provide additional capacity at each junction to smooth traffic flow, improve journey times and journey time reliability over a 60-year period.
Benefit Cost Ratio (BCR)	2.1:1 over a 60-year period.
Safety	Reduction of 11 accidents in which people are killed or seriously injured over 60-year period.
Air quality	It is unlikely that this scheme will lead to a significant impact on air quality but further assessment will be undertaken at the next stage.
Construction impact/duration	The programme allows for a construction period of 3 years but it is hoped to reduce this as the scheme is further developed. There will be significant traffic management during construction as the existing junctions are reconstructed.
Landscape and townscape impact	Overall slight impact but no direct impact on ancient woodland.
Land take – community	Acquisition of land and properties.
Non-motorised users	Existing routes will be maintained and crossing of the roads at the roundabouts will be facilitated by the introduction of traffic signals.
Scheme cost	£125m

Relationship with other local projects

Highways England's proposed Lower Thames Crossing

The Lower Thames Crossing project is a separate proposal to the Bean and Ebbsfleet junction improvements although any decision about the Lower Thames Crossing will have an effect on future traffic on the A2. The Government is still to make a decision on the Lower Thames Crossing. The improvements at Bean and Ebbsfleet have been designed to accommodate whichever decision is made.

London Paramount Entertainment Resort

Our proposals for the Bean and Ebbsfleet junctions are separate to any proposal currently being developed by the promotors of the London Paramount Entertainment Resort.

At this stage there has been no application for planning permission.

As we are a statutory consultee, we are working with London Paramount to understand how their proposed development will impact upon the roads we manage and how any potential effects might be mitigated.

London Paramount is also engaging with the local authorities and the community regarding the impact that this development might have on the local road network.

Bluewater

The improvements that we have proposed for the Bean junction have been designed to accommodate the future traffic flows up to 2037 including known developments at the Bluewater shopping centre.

We want to hear your views

Your views are important and we would like your feedback on the proposed scheme. You can find out more about the scheme on line at www.highways.gov.uk/a2be or at the public consultation exhibitions where our project team will be on hand to answer your questions. The public exhibitions are being held as follows:

Date	Location	Time
Wednesday 18 January	Bean Youth and Community Centre High Street, Bean, DA2 8AS	17:30 - 20:00
Saturday 21 January		12:00 - 17:00
Saturday 28 January	Eastgate 141 Springhead Pkwy, Gravesend, DA11 8AD	12:00 - 17:00
Wednesday 1 February		13:00 - 20:00
Monday 20 February		13:00 - 20:00

You can also find further copies of this brochure at the following locations:

Location	Address
Bean Youth and Community Centre	High Street, Bean, DA2 8AS
Dartford Library	Central Park, Dartford, DA1 1EU
Greenhithe Library	London Road, Greenhithe, DA9 9EJ
Fleetdown Library	Swaledale Road, Dartford, DA2 6JZ
Longfield Library	49 Main Road, Longfield, Kent, DA3 7QT
Swanscombe and Greenhithe Town Community Hall	The Grove, Swanscombe, DA10 0GA
Swan Valley Library	Swanscombe Library Discovery Centre, Southfleet Road, Swanscombe, DA10 OBZ
Temple Hill Community Centre	Temple Hill Square, Dartford, DA1 5HY
Coldharbour Road Library	Northfleet, DA11 8AE
Hive House Library	Hive House, Northfleet, DA11 9DE
Gravesend Library	Windmill Street, Gravesend, DA12 IBE
Gravesham Borough Council	Civic Centre, Windmill Street, Gravesend, DA12 1AU
Maidstone County Hall	County Hall, Maidstone, ME14 1XQ
Stone Pavilion	Hayes Road, Stone, Greenhithe, DA9 9DS

How to give us your views:

- Visit our website and fill in the online questionnaire at **www.highways.gov.uk/a2be**
- Email us: **A2BeanandEbbsfleetJunctionsImprovements@highwaysengland.co.uk**
- Write to us: **Freepost A2 Bean & Ebbsfleet junction improvements**
- Call **0300 123 5000** (24 hours).

The closing date for submitting feedback is **11.45pm on 1 March 2017.**

Your feedback and comments must be received by this deadline so that we can consider your response. We will not be able to respond to individual feedback but we will review and consider all comments received and acknowledge receipt of the response at the end of the consultation.

How we use your feedback

All views and comments received will help us to:

- Make sure potential impacts on the community and environment have been fully considered
- Ensure the final scheme design is updated with all relevant responses where applicable
- Ensure the final environmental statement takes into account impacts or mitigation measures that you have told us about
- Record how we have considered feedback to develop the scheme further in our consultation report

What happens after the public consultation

Following our normal procedures we will analyse all feedback and produce a consultation report which informs the preferred route. We will then develop detailed proposals for the scheme. This will include surveys and investigations to allow us to design the proposals in more detail. When the detailed designs are complete there will be another opportunity to have your say in a statutory consultation.

After this second consultation we will submit a planning application to the Planning Inspectorate. This is called the Development Consent Order process. We are required to undertake this for all projects of this nature, known as Nationally Significant Infrastructure Projects. The Development Consent Order application will be examined by the independent Planning Inspectorate, who will ask for representations from interested parties. After the examination, the Planning Inspectorate will make a recommendation to the Government which makes the final decision on the scheme. We will only be given consent to construct the scheme if the Development Consent Order is granted. Consent will also allow compulsory purchase of any land required.

Scheme milestones

Summer 2017

After considering your feedback alongside that of our stakeholders and partners we will produce a consultation report which will inform our decision on a preferred route.

Winter 2017/18

Statutory public consultation on the preferred route.

Summer 2018

We will submit a planning application which includes the final consultation report to the Planning Inspectorate. This is called the Development Consent Order process.

2018-2019

The Planning Inspectorate will evaluate the scheme.

2019/20

The Planning Inspectorate will make a recommendation to the Government, which will decide whether to give the scheme consent.

2020

If planning consent is granted then construction starts.

2022/23

Scheme opens for traffic.

If you need help accessing this or any other Highways England information, please call **0300 123 5000** and we will help you.

Contact us

Please complete the A2 Bean and Ebbsfleet junction improvements consultation questionnaire.

You can also contact us as follows:

- Visit our website and fill in the online questionnaire at **www.highways.gov.uk/a2be**
- Email us: **A2BeanandEbbsfleetJunctionsImprovements@highwaysengland.co.uk**
- Write to us: **Freepost A2 Bean & Ebbsfleet junction improvements**
- Call **0300 123 5000** (24 hours).

The closing date for submitting feedback is **11.45pm on 1 March 2017.**

This document is also available on our website at **www.gov.uk/highways**

If you have any enquiries about this publication email **info@highwaysengland.co.uk** or call **0300 123 5000***. Please quote the Highways England publications code **PR176/16**.

Highways England Creative S160533

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A2 Bean and Ebbsfleet junction improvements

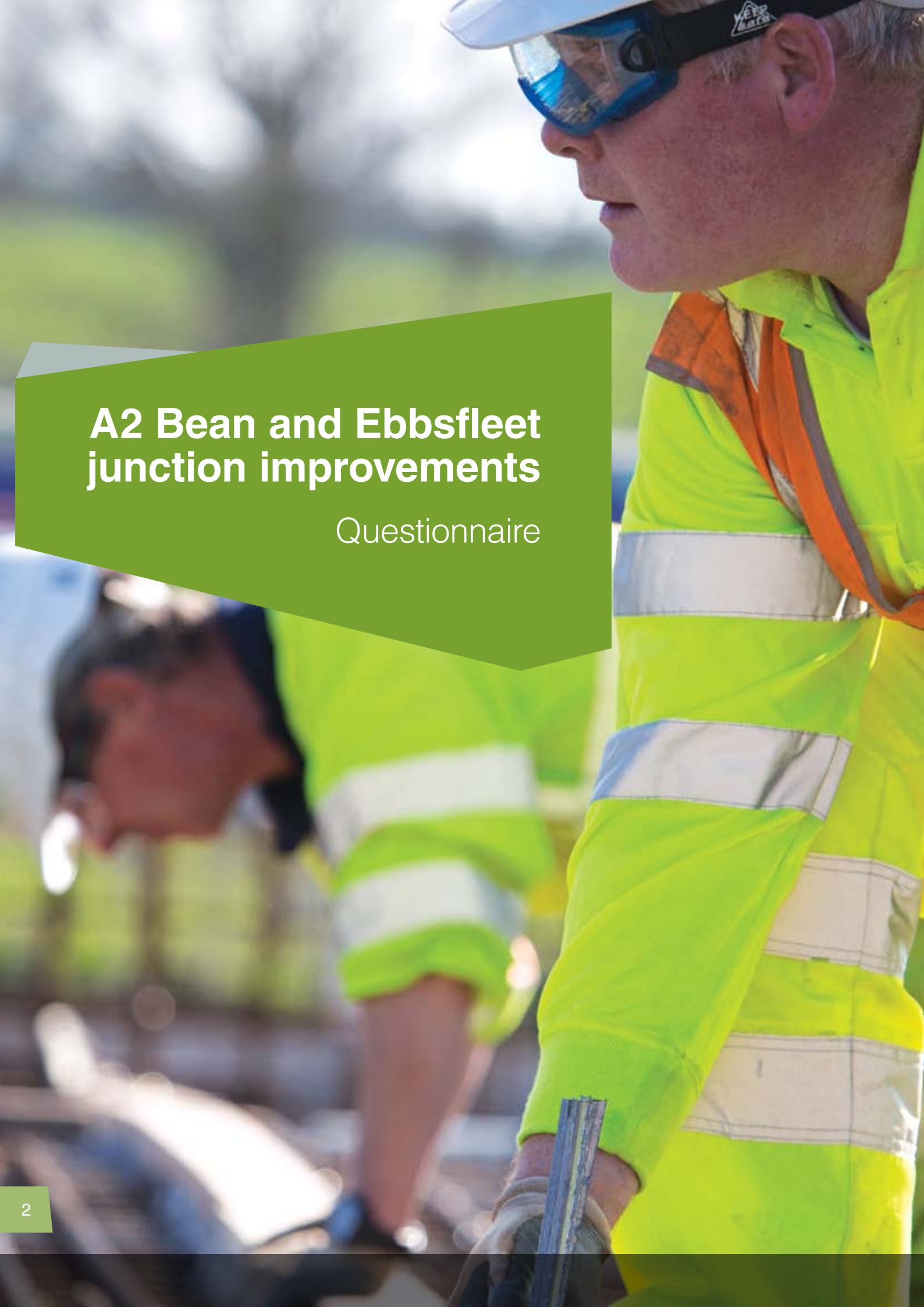
Questionnaire

18 January to 1 March 2017

Please read the consultation document before completing this questionnaire.

Questionnaires can be completed and returned as follows:

- Send it to us at our freepost address: **FREEPOST A2 Bean & Ebbsfleet junction improvements**
- Deposit the completed questionnaire at any of the 5 public exhibitions listed on page 13 of the consultation document
- Fill in the questionnaire online at: **www.highways.gov.uk/a2be**
- Email us: **A2BeanandEbbsfleetJunctionsImprovements@highwaysengland.co.uk**



A2 Bean and Ebbsfleet junction improvements

Questionnaire

A2 Bean and Ebbsfleet junction improvements questionnaire

The consultation will run from **18 January to 1 March 2017.** The closing date for returning this questionnaire and for any other comments and feedback is **Wednesday 1 March 2017 at 11.45pm.** Please complete your contact details below in capital letters.

Title: _____

Name: _____

Address: _____

Please provide your postcode if you do not want to provide your full address.

Postcode: _____

Email (optional): _____

Are you responding on behalf of an organisation: ☐ Yes ☐ No

If yes, please name the organisation: _____

The information you provide will be kept in a secure environment only accessible by Highways England and the specific contractor(s) working with us on this project. Your personal information will not be shared with any other individuals or organisations beyond the provision set out in the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information you submit will only be used in support of the purpose specified in the survey. Personal details are collected only to ensure entries are not duplicated and in order to contact correspondents if necessary.

Current situation

1. How concerned are you about the following current issues? (Please tick the appropriate boxes) ✓

Issue	Very concerned	Concerned	Slightly concerned	No concern	No opinion
Ease of turning onto/off the A2 at Bean junction					
Journey times travelling around Bean junction					
Ease of turning onto/off the A2 at Ebbsfleet junction					
Journey times travelling around Ebbsfleet junction					
Provision of footpaths, cycleways and crossings at Bean and Ebbsfleet junctions					
Road safety at the junctions					
Air quality around the junctions					

About the scheme

Bean junction

The following questions relate to the Bean junction which connects to the B255, the A296, Bluewater Shopping Centre and the wider area. (Please tick the appropriate boxes) ✓

2. How often do you currently use the Bean junction?

	Every day	3-4 times a week	About once a week	Once or twice a month	Rarely
Weekdays morning peak (8.00-9.00)					
Weekdays afternoon peak (17.00-18.00)					
Weekdays off peak (all other times)					
Weekends anytime					

3a. To what extent do you agree or disagree that the Bean junction proposal will achieve the following objectives?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
Support the economic and housing growth proposed for the north Kent area						
Improve the capacity of the Bean junction and minimise the impact on the A2						
Improve journey times at the Bean junction						
Improve road safety at the Bean junction						
Minimise impact on the environment at the Bean junction						
Provide value for money						

3b. Please provide details to illustrate your answers.

4a. Overall to what extent do you agree with the proposed option for Bean junction?

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know

4b. Please provide details to illustrate your answer.

5. Are there any local issues that you feel we should be aware of in developing our proposals around the Bean junction? Please provide details to illustrate your answers.

Ebbsfleet junction

The following questions relate to the Ebbsfleet junction which serves the Ebbsfleet International Rail Station and connects the A2 to the A2260. It already provides access to the wider area and will also provide access to the proposed new and ongoing developments. (Please tick the appropriate boxes) ✓

6. How often do you currently use the Ebbsfleet junction?

	Every day	3-4 times a week	About once a week	Once or twice a month	Rarely
Weekdays morning peak (8.00-9.00)					
Weekdays afternoon peak (17.00-18.00)					
Weekdays off peak (all other times)					
Weekends anytime					

7a. To what extent do you agree or disagree that the Ebbsfleet junction proposal will achieve the following scheme objectives?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
Support the economic and housing growth proposed for the north Kent area						
Improve the capacity of the Ebbsfleet junction and minimise the impact on the A2						
Improve journey times at the Ebbsfleet junction						
Improve road safety at the Ebbsfleet junction						
Minimise impact on the environment at the Ebbsfleet junction						
Provide value for money						

7b. Please provide details to illustrate your answers.

8a. Overall to what extent do you agree with the proposed option for Ebbsfleet junction?

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know

8b. Please provide details to illustrate your answer.

9. Are there any local issues that you feel we should be aware of in developing our proposals around the Ebbsfleet junction? Please provide details to illustrate your answers.

10. Do you have any further comments about this Bean and Ebbsfleet junction improvements scheme?

About the consultation

(Please tick the appropriate boxes) ✓

11. How did you find out about the A2 Bean and Ebbsfleet junction improvements consultation?

- ☐ Letter through door
- ☐ Local council website or email
- ☐ Local radio
- ☐ Highways England website
- ☐ Poster
- ☐ Local community group
- ☐ Public notice
- ☐ Other (please state)

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12. Have you found the consultation materials useful in answering your questions?

☐ Yes ☐ To a certain extent ☐ No

13. Have you found any of our public exhibitions helpful in addressing your questions?

☐ Yes ☐ To a certain extent ☐ No ☐ Not applicable

14. Do you have any comments on the consultation process?

Thank you for completing this consultation questionnaire.

Completed questionnaires can be returned as follows:

- Send it to us at our freepost address: **FREEPOST A2 Bean & Ebbsfleet junction improvements**
- Deposit the completed questionnaire at any of the 5 public exhibitions listed on page 13 of the consultation document
- Fill in the questionnaire online at: **www.highways.gov.uk/a2be**
- Email us: **A2BeanandEbbsfleetJunctionsImprovements@highwaysengland.co.uk**

Your views help shape the scheme. All consultation questionnaires received are formally recorded and in accordance with data protection your personal details are used solely in connection with the consultation process.

Equality and diversity

To ensure we are meeting our diversity guidelines please help us by filling in the following section of this questionnaire only if you are not responding on behalf of an organisation. You are not obliged to complete this; the information will only be used by Highways England to monitor its effectiveness at consulting with the whole community. This information will not be used for any other purpose and in publishing the results individuals will not be identified. **(Please tick the appropriate boxes)** ✓

15. Age

☐ Under 18 ☐ 18-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ Over 65

16. Gender

☐ Male ☐ Female ☐ Prefer not to say

17. Ethnic group

British or Mixed British

☐ English ☐ Irish ☐ Scottish ☐ Welsh ☐ Other (specify if you wish)

_____

South Asian

☐ Bangladeshi ☐ Indian ☐ Pakistan ☐ Other (specify if you wish)

_____

Black

☐ African ☐ Caribbean ☐ Other (specify if you wish)

_____

East Asian

☐ Chinese ☐ Japanese ☐ Other (specify if you wish)

_____

Mixed

☐ Please specify if you wish

_____

Any other ethnic background

☐ Please specify if you wish ☐ Prefer not to say

_____

18. Do you follow a religion or faith?

☐ Yes ☐ No ☐ Prefer not to say

19. Do you consider yourself to have a disability?

☐ Yes ☐ No ☐ Prefer not to say

Equality and diversity

If you need help accessing this or any other Highways England information please call **0300 123 5000** (24 hours) and we will help you.

Contact us

Please use the following methods to respond to the consultation:

- Complete the questionnaire and send to us at: **FREEPOST A2 Bean & Ebbsfleet junction improvements**

You can also:

- Attend a public consultation event and deposit your completed questionnaire at the event.
- Complete the consultation questionnaire online at: **www.highways.gov.uk/a2be**
- Email: **A2BeanandEbbsfleetJunctionsImprovements@highwaysengland.co.uk**
- Call: **0300 123 5000 (24 hours)**

The closing date for submitting this completed questionnaire is 11.45pm on 1 March 2017.

This document is also available on our website at **www.gov.uk/highways**

If you have any enquiries about this publication email **info@highwaysengland.co.uk** or call **0300 123 5000***. Please quote the Highways England publications code **PR177/16**

Highways England, Creative S160533

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Appendix B – Appraisal Summary Table

Appraisal Summary Table Version 3

Date produced:	14 August 2017

Contact:	
Name	Hugh Coakley
Organisation	Highways England
Role	Project Manager

Name of scheme:	A2 Bean and Ebbsfleet Junction Improvements - PCF Stage 2
Description of scheme:	Bean Option 5 combined with Ebbsfleet Option 1b

Impacts		Summary of key impacts	Assessment: Quantitative		Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme will benefit business users. About 1/3 of the journey time benefits occur to this group. Overall business benefit is reduced because of the impact of developer contributions	Value of journey time changes(£) £49.09m Net journey time changes (£): 0 to 2min £34.75m; 2 to 5min £14.20m; > 5min £0.14m			£32.18m	
	Reliability impact on Business users	Business users will benefit from around one half of the reliability impact				£5.15m	
	Regeneration	Quantative assessment not carried out at Stage 1. In view of the low journey time benefits, can be assumed at this stage to be neutral.			Beneficial		
	Wider Impacts	Wider Impacts were assessed at £22.5m for Stage 1. This analysis is carried forward to the Stage 2 Assessment , and raises the BCR from 1.7 to 2.2.	Agglomeration £18.85m Imperfectly Competitive Markets £0.60m Tax Revenue from Labour Market £3.04m			£22.49m	
Environmental	Noise	A slightly beneficial effect, the worst effects are felt along Shellbank Lane towards the south of Bean and Knockhall Road to the north of the A2. The majority of benefits are felt in Ebbsfleet along Springhead Parkway.	Overall 164 households are predicted to experience increased daytime noise in the forecast year, opposed to 19 households predicted to experience decreases in noise.		Slight Benefit	£0.26m	
	Air Quality	Predicted NO_2 and PM_{10} concentrations are below the AQS Objectives. Multiple AQMA's have been declared by Dartford (AQMA's No. 1-4) and Gravesham Borough Council (A2 AQMA) within the vicinity of the option. Based on current traffic flows, the highest modelled NO_2 concentration is 33.4µg/m³ , therefore the option is unlikely to lead to a significant impact on air quality. There is also unlikely to be a risk with regards to compliance with the EU Limit Values.	Local air quality modelling has been completed for worst case receptor locations using the DMRB screening tool at PCF Stage 2.		Slight Adverse	Not undertaken for PCF Stage 2.	Not required during PCF Stage 2.
	Greenhouse gases	There is predicted to be an increase in CO_2 emissions as a result of the Scheme as there is an increase in traffic. Emissions calculated using the Emission Factor Toolkit V7.	Change in non-traded carbon over 60y (CO2e), tonnes	57,948		-£2.66m	
			Change in traded carbon over 60y (CO2e), tonnes	0			
	Landscape	The scheme would have minor adverse change on landscape features and character, which are typical of the regional and local landscape character areas, such as the visual setting of Hope Cottages.			Slight Adverse		
	Townscape	The scheme would have slight adverse change on townscape features and character, which are typical of the regional and local townscape character areas, such as Hope Cottages.			Slight Adverse		
	Historic Environment	There is the potential for slight adverse effects to the setting of one scheduled monument (Darenth Wood) and moderate adverse effects to the setting of another scheduled monument (Springhead Roman Site). There is also the potential for slight adverse effects resulting from physical impacts to a number of undesignated heritage assets.			Slight Adverse		

	Biodiversity	Loss of small area of high value dormouse habitat. Localised loss or disturbance to other receptors, including possible loss of bat roosts.							Slight Adverse		
	Water Environment	The large majority of the Scheme is in the low risk flood zone (FZ1) and would result in no increase in surface water flood risk. Impacts to groundwater quality could occur due to proposed continued use of a drainage water infiltration ditch which lies on a SPZ1 at Bean junction, but pollution control measures would be added if not already in place. Where land contamination legacy issues are proven, remediation would be undertaken as part of the scheme and any other mitigation measures agreement in consultation with the regulator.							Neutral		
Social	Commuting and Other users	The scheme will benefit commuting and other users, who will receive around two thirds of the net benefit from travel time change.	**Value of journey time changes(£)**				£94.53m			£89.21m	
			Net journey time changes (£)								
			0 to 2min		2 to 5min		> 5min				
			£61.92m		£32.43m		£0.18m				
	Reliability impact on Commuting and Other users	Non business users will benefit from almost one half of the reliability impact								£5.04m	
	Physical activity	Changes in the number of pedestrians/cyclists/equestrians or their average journey times are anticipated to be insignificant.							Neutral		
	Journey quality	Traveller care, together with the nature and extent of travellers' views, would not alter significantly. Traveller stress would reduce. Journey quality is expected to improve, overall.							Moderate Beneficial		
	Accidents	It is estimated that 45 accidents will be saved over 60 year period of assessment. The causalities saved by scheme over the period are 5.1 serious and 46.7 slight, with a prediction that fatal accidents will increase by 0.8. This would appear to be a consequence of a minor increases in the distance driven on the surrounding road network.								£1.31m	
	Security										
	Access to services	Scheme is unlikely to have substantial impact on access to services.							Neutral		
	Affordability	It is expected that any affordability impact as a result of the scheme would be so marginal that it would be difficult to quantify.							Neutral		
	Severance	There would be little or no hindrance to pedestrian movement.							Neutral		
	Option and non-use values	Scheme would not affect transport mode options in the study area.							Neutral		
	Land use impact	11 cottages (Ightham Cottages) would have to be acquired, together with land associated with the Spirits Rest Horse Sanctuary and small parcels of land from land holders adjacent to the project extents.							Major adverse		
Public Accounts	Cost to Broad Transport Budget	The total construction cost is likely to be £70.18 million, in 2010 prices, discounted to 2010. This cost includes the effect of developer contributions of £15.12 million on the same price basis.								£70.18m	
	Indirect Tax Revenues	There is a disbenefit to government. Probably due to a reduction in congestion, fuel consumption is reduced slightly, thereby decreasing indirect tax revenues.								-£1.65m	