highways england

Road Investment Strategy
M25 Junction 25 Improvements
Technical Appraisal Report
November 2016

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Document control

The Project Manager is responsible for production of this document, based on the contributions made by his/her team existing at each Stage.

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Table of Abbreviations

AADT	Annual Average Daily Traffic
AIES	Assessment of Implications on European Sites
ALC	Agricultural Land Classification
AMCB	Analysis of Monetised Costs and Benefits Table
AOD	Above Ordnance Datum
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
AST	Appraisal Summary Table
ASR	Appraisal Specification Report
ATC	Automatic Traffic Counter
BAP	Biodiversity Action Plan
BCR	Benefits Cost Ratio
BBC	Broxbourne Borough Council
BGS	British Geological Survey
BMV	Best and Most Versatile Agricultural Land
BS EN	British Standard European Norm
CC	Command and Control System
CCTV	Closed Circuit Television
CDM	Construction Design Management
CLF	Cableless Linking Facility
COBALT	Cost and Benefit to Accidents Light Touch
CPS	Connect Plus Services
CPO	Compulsory Purchase Order
CSR	Client Scheme Requirements
DCO	Development Consent Order
DDS	Dynamic Display System
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DM	Do minimum
DMRB	Design Manual for Roads and Bridges
DNO	Distribution Network Operator (Electricity Supply)
DS	Do Something
EA	Environment Agency
EAR	Economic Assessment Report

EAST	Early Assessment Sifting Tool
ELV	Extra Low Voltage
ERA	Environmental Risk Assessment
ERT	Emergency Roadside Telephone
ESS	Entry Slip Signal
ESR	Environmental Study Report
ESSR	Environment Study Scoping Report
FWFD	Fresh Water Fisheries Directive
HAIL	Highways Agency Information Line
HATMS	Highways England Traffic Management System
HGV	Heavy Goods Vehicle
HPI	Habitat of Principal Importance
IAN	Interim Advice Note
ICCS	Integrated Communications Control System
IP	Internet Protocol (Ethernet)
KPI	Key Performance Indicator
LBE	London Borough Enfield
LDF	Local Development Framework
LEP	London Enterprise Panel
LGV	Light Goods Vehicle
LinSig	Transport modelling tool
LMVR	Local Model Validation Report
LNR	Local Nature Reserves
LP	London Plan
MCHW	Manual of Contract Documents for Highway Works
MET	Meteorological Subsystem
MIDAS	Motorway Incident Detection and Automatic Signalling
MOVA	Microprocessor Optimised Vehicle Actuation
MS4	Motorway Signal Mark 4
MSS	Message Sign Sub-system
MyRIAD	Motorway Reliability Incidents And Delays
NGAP	Northern Gateway Access Package
NNR	National Nature Reserves
NMCS	National Motorway Communication System
NMU	Non-Motorised User
NO_2	Nitrogen Oxide

NPV	Net Present Value
NRTS	National Roads Telecommunications Service
NRSWA	New Roads and Streetworks Act
NSIP	Nationally Significant Infrastructure Project
NTM	National Transport Model
NTIS	National Traffic Information Service
OA	Opportunity Area
OAPF	Lee Valley Opportunity Area Planning Framework
OGV	Other Goods Vehicle
OS	Ordnance Survey
PCF	Project Control Framework
PEEK	Traffic Signals Equipment Manufacturer
PM_{10}	Particles with diameter less than 10µg
PRoW	Public Right of Way
PTS	Professional and Technical Solutions
PTZ	Pan/Tilt/Zoom
PVB	Present Value of Benefits
PVC	Present Value of Costs
QUADRO	Queues and Delays at Roadworks
Ramsar	Convention on Wetlands
RCC	Regional Control Centre
RFC	Ratio of Flow to Capacity
RIS	Road Investment Strategy
RM	Ramp Metering
RSA	Road Safety Audit
RSI	Roadside Interview
RTMC	Regional Technology Maintenance Contractor
SAC	Special Area of Conservation
SCOOT	Split Cycle Offset Optimisation Technique
SEP	Strategic Economic Plan
SMI	Site of Metropolitan Importance
SMIS	Structures Management Information System
SPA	Special Protection Area
SPI	Species of Principal Importance
SPZ	Source Protection Zone
SRN	Strategic Road Network

SS	Signal Sub System
SSSI	Site of Special Scientific Interest
TAME	Traffic Appraisal Modelling and Economics
TA	Traffic Advisory Note
TAR	Technical Appraisal Report
TD	Technical Directive
TDCR	Traffic Data Collection Report
TEE	Economic Efficiency of the Transport System
TEMPRO	Trip End Model Projections
TfL	Transport for London
TFR	Traffic Forecasting Report
TLRN	Transport for London Road Network
TRADS	Traffic Information Database system
TUBA	Transport Users Benefits Appraisal
UTC	Urban Traffic Control
VISSIM	Transport modelling tool
VMS	Variable Message Sign
VMSL	Variable Mandatory Speed Limit
WebTAG	Web based Transport Analysis Guidance
WFD	Water Framework Directive

Executive summary

This study

This Technical Appraisal Report (TAR) draws together and summarises the technical analysis undertaken as part of the M25 Junction 25 PCF Stage 1, drawing on a range of multi-disciplinary supporting documents that have been referenced throughout.

In December 2014 the Department for Transport (DfT) published the Road Investment Strategy (RIS) for 2015-2020. The work confirmed the case for the need for an improvement at M25 Junction 25, and considered the options available to take forward to the options identification stage.

Based on the RIS statement, the scheme is described in the Client Scheme Requirements for Junction 25 as an "*upgrade of the junction between the M25 and the A10 at Cheshunt, providing greater capacity for traffic*".

The scheme is currently in PCF Stage 1 (option identification) and the phase objectives are therefore to:

- Identify options to be taken to public consultation
- Assess options in terms of environmental impact, traffic forecasts and economic benefits
- Refine the cost estimate of options (including an allowance for risk)

Study area

Junction 25 lies to the north of the M25 London Orbital on the border between Hertfordshire County to the north and the London Borough of Enfield to the south. Holmesdale Tunnel lies on the M25 to the east of Junction 25, which is at the intersection of the M25 and the A10 Great Cambridge Road in Waltham Cross.

The M25 section between Junctions 23 and 27 has recently been upgraded and is now running as a "smart" motorway. The hard shoulder has been converted for use as a permanent traffic lane.

Junction 25 itself is a 4-arm signalised roundabout with a three lane approach on all arms, including the eastbound and westbound M25 slip roads and the north and southbound A10. The circulatory carriageway varies between two and three lanes wide.

Strategic case

Based on the evidence review undertaken during PCF Stage 0, seven key problems were identified for Junction 25:

- Queueing back from junction onto mainline/Holmesdale Tunnel inhibits strategic M25 function
- High number of complaints (HAILs) raised mostly related to signal reliability and performance
- Poor junction performance (delays, reliability and queues)
- Comparatively high collision frequency identified at Junction 25
- Poor quality pedestrian/cycle facilities through Junction 25 inhibit potential usage
- Lack of spare junction capacity to support projected population and employment, inhibiting opportunities for all
- Sensitive environmental receptors identified in the vicinity of the Junction 25 associated with high traffic volumes, delay and a high proportion of HGV noise

Without appropriate intervention to improve the performance of Junction 25, each of these problems would be expected to deteriorate further in the future as traffic levels increase. This would result in significant consequences for the efficiency of traffic flow, road safety, network resilience and user satisfaction. Ultimately it will reduce the ability of the junction to perform its role in supporting local and regional aspirations for development and growth.

Project objectives

To address the identified issues and in alignment with local, regional, national policy and Highways England KPIs, the following scheme objectives have been developed:

- Reduce queueing (number of vehicles) on the junction and its approaches, particularly the Junction 25 off-slips adjacent to Holmesdale Tunnel being the highest priority
- Reduce the number of HAILs (particularly related to signal operation and performance)
- Reduce the average delay (time lost per vehicle per mile) through the junction
- Smooth the flow of traffic by improving journey time reliability through the junction
- Reduce annual collision frequency and severity ratio on both the gyratory and on the M25 slips
- Improve existing cycling, walking and other vulnerable user group connections across the M25 in the vicinity of Junction 25
- Support the projected population and economic growth in the area as identified in key policy documents
- Minimise environmental impact including reducing the impact of ground based traffic on air quality and noise pollution, specifically at local AQMAs (Teresa Gardens, Arlington Crescent and LBE) and identified Important Areas for Noise (Waltham Cross and Holmesdale Tunnel)

Option identification

PCF Stage 0 considered the available evidence, identified opportunities and constraints and aligned with Highways England Key Performance Specification Objectives (KPIs) and DfT Early Assessment Sifting Tool (EAST). A proportionate optioneering/sifting assessment was implemented in order to identify best performing solutions to take forward to PCF Stage 1. In summary, the assessment initially considered several Strategic Solutions before identifying and assessing Option Variants in further detail. In total three options were taken forward into PCF Stage 1.

Options considered under PCF Stage 1

Following the assessments carried out at PCF Stage 0, three options were developed that provide improvements at the junction:

- Option 1: widen the M25 J25 circulatory carriageway to three / four lanes throughout, widen the A10(N) Southbound entry to the roundabout, re-provide and improve the pedestrian/cycle facility that would be lost
- Option 2: Option 1 as described above plus widen the M25 East and West diverges, add segregated left turn M25 West to A10 North
- Option 3: Option 2 as described above plus segregated left turn A10 South to M25 West, widen A10(S) southbound on approach to Bullsmoor Lane junction to provide dedicated left turn lane between M25 and Bullsmoor Lane

Note that these options assume that a signal improvement would proceed (part of the catch-up signal technology programme).

The preferred scheme is to begin construction in 2020 and be open to traffic by 2022.

Summary of Assessments

The key findings of the assessment of the options for the M25 Junction 25 Improvements are highlighted below.

Value Management Workshop

A value management review has commenced under PCF Stage 1. This entailed a value management workshop to review the options being considered to deliver the M25 Junction 25 scheme objectives and to undertake an initial assessment of the options to assist the selection of options to be taken forward to PCF Stage 2 - Option Selection.

The table below shows that by a small margin, Option 2 is shown to offer the highest overall score. It offers the greatest value in achieving the project objectives and in terms of implementation.

Summary of the overall performance of Junction 25 RIS1 options

Option	Feasibility	Objectives	Implementation	Overall Score	RIS Costs
Option 1	6	3	5	**14**	Within budget
Option 2	4	5	6	**15**	Within budget
Option 3	2	6	4	**12**	Slightly over

Key to assessment scoring:

6 = Delivers the best of the options

5 = Not quite the best

4 = Nearer best than worst

3 = Between best and worst

2 = Nearer worst than best

1 = Not quite the worst

0 = Does not deliver

Traffic

The Do Minimum (DM) network (signal improvements only) will struggle to cope with the additional growth by 2022 across all time periods.

Option 1, as with the DM, is unlikely to cope with the additional growth. Benefits are restricted due to none of the approach arms being widened, limiting possible traffic throughput at Junction 25. This demonstrates that a more substantial scheme is required to tackle the congestion issues at the M25 Junction 25 (and Bullsmoor Lane).

Option 2 provides substantial benefits in the study area across a number of indicators:

- Overall Option 2 performs at similar levels to the Base Year network performance indicators despite there being 8 years' worth of growth in the network and the network being able to process higher flows.

- Substantial increases in the numbers of vehicles processed across most of the network.
- The best performing scenario for a few journey time routes and comparable with the Option 3 on a number of others.

Option 3 provides additional benefits:

- The Option 3 performs slightly better than Option 2 across all performance indicators and is the best performing across all options.
- Higher numbers of processed vehicles are forecast across most of the network than for Option 2.
- Is the best performing scenario for journey times along most routes, generally improving journey times compared to the Base Year despite increased vehicle throughput.

The 2037 assessment is similar to that for 2022 across all time periods and indicators. The DM and Option 1 are insufficient to cope with the additional growth by 2037 across all time periods.

Option 2 and Option 3 are the better performing options, with Option 3 performing marginally better.

As for 2022, Option 3 is the best performing option for the vast majority of journey time routes, with Option 2 forecast to perform similarly to Option 3 for most routes.

The scheme will also improve reliability for commuting and other users through the increased capacity provided which will improve the junction's resilience to incidents and reduce the scale of delay associated with incidents and lane closures.

Constraints

Option 3 requires incrementally more land take compared to Options 1 and 2. Option 1 land take is minimal whilst Options 2 and 3 are likely to require a Compulsory Purchase Order (CPO).

Local Air Quality Management Areas (AQMA) and Noise Important Areas close to the junction will be impacted upon by all options.

Engineering

Option 1 consists of minimal junction improvements and is overall the more feasible option. Options 2 and 3 require incrementally greater improvements, additional earthworks etc. Option 3 affects the existing access road to an aqueduct which is currently directly off the roundabout circulatory carriageway between the A10 northbound entry and the M25 westbound exit from the roundabout. For Option 3 the slip road will require widening as the standard cross-section for a motorway two lane merge also includes a hard shoulder. It is proposed that a Departure from Standard is then applied to reduce the two lanes on the slip road down to a single lane before the merge nosing at the end of the slip road, owing to existing constraints on the site.

Economic Assessment

Economic assessment of the impact of the options after opening was undertaken using information on trip numbers, time and distance through the junction for each vehicle type, time period and modelled year as forecast by the transport model. These outputs were then used in conjunction with the DfT's TUBA and COBALT programmes, assessing transport economic efficiency and accident savings respectively. The resultant estimate of impacts over a 60 year appraisal period shows that all three options perform strongly in economic terms, generating BCRs that can be considered to represent High Value for Money (Option 1) or Very High Value for Money (Options 2 and 3). However, the scale of benefits varies

considerably between options, with the PVB associated with Options 2 and 3 exceeding the PVB for Option 1 more than fourfold.

This differential arises primarily because a large proportion of the Do Minimum congestion at the junction arises from delay at the signalised pinch-points at the top of each off-slip from the M25. Option 1 does not offer a significant increase in capacity for traffic flow through these pinch-points and so cannot alleviate as much congestion as Options 2 and 3.

Additionally the more limited nature of the improvements in Option 1 means that the benefits achieved for some movements are generated at the expense of a (smaller) increase in delay on other movements. In particular the optimisation of signals at the junction improves levels of delay at the junction on average but causes some redistribution, particularly through increased queuing on the eastbound off-slips from the M25 which ultimately leads to queues onto the M25 mainline in the peak periods, affecting the journey times for the high volume of through traffic.

The table below summarises the overall option costs, benefits and BCRs.

Overall summary of economic assessment

Option	PVC	PVB	BCR
Option 1	£19,535	£70,312	3.6
Option 2	£22,727	£340,966	15.0
Option 3	£32,054	£424,004	13.2

All values in £000s and discounted in 2010 prices and values unless otherwise stated

Safety

All three options include for elements of junction widening, segregated left turn facilities and improvements to the A10 which should relieve congestion and contribute towards addressing safety issues associated with high traffic volumes. Option improvements consider visibility splays, additional space for street furniture, safety fencing, guardrails etc. to ensure accordance with current standards. A proposed new foot/cycle bridge over the M25 carriageways with associated subway refurbishment and upgrade works should enhance personal safety concerns of pedestrian/cyclists as well as slightly shorten their journey distance.

In terms of the economic assessment each option is forecast to slightly decrease accidents as a result of increased capacity and decreased conflicts.

Environmental Assessment

The table below compares the environmental impacts of the options. In large part many of these potential impacts are relatively minor and localised.

Summary of environment assessment AST results

Criteria	Option 1	Option 2	Option 3
Noise	Negligible	Potential minor increase	Potential minor increase
Air quality	Potential increase in pollutants	Potential increase in pollutants	Potential increase in pollutants
Townscape	Neutral	Slight adverse	Slight adverse
Heritage	Slight adverse	Slight adverse	Moderate adverse
Biodiversity	Slight adverse	Slight adverse	Slight beneficial
Water environment	Moderate adverse	Moderate adverse	Moderate adverse

Due to the incremental nature of the options, Option 1 would be the least environmentally damaging option in terms of nature conservation, cultural heritage, landscape and water environment. However, Option 1 would not provide opportunities for enhancement for biodiversity and landscape through land take and therefore from an enhancement perspective, Option 1 and then Option 2 would be the least preferred. All options will result in adverse impacts to noise sensitive receptors to varying degrees.

Option 3 is considered to be the least preferred in terms of impacts on people and communities, this option requires the largest land take over and above the previous options and would result in the potential loss of commercial business along Great Cambridge Road (Waterworld Aquatics Centre) while significantly effecting a planning application site at Kingswood Nurseries.

The traffic model for the opening year has shown that there are likely to be a number of roads affected with an increase in traffic, indicating a potential increase in pollutant concentrations at a number of nearby receptors.

Summary of option assessments – the need for a scheme

Whilst a degree of uncertainty always exists over economic growth, it is apparent that a high scale of growth is forecast across the immediate and the wider study area that will increase traffic on the entire orbital route and wider SRN. Junction 25 will potentially be most affected by growth in Broxbourne and Enfield and well as that associated with the Hertfordshire LEP and the Upper Lee Valley Opportunity Area.

This projected growth and related traffic increase will exacerbate existing problems at Junction 25; this has been demonstrated by traffic modelling undertaken in PCF Stage 1.

It is understood that the Signal Improvement Scheme will proceed prior to the RIS scheme, however evidence suggests that this is only a short term solution and that a longer term option to reduce traffic related impacts is required.

In summary the options identified each contribute to address the scheme objectives:

- Traffic modelling has demonstrated that junction performance would improve across all time periods and in 2022 and 2037.
- The economic assessment demonstrated High Value / Very High Value BCRs which included accident reduction benefits.
- Environmental assessments have demonstrated that possible adverse impacts could be managed through mitigation and opportunities for enhancement have been identified
- Pedestrian and cycle facilities would be improved.

This would contribute towards reducing queueing, average delay, smoothing the flow of traffic and would help support planned local and regional growth. In combination and alongside the Signal Improvement Scheme these factors would help to improve customer satisfaction and contribute towards reducing customer complaints.

Programme

An outline programme has been produced for the M25 Junction 25 Improvements scheme from PCF Stage 1 through to the commencement of PCF Stage 2 in November 2016 and the start of works in 2020 and scheme opening in 2022.

Recommendation of options for progression to PCF Stage 2 / public consultation

This PCF Stage 1 TAR sets out the current conditions and performance of M25 Junction 25 highlighting the need for improving the junction. The TAR summarises the traffic operational and safety issues with the current highway arrangement and confirms the case for improvements at this junction with a set of issue led project specific objectives.

The surrounding environment and key issues and constraints have also been identified, including environmental, technical and operational issues.

Three options have been identified to address the problems and achieve the project specific objectives. The extent to which these achieve the objectives, and offer value for money is discussed in more detail in the chapters below, based on the traffic, environmental and economic assessments.

It is therefore recommended that both options 1 and 2 are taken forward to PCF Stage 2 and Public Consultation. Option 3 is not to be taken forward for further consideration for two main reasons: a) although it is predicted to deliver a Very High value BCR, its capital expenditure is likely to exceed the budget limit of £30M, based on assumptions used in PCF Stage 1; b) both options 1 and 2 are more dedicated at delivering improvements for A10 at Cheshunt, making them more closely aligned to project objectives.

1 Introduction

1.1 Introduction

In December 2014 the Department for Transport (DfT) published the Road Investment Strategy (RIS) for 2015-2020. The work confirmed the case for the need for an improvement at M25 Junction 25, and considered the options available to take forward to the options identification stage. The scheme is defined as an "*upgrade of the junction between the M25 and the A10 at Cheshunt, providing greater capacity for traffic*".

Possible design solutions for schemes named in the RIS were identified through the route strategies process run by Highways England. That process included the collation of evidence of network performance issues, and local stakeholders and interested parties were engaged with on the problems, issues and the potential range of solutions.

In 2015, Atkins Ltd were commissioned by Highways England to compile existing and new information and to produce the necessary documentation for PCF Stage 0 (Strategy, Shaping and Prioritisation). This work culminated in the recommendation of developing the preferred strategic-level option i.e. online improvements to the existing junction.

Atkins Ltd have been commissioned to undertake PCF Stage 1: Option Identification, which commenced in November 2015. Highways England provided an updated 'Client Scheme Requirements' (CSR) which highlights the needs and objectives of the scheme (document reference: Stage_0_CSR_M25_Jn25_-_Signed.pdf, dated 14 March 2016). As part of PCF Stage 1 this has been updated (document reference: Stage1_M25_J25_Client_Scheme _Requirements.pdf).

The need to address existing and future issues at Junction 25 is well established and potential improvements at the junction have been indicated in several previous studies, including:

- Delivering Strategies 'Broxbourne Transport Modelling', MVA (2010)
- Cheshunt and Waltham Cross A10 Study, Mouchel (2011)
- M25 Junction 25 / A10 Great Cambridge Road Roundabout Improvement Study Report, Atkins (2015)

1.2 Timeframe

Drawing on the available evidence and identified opportunities and constraints and aligned with Highways England Key Performance Specification Objectives (KPIs) and DfT Early Assessment Sifting Tool (EAST), a proportionate optioneering/sifting assessment was implemented in order to identify best performing solutions to take forward to PCF Stage 1. Three Options and a Do minimum (DM) have been developed and are described further in section 5.

Recognising the early stage of project development, from inception to delivery it is assumed that all Options are deliverable within the RIS timeframe. Scheduled start of works is currently set at March 2020, with the scheme opening to traffic in March 2022. There is a possibility that Options 1 and 2 could be 'fast-tracked' prior to the RIS timeframe.

Table 1-1 sets out the timeframe over which the scheme will develop from the current stage through to construction (taken from the Client Scheme Requirements).

Table 1-1 Scheme timeframe within RIS1

Stage	Phase	From	To
1	Option phase	10/2015	10/2016
2		11/2016	06/2017
3	Development phase	072017	06/2018
4		07/2018	05/2019
5		05/2019	03/2020
6	Construction phase	03/2020	06/2021
7		07/2021	06/2022

1.3 Scheme context

The M25 Junction 25 lies to the north of the M25 London Orbital on the border between Hertfordshire County to the north and the London Borough of Enfield to the south. Holmesdale Tunnel lies on the M25 to the east of Junction 25, which is at the intersection of the M25 and the A10 Great Cambridge Road in Waltham Cross.

A high north-south traffic flow on the A10 conflicts with strategic traffic on the M25. This is also disrupted by the busy signal crossroads at Bullsmoor Lane only a few hundred metres away.

Congestion and delay at Junction 25 have implications for the wider M25 network, with queuing back onto the junction impacting upon through traffic on the M25 (Holmesdale Tunnel). Further detail about the scheme context can be found in the existing conditions Section 0.

1.4 Purpose of the Technical Appraisal Report (TAR)

This TAR summarises the technical aspects of the existing highway problems and describes how a suitable scheme could solve them. The existing highway network in the study area, existing traffic conditions, and the condition of the surrounding environment and landscape are described.

The planning factors that affect the potential scheme are summarised along with a description of alternative options previously considered and reasons for their rejection. Shortlisted options are considered including assessments of how they support local Planning Policies, assessments of the environmental impacts, traffic and economics factors, and outlines a proposed programme to achieve the Scheme objectives. The TAR describes the option(s) for consultation.

1.5 Structure of this report

The TAR report is arranged in 16 chapters following this introduction, supported by a number of appendices.

- Chapter 2 summarises key aspects of the consultant's brief and the objectives of the project
- Chapter 3 describes the existing conditions, primarily relating to traffic, engineering and environmental aspects
- Chapter 4 sets out the planning factors which have influenced the development of the Junction 25 scheme options
- Chapter 5 introduces the scheme options considered, including sections on the development of options in previous work and a description of the route options set out full appraisal

- Chapter 6 presents a detailed engineering assessment of junction options, identifying anticipated engineering difficulties, including a summary of the vertical and horizontal geometry, operational issues, and works to existing and new structures
- Chapter 7 summarises the traffic analysis undertaken, and presents traffic forecasts for use in the option development, environmental assessments and economic appraisal of the Junction 25 options
- Chapter 8 summarises the economic assessment
- Chapter 9 summarises the initial safety assessment
- Chapter 10 summarises the assessment of the on- and off-road technology requirements of the project
- Chapter 11 provides an early assessment of the implications of the scheme on the future maintenance regime
- Chapter 12 presents a summary of the assessment of environmental impacts
- Chapter 13 provides a summary assessment of the scheme options, including the Appraisal Summary Tables (ASTs) for the options
- Chapter 14 provide the current programme for the scheme development and implementation
- Chapter 15 concludes the report with a summary of the key findings and recommendation for the subsequent stages of the project, and confirms those options to be taken forward further consideration and consultation in PCF Stage 2.

The report also contains the following appendices:

- Appendix A – Existing utilities
- Appendix B – PCF Stage 0 variant options scoring
- Appendix C – Environmental constraints plan
- Appendix D – Option cross sections
- Appendix E – Option 1: layout and land take
- Appendix F – Option 2: layout and land take
- Appendix G – Option 3: layout and land take
- Appendix H – Options estimates
- Appendix I – Appraisal Summary Tables
- Appendix J – Programme
- Appendix K – Accident analysis

2 Planning brief

2.1 Phase objectives

The scheme is currently in PCF Stage 1 (option identification) and the phase objectives are therefore to:

- Identify options to be taken to public consultation
- Assess options in terms of environmental impact, traffic forecasts and economic benefits
- Refine the cost estimate of options (including an allowance for risk)

2.1.1 Transport objectives

To address the identified issues and in alignment with local, regional, national policy and Highways England KPIs, the following scheme objectives have been developed:

- Reduce queueing (number of vehicles) on the junction and its approaches, particularly the Junction 25 off-slips adjacent to Holmesdale Tunnel being the highest priority
- Reduce the number of HAILs (particularly related to signal operation and performance)
- Reduce the average delay (time lost per vehicle per mile) through the junction
- Smooth the flow of traffic by improving journey time reliability through the junction
- Reduce annual collision frequency and severity ratio on both the gyratory and on the M25 slips
- Improve existing cycling, walking and other vulnerable user group connections across the M25 in the vicinity of Junction 25
- Support the projected population and economic growth in the area as identified in key policy documents
- Minimise environmental impact including reducing the impact of ground based traffic on air quality and noise pollution, specifically at local AQMAs (Teresa Gardens, Arlington Crescent and LBE) and identified Important Areas for Noise (Waltham Cross and Holmesdale Tunnel)

In addition, the following objectives should also be considered in order to optimise value for money and deliverability. The scheme should:

- Make best use of existing infrastructure providing additional capacity within the existing highway boundary
- Avoid the need for further capacity improvements for at least 10 years post-opening i.e. be a mid to long term solution
- Provide good value for money
- Feasible and deliverable within the RIS timeframe
- Look to minimise the impact on the surrounding highway network (e.g. TfL and Hertfordshire)
- Support and enhance the role of the M25 as a major national and inter-urban regional transport artery
- Improve biodiversity if the opportunity exists

2.2 Strategic need

As well as providing a solution to the specific scheme objectives, an M25 Junction 25 scheme can be seen to be supportive of a number of other national and local policies.

The M25 has been shown to have a widespread geographical function, therefore national, regional and local policy has been reviewed. Clearly the requirement for intervention at Junction 25 is consistent with many of these policies. A number of issues have been identified, including a reliance on the A10 local network (which does not have a north/south bus service and suffers from congestion) to connect employment and residential areas. A strong relationship between Hertfordshire and London is outlined in the Hertfordshire Strategic Economic Plan (SEP), clearly dependent on good access through the M25, particularly at Junction 25 with congested infrastructure identified as a potential barrier. The Upper Lee Valley emphasises that good access to the M25 is essential in supporting freight movements and business aspirations.

Nationally there is a requirement for the DfT to invest in and maintain the trunk road network, whilst making the roads less congested and polluted and maintaining high standards of safety. These themes are reiterated in regional and local policy objectives.

The policy documents, including the Hertfordshire Local Enterprise Partnership (LEP), the Hertfordshire SEP, Enfield Plan Core Strategy, the London Plan and the Broxbourne LDF are in general support of new transport infrastructure in order to address existing and future issues that constrain economic development.

Other consistent themes include improving public transport provision, minimising environmental impacts, enhancing quality of life, and improving safety and opportunities for all. New infrastructure should clearly align with these themes.

Another key theme is the requirement to support a high degree of medium and longer term economic growth in the wider and immediate Junction 25 area. This is consistent across a number of policy documents and spatial plans. In the wider area, the orbital route is subject to considerable projected housing and employment growth, driven by a number of London Opportunity Areas (OA) and growth corridors. In the local area Junction 25 is in close proximity to growth areas in Hertfordshire and the north London OA at Upper Lee Valley.

Whilst a degree of uncertainty always exists over economic growth, Junction 25 will potentially be most affected by:

- An increase of an additional 50,000 homes and 17,500 jobs by 2021 and 60,000 homes and 33,600 jobs by 2031[1]
- The residential / commercial Upper Lee Valley OA development (20,100 homes and 15,000 jobs)[2]
- An additional 1,200 homes between 2016 and 2021[3]
- The Enfield Core Strategy indicates that the borough is planning for a population increase from 285,100 (2006) to 309,500 (2026), during which 11,000 new homes and 6,000 jobs will be created[4]

It is clear that additional stress will be exerted on Junction 25 and the connecting local road network. Without intervention, existing transport related problems will be exacerbated and economic growth constrained.

[1] London Orbital and M23 to Gatwick Route Strategy Evidence Report Technical Annex, Highways England, April 2014
[2] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/opportunity-areas/opportunity-areas/upper-lee-valley
[3] Broxbourne Local Development Framework Submission Core Strategy, Borough of Broxbourne, 2010
[4] The Enfield Plan Core Strategy 2010-2025, Enfield Council, 2010

2.2.1 Highways England Business Plan

The Highways England Business Plan (2014) sets out the outcomes, KPIs and associated targets within the RIS1 plan period. As a primarily congestion-relieving scheme, the key objectives are to encourage economic growth and support the smooth flow of traffic.

2.2.2 DfT's Roads Investment Strategy

The Department for Transport's Roads Investment Strategy: Performance Specification details eight areas for improved performance including three particularly relevant to this project:

- Encouraging economic growth
- Supporting the smooth flow of traffic
- Making the network safer

2.3 Current problems and issues

The following problems and issues at M25 Junction 25 were identified at PCF Stage 0:

- Queueing back from junction onto mainline/Holmesdale Tunnel inhibits strategic M25 function
- High number of complaints (HAILs) raised mostly related to signal reliability and performance
- Poor junction performance (delays, reliability and queues)
- Comparatively high collision frequency identified at Junction 25
- Poor quality pedestrian/cycle facilities through Junction 25 inhibit potential usage
- Lack of spare junction capacity to support projected population and employment, inhibiting opportunities for all
- Sensitive environmental receptors identified in the vicinity of Junction 25 associated with high traffic volumes, delay and a high proportion of HGV noise

3 Existing conditions

3.1 Description of the locality

The M25 Junction 25 location is shown in Figure 3-1.

Figure 3-1 Location of M25 Junction 25

A number of towns are located in the vicinity of the junction, including Waltham Cross and Cheshunt to the north, Waltham Abbey to the east and Enfield to the south. As well as being part of the London Orbital, Junction 25 links Hertfordshire with north and central London, connecting the towns of Broxbourne, Hoddesdon, Hertford and Ware to London thus providing regional access to these towns.

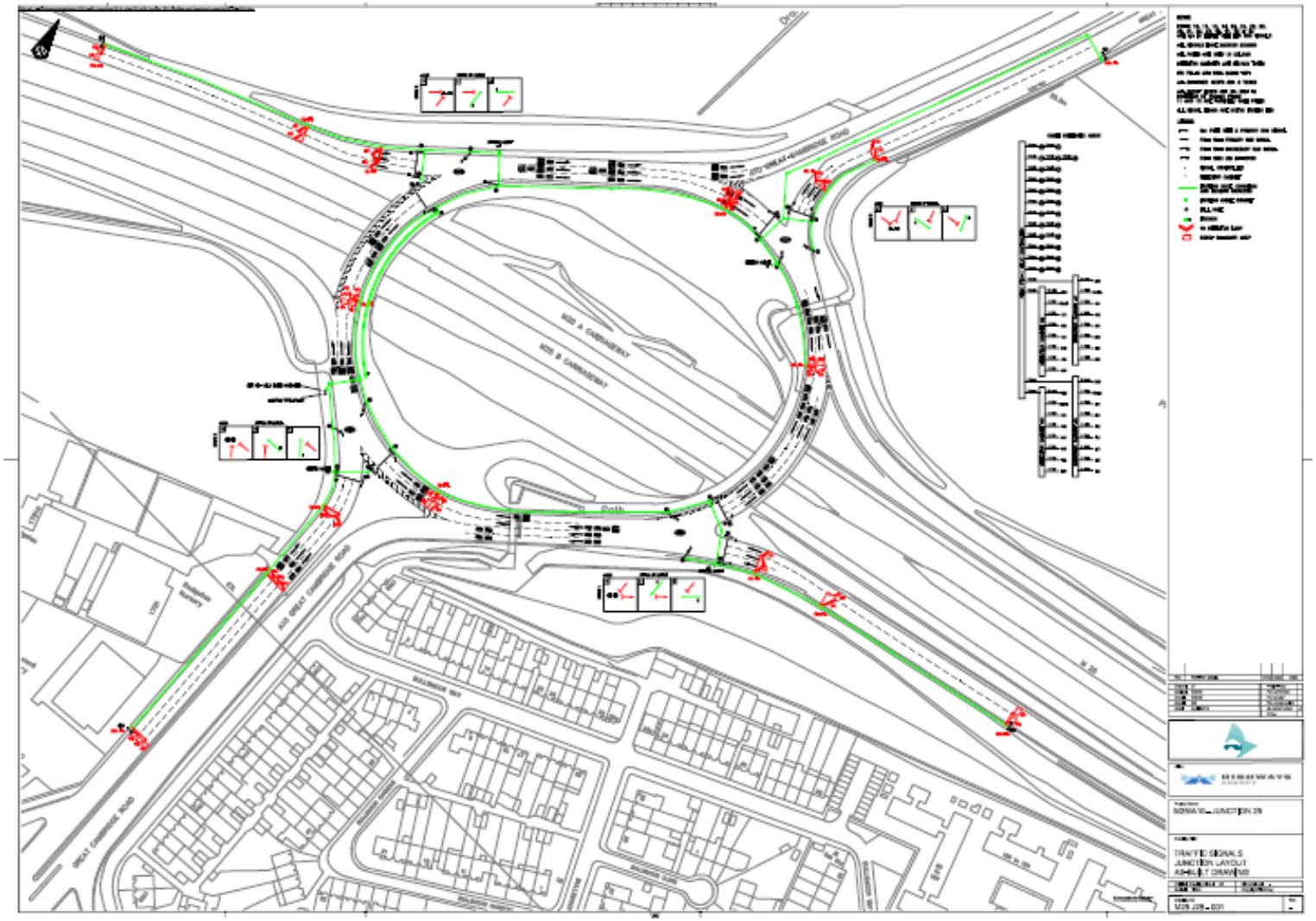
In close proximity of the junction, approximately 800m to the north is a commercial development at Park Plaza, accessed by a signal controlled junction. To the north, the A10 Great Cambridge Road connects with the A11 at Cambridge.

3.2 Existing highway network

The M25 section between Junctions 23 and 27 has recently been upgraded and is now running as a "Smart" motorway which comprises the conversion of hard shoulder for use as a permanent traffic lane.

Junction 25 itself is a four-arm signalised roundabout with a three lane approach on all arms, including the eastbound and westbound M25 slip roads and the north and southbound A10. The circulatory carriageway varies between two and three lanes wide, see Figure 3-2.

Figure 3-2 Detailed junction drawing

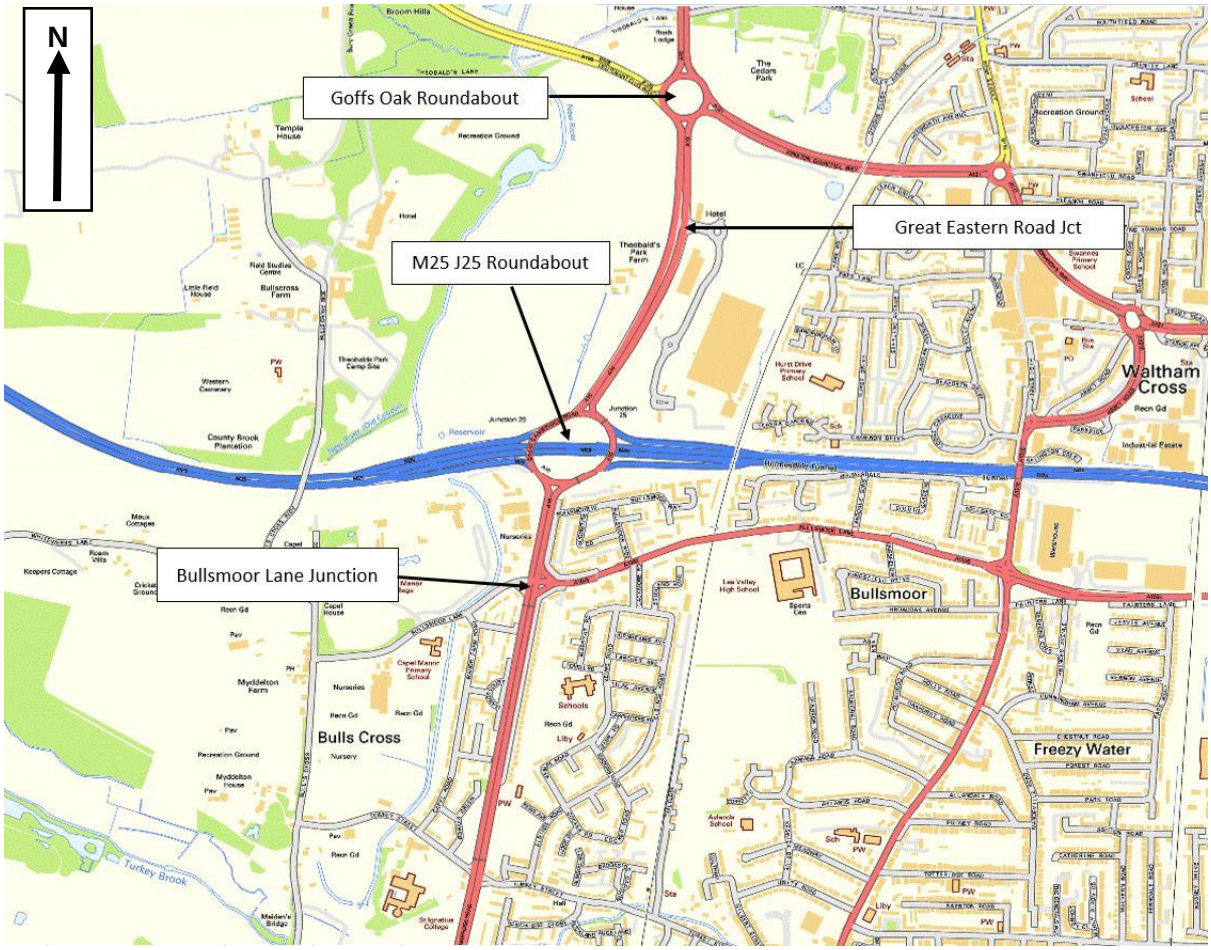


The A10 south of Junction 25 forms part of the Transport for London Road Network (TLRN). To the north of Junction 25, the A10 is maintained by Hertfordshire County Council as the highway authority.

The wider network is shown for context in Figure 3-3. The other key junctions in the study area are:

- **Goffs Oak Roundabout** – a 4-arm roundabout consisting of the A10 (north and south arms), the A121 Winston Churchill Way (east arm) and B198 Lieutenant Ellis Way (west arm)
- **Great Eastern Road Junction** – a signalised 3-arm junction located between Goffs Oak roundabout and the M25 junction 25. It consists of Great Eastern Road (east arm) and the A10 (north and south arms)
- **Bullsmoor Lane Junction** – a 4-arm signalised junction consisting of the A10 (north and south arms) and Bullsmoor Lane (east and west arms).

Figure 3-3 M25 Junction 25 location plan



Source: Contains Ordinance Survey Data Crown Copyright and Database Rights 2012

3.3 Traffic

3.3.1 Previous studies

A literature review undertaken at PCF Stage 0 determined the following regarding the existing traffic situation[5]:

- The M25 between Junction 24 and Junction 25 has been identified as being the 93rd busiest link on the Strategic Road Network (SRN) with an Annual Average Daily Traffic (AADT) of 66,422.
- In general, the north quadrant, particularly from Junction 21a to 27 has a high proportion of freight traffic. Goods vehicles account for an average of 26% of all traffic over this section.
- Given the regional function of the A10, it carries high volumes of through traffic.

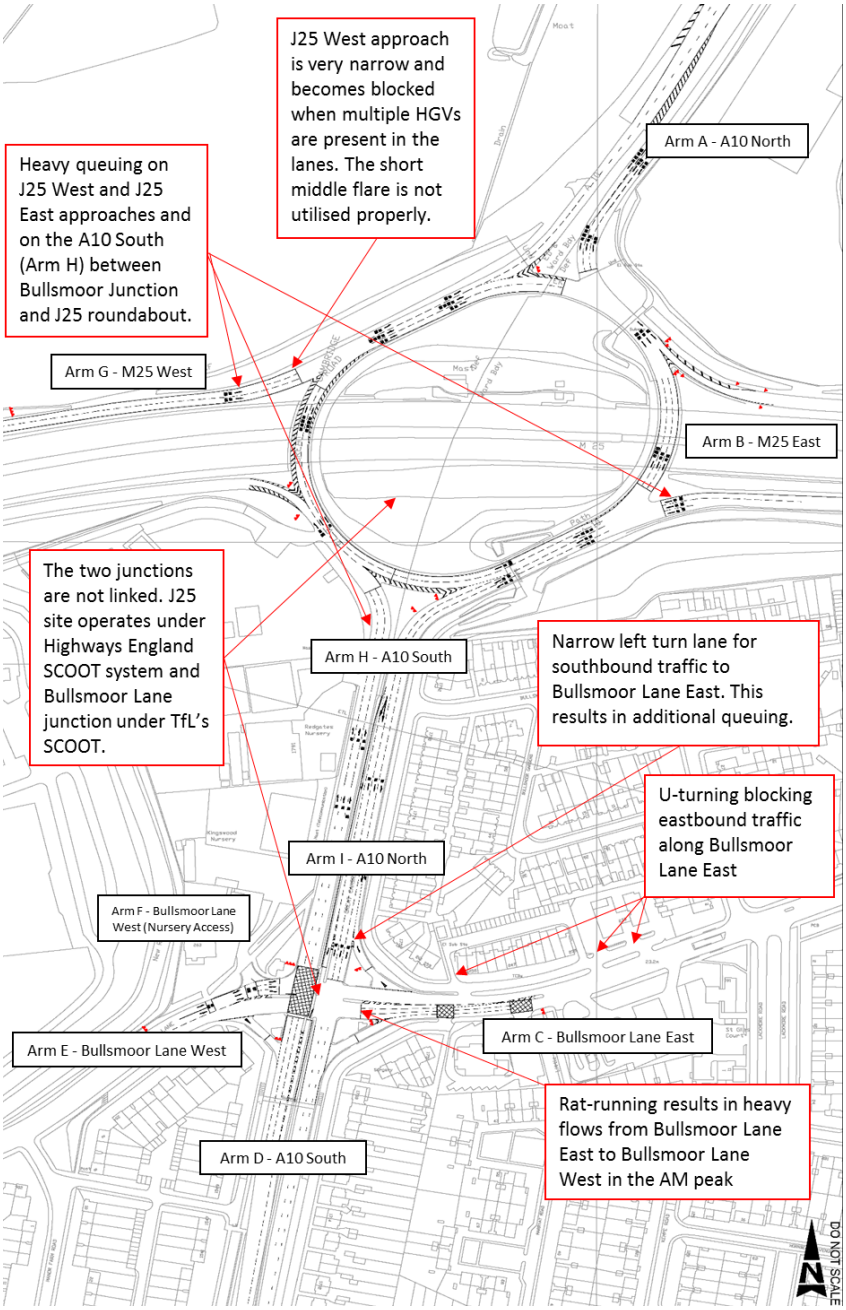
Several studies identify capacity issues at Junction 25:

- The Junction is a significant constraint in the wider highway network, and increased local demand could increase congestion problems on the M25 and in Enfield. On the local road network there is general congestion on the A10, especially during peak hours and at the major junctions.[6] [7]
- Junction 25 has 'key junction capacity issues'[8]. Additionally it is over capacity, leading to local congestion and potentially affecting nearby growth areas.
- Other modelling studies identify congestion at Junction 25[9]. Also the A10 southbound approach to Junction 25 was identified as one of a number of congestion hotspots within the borough[10].
- An Atkins study based on survey data and observations in December 2014, summarised key Junction 25 issues[11]. Observations and operational issues are indicated in Figure 3-4. Base Year modelling work undertaken as part of the study indicates that the junction operates over capacity with long queues and delays during the AM and PM peaks.

Projected growth, and related traffic increase will likely exacerbate existing problems at Junction 25 and a solution is required to reduce traffic related impacts.

[5] London Orbital and M23 to Gatwick Route Strategy Evidence Report Technical Annex, Highways Agency, 2014
[6] Cheshunt and Waltham Cross Urban Transport Plan, Appendix Volume 1, Hertfordshire County Council, 2010
[7] Upper Lee Valley Opportunity Area Planning Framework, Mayor of London, 2013
[8] London Orbital and M23 to Gatwick Route Strategy Evidence Report Technical Annex, Highways Agency
[9] Sustainability Appraisal of the Broxbourne Local Plan, Scoping Report, Lepus Consulting, 2012
[10] The Sustainable Transport Study, MVA Consultancy, 2008
[11] M25 J25 / A10 Great Cambridge Road Roundabout Traffic Modelling Assessment Study, Atkins, 2015

Figure 3-4 Junction 25 and Bullsmoor Lane observations and identified issues



3.3.2 Existing traffic situation – data analysis

The Traffic Data Collection Report (TDCR) provides a high level overview of existing traffic conditions based on a number of identified data sources in the modelled study area.

The available traffic data ranges from between 2010 and 2014 and across a number of months. Factors were derived and applied to the turning count data to bring it all to a consistent point in time (November 2014). Section 5.2 of the TDCR outlines how these factors were derived in order to achieve a consistent basis for all traffic flows and thereby to support VISSIM Base Year traffic models described in section 7.

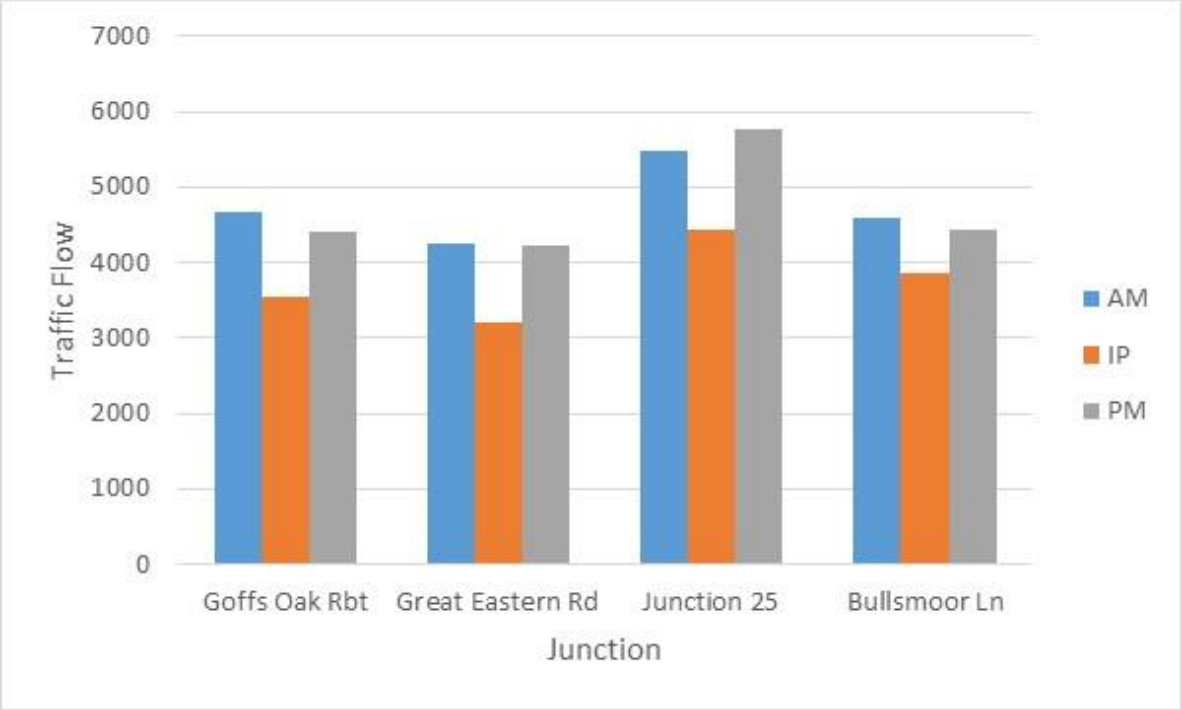
The data was used to calculate the peak hours as being:

- AM peak hour - 07:30 – 08:30

- PM peak hour - 16:00 – 17:00
- IP peak hour - an average of the period 10:00 – 16:00.

Figure 3-5 shows the total factored traffic flow across each junction in the modelled area, with the AM peak being highest overall. Traffic is slightly higher at the M25 Junction 25 in the PM peak hour.

Figure 3-5 Total traffic flow by junction and peak hour



Key traffic movements through the Bullsmoor Lane, Great Eastern Road and Goffs Oak junctions are predominantly between the A10 (N) and A10 (S) in both directions during all peak periods.

The main M25 Junction 25 traffic movements are also between the between A10 (N) and A10 (S) in both directions. Additionally M25 Junction 25 experiences substantial flows (over 500 vehicles per hour):

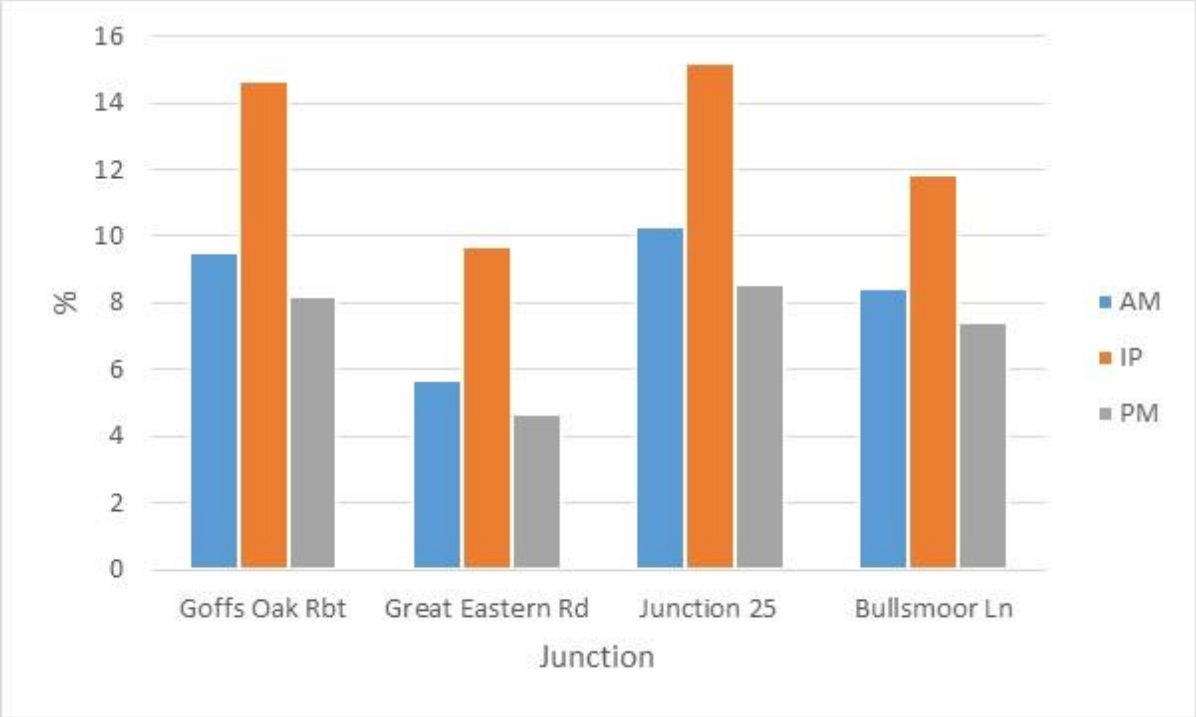
- From M25 (W) to A10 (N) – 899 and 725 vph in the AM and PM peak respectively
- From A10 (S) to M25 (W) – 592 vph in the AM peak
- From M25 (E) to A10 (N) – 593 vph in the PM peak
- From A10 (N) to M25 (W) – 612 vph in the PM peak.

Heavies[12] account for between 7% (PM peak) and 13% (Inter peak) of the overall traffic in the modelled area.

Figure 3-6 shows that, by junction, the heavies proportion varies from 5% at Great Eastern Road junction (PM peak) to 15% at the M25 Junction 25 and Goffs Oak Roundabout (both Inter peak).

[12] For consistency, data was classified as being 'Lights' (Cars / Taxis / LGVs) or 'Heavies' (MGVs / OGV1 / OGV2 / HGVs)

Figure 3-6 Total 'heavies' % by junction and peak hour



The highest individual HGV volumes experienced are those northbound on the A10 through Goffs Oak Roundabout (27% of all traffic in the Inter peak) and from the A10 (N) into Bullsmoor Lane (E) (27% of all traffic in the Inter peak).

A high level and indicative link flow / capacity analysis (drawing upon TRL Report RR67) was undertaken for the key approaches to M25 Junction 25 and is shown in Table 3-1. The flow/capacity ratios indicate that the off-slip approaches to M25 Junction 25 are close to or over capacity for all time periods whilst the A10 approaches appear to have some spare capacity. As stated these are indicative tests to sense check the data, which broadly reflects that there are capacity issues at the junction.

Table 3-1 Link capacity assessment for M25 Junction 25

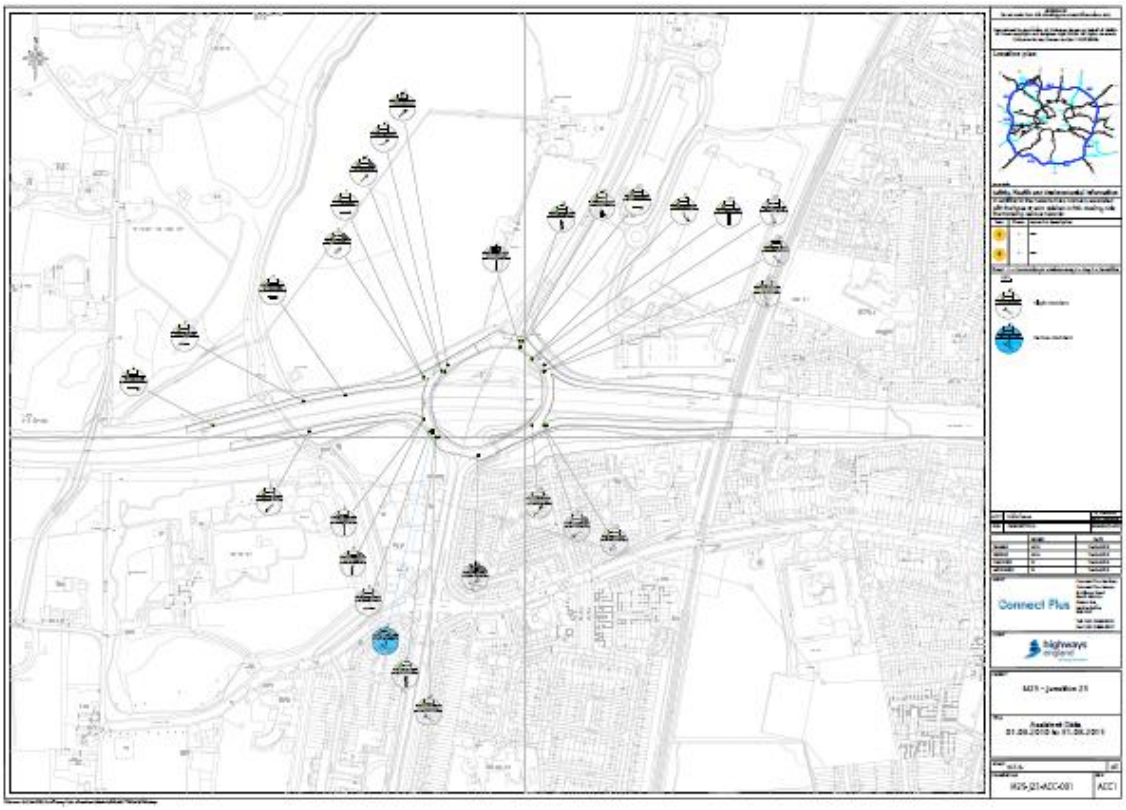
Link	Lanes	Approximate Sat Flow (RR67)	Time Period	Signal % Green Time	Theoretical Capacity	Existing Traffic Flow	Ratio of Flow / Capacity
M25 Eastbound Off-Slip	2	3,800	AM	23	874	1,410	1.61
			IP	30	1,140	980	0.86
			PM	30	1,140	1,324	1.16
M25 Westbound Off-Slip	2	3,800	AM	23	874	846	0.97
			IP	20	760	681	0.90
			PM	20	760	9,22	1.21
A10 (S) Northbound	3	5,700	AM	38	2,166	1,777	0.82
			IP	41	2,337	1,715	0.73
			PM	38	2,166	2,054	0.95
A10 (N) Southbound	3	5,700	AM	48	2,736	2,068	0.76
			IP	45	2,565	1,838	0.72
			PM	45	2,565	2,012	0.78

3.4 Accidents and journey time reliability

3.4.1 Accidents

The latest available 5 years (September 2010 to August 2015 inclusive) of collision data for the M25 Junction 25 has been sourced from CPS and is shown in Figure 3-7.

Figure 3-7 M25 Junction 25 - 5 years collision data



In summary there were 28 collisions at Junction 25 (including the slip roads), averaging 5.6 per year. There was one collision in 2010, peaking at 11 in 2011 and only 6 in the last 2 years.

The 28 collisions resulted in 34 casualties and 66 vehicles, none were fatal and only one (3%) was classified as serious, this is well below the average expected on a motorway (1.7% fatal and 12% serious 2014[13]).

Table 3-2 summarises the collisions by SRN junction between Junction 24 and 26.

Table 3-2 Comparison of collisions

Section	Slight	Serious	Fatal	Total	Per year
M25 Junction 24	18	0	0	18	3.6
M25 Junction 25	27	1	0	28	5.6
M25 Junction 26	2	0	0	2	0.4
Total	47	1	0	48	9.6

[13] DfT Reported accidents by speed limit, road class and severity, Great Britain, 2014

A summary of the 28 collisions' accident characteristics at Junction 25 is provided in Appendix K:

- 18% occurred in wet conditions
- 18% in dark conditions
- Half of the casualties occurred in the inter peak period (10:00 to 16:00), with 7 occurring between 10:00 and 11:00. 5 casualties occurred in the PM peak hour.
- Of the 66 vehicles involved 23 (35%) were HGVs
- The predominant vehicle manoeuvres were going ahead other (33 i.e. 50%) and stopping (30 i.e. 45%)

In terms of cluster locations 24 collisions occurred at the roundabout:

- 9 accidents occurred on the roundabout between the A10 (N) stop-line and the M25 Junction 25 eastbound on slip. Of these all occurred in daylight and 2 in wet conditions:
  - 8 (89%) involved goods vehicles
  - 7 (78%) involved rear collisions of which 6 involved goods vehicles
  - 2 involved vehicles changing lanes of which both involved goods vehicles
- 6 accidents occurred on the roundabout between the A10 (S) stop-line and the M25 Junction 25 westbound on slip. One of these was serious, 1 occurred in dark and 1 in wet conditions:
  - 4 (67%) involved goods vehicles
  - 2 (33%) involved vehicles changing lanes, 1 passing too closely, 1 overtaking, 1 rear collision and 1 vehicle swerving to avoid an accident
- 5 collisions occurred on the roundabout between the M25 Junction 25 eastbound off slip and the A10 (N). Of these, one occurred in dark and all in dry conditions:
  - 4 (80%) involved a goods vehicle
  - 3 (60%) involved rear collisions, 1 vehicle passing too close and 1 changing lanes
- 4 collisions occurred on the roundabout between the M25 Junction 25 westbound off slip and the A10 (S). Of these 1 was in dark conditions and 1 in wet conditions:
  - 2 (50%) involved goods vehicles and 2 (50%) motorcycles
  - 2 (50%) involved vehicles changing lanes, 1 overtaking and rear collision

In summary a large number of collisions (18 i.e. 75%) at the roundabout involved a goods vehicle, particularly between the A10 (N) stop-line and the M25 Junction 25 eastbound on slip. This should be considered as the design is progressed in PCF Stage 2.

3.4.2 Journey time reliability

TomTom data reflecting weekday conditions between September and November 2014 was analysed to understand journey times along specified routes within the study area. Figure 3-8 summarises the average vehicle speeds for 12 'full traversal[14]' journey time routes for the peak periods (see TDCR and Figure 7-4 to Figure 7-8 for details of routes).

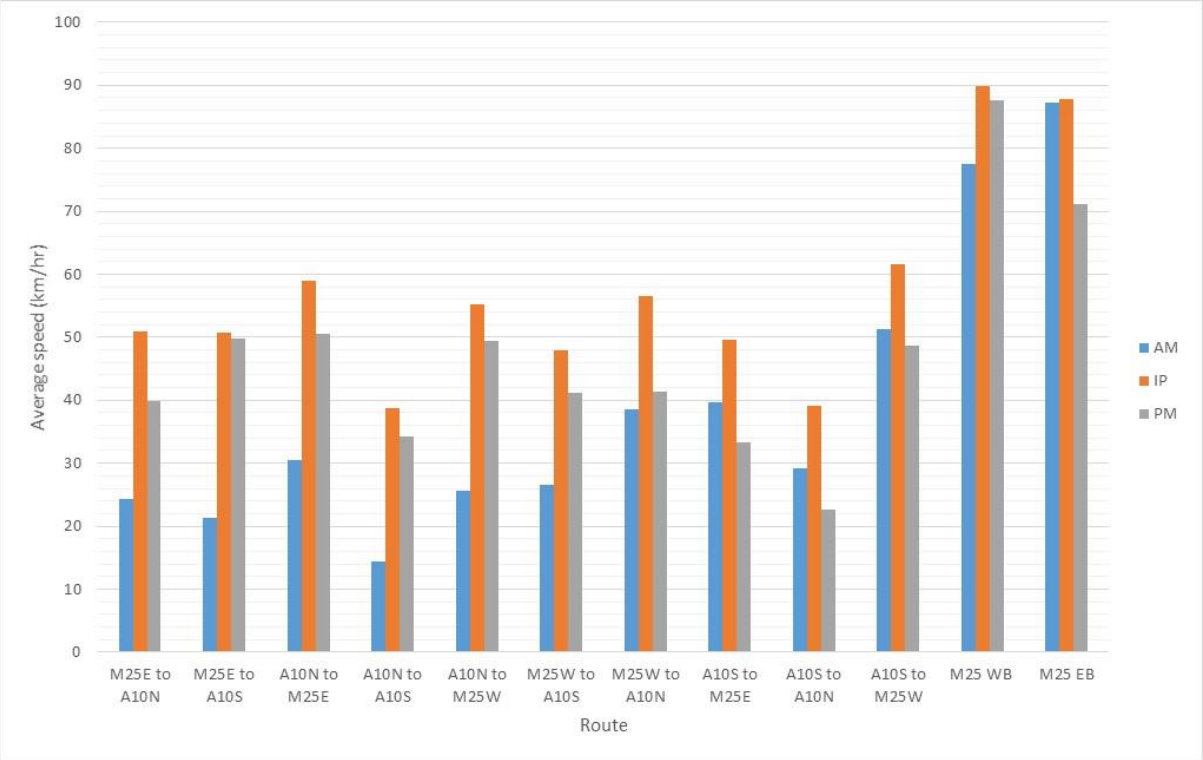
The AM peak hour speeds are consistently the lowest across most routes, other than those from the A10(S) and M25 EB main carriageway where the PM peak speeds are the slowest.

The best performing routes are the M25 EB and WB main carriageway, with average speeds above 70kph in all peak periods. The slowest speeds are generally associated with the

[14] Full traversal queries only include vehicles that made the whole 'A to B' vehicle movement in the sample. Full traversal queries facilitate high data accuracy when different movements at junctions are likely to experience different delays

movements between the A10 (N) and A10 (S). The M25 (E) to A10 (S) average vehicle speed is also notably slow in the AM peak.

Figure 3-8 TomTom average vehicle speeds (kph) – AM, Inter and PM peak

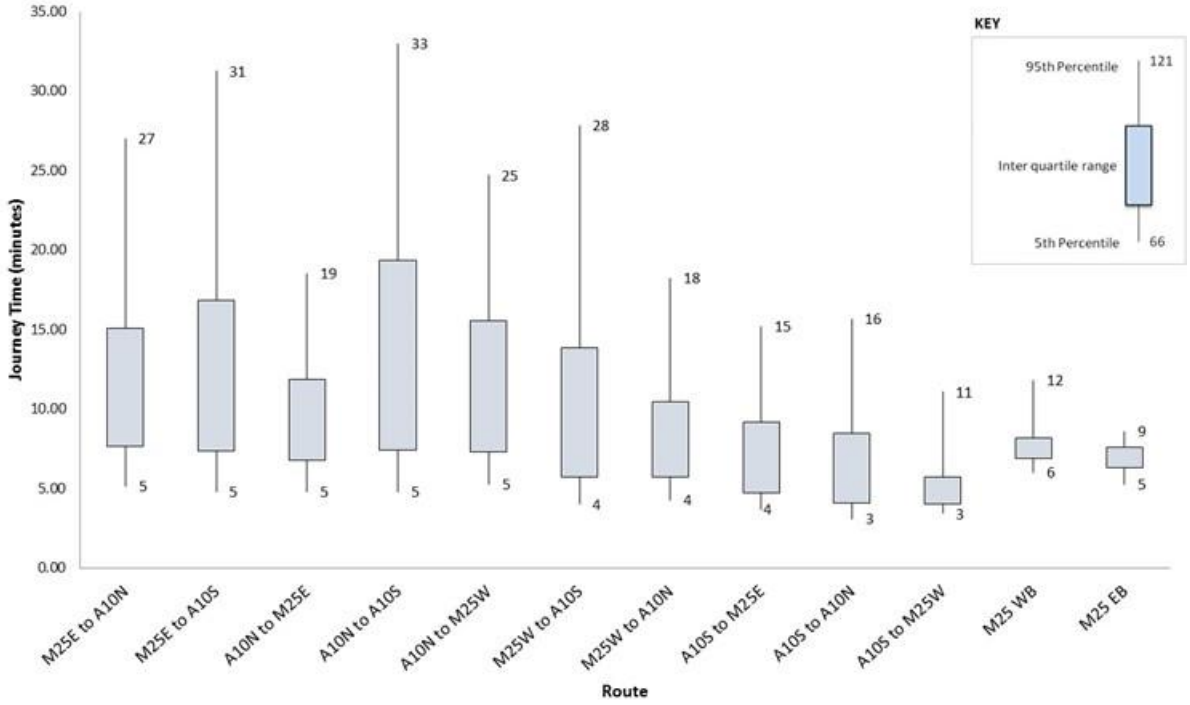


3.4.3 Journey time variability

The AM peak period has the most variable journey time performance (see Figure 3-9), with large inter-quartile ranges. There is generally a much larger difference between the 5th and 95th percentile journey time values on most arms with the largest spread being:

- A10 (N) to A10 (S) - 28 minutes
- M25 (E) to A10 (S) - 26 minutes
- M25 (W) to A10 (S) - 24 minutes
- M25 (E) to A10 (N) - 22 minutes

Figure 3-9 TomTom journey time reliability (kph) – AM peak



Whilst the extent of the difference between the 5th and 95th percentiles is generally lower in the PM peak than the AM peak, some arms also experience substantial variability:

- A10 (S) to A10 (N) - 21 minutes
- A10 (S) to M25 (E) - 18 minutes
- M25 (W) to A10 (N) - 14 minutes

The M25 westbound journey time varies by 3 minutes with all other arms ranging between 7 and 12 minutes variance.

3.5 Topography, land use, property and industry

3.5.1 Topography

The M25 Junction 25 is situated in low lying ground within the Lee Valley which lies in a north to south orientation at this location. Ground levels at the junction are around 25m Above Ordnance Datum (AOD) and the New River, which is a tributary of the Lee lies just to the west of the roundabout. Between the Lee and New River there is little variation in topography with the built up area of Waltham Cross slightly elevated above both watercourses. To the west of the New River the ground gently rises to a ridge of higher ground at a maximum elevation of around 100m AOD. To the south the Cuffley Brook runs east west to join the Lee at Enfield Lock.

3.5.2 Land use

There are number of towns located in the vicinity of the junction, including Waltham Cross and Cheshunt to the north, Waltham Abbey to the east and Enfield to the south. As well as being part of the London Orbital, Junction 25 links Hertfordshire with north and central London, connecting the towns of Broxbourne, Hoddesdon, Hertford and Ware to London, thus providing regional access to these towns.

Approximately 300m to the south of Junction 25 there is the residential area of Bullsmoor. In close proximity of the junction, approximately 800m to the north is a commercial development at Park Plaza.

3.5.2.1 Agricultural land

According to Natural England Regional Agricultural Land Classification Maps, the western section of the site falls within an area classified as a Grade 3 (good to moderate quality land). The south western section of the site falls within an area classified as land predominantly in urban use.

3.5.2.2 Residential, commercial and industrial properties

Junction 25 is surrounded by a mixture of privately owned uses including agricultural land, residential, commercial and industrial land:

- To the south east of Junction 25 are residential dwellings located along Great Cambridge Road access road.
- A residential estate 'Bullsmoor Way' is located south east of Junction 25 and is bound by the M25, A10, railway and Bullsmoor Lane.
- To the south west of Junction 25 are various commercial properties including Red Gates Nursery, Walton Lodge Veterinary Clinic and Waterworld Aquatics Centre along the A10 Great Cambridge Road.
- Residential properties are located behind the commercial properties (above) along the A10 near to the New River.
- A small shopping parade is located along Bullsmoor Lane close to the junction with the A10.
- To the north east of Junction 25 are the Park Plaza employment land including the Newsprinters print works and Travelodge located along Great Eastern Road.
- To the east of Junction 25 is a Network Rail owned railway line and bridge over the M25.
- To the west of Junction 25 is a Thames Water owned aqueduct carrying the New River over the M25.
- The areas to the south, east and north east are predominately residential containing the suburb of Bullsmoor in Enfield and the settlement of Waltham Cross in Broxbourne.

3.5.2.3 Community land

There are a number of parks and formal open spaces within the 750m search area (Aylands Open Space and Holmesdale Tunnel Open Space). In Bullsmoor there is a playground contained within the Aylands Open Space. None of these community facilities are located within the land required for the proposed development. There are no areas designated as Open Access Land under the Countryside and Rights of Way Act (2000).

Within Bullsmoor there are 4 schools (Lea Valley High School, Honilands Primary School and Capel Manor Primary School and College) and Waltham Cross contains 3 education facilities (Hurst Drive Primary School, Greenfield Nursery School and Rivers Education Support Centre). Bullsmoor has a library and Theobalds Park contains a place of worship and cemetery (Western and West End Great Synagogue and Cemetery).

3.6 Climate

M25 Junction 25 lies in the Southern England climate zone, which is typified by an altitude which is generally less than 100m and covers from Kent westwards to Wiltshire and Dorset.

Climate information is available from Meteorological Office[15] data averaged over a 30 year period from 1981 to 2010. The closest weather station is Hampstead. The average annual rainfall is 704.5mm per annum, peaking in October with a monthly average of 77.7mm.

[15] http://www.metoffice.gov.uk/public/weather/climate

Annual average sunshine is 1,540 hours per annum ranging from 200 hours in July to 52 hours in December. Average temperatures range from an average maximum of 22.4°C in July and 22.0°C in August, to an average minimum of 1.7°C in February.

3.7 Drainage

The existing drainage system has been identified to be a kerb and gully system on the roundabout circulatory carriageway and the approaches to the junctions under consideration. This has been identified through visual observation. There are no existing culverts within the extents of the junctions. There are records of flooding and poor drainage systems in Holmesdale Tunnel.

3.8 Geology

Baseline information was gathered from the readily available sources as well as an Envirocheck Report purchased from Landmark Information Group on 22 June 2016, held by Atkins and presented in Appendix I of the Environmental Study Report (ESR).

Geological mapping identifies that superficial deposits are expected in the study area, although they are indicated to be absent throughout the majority of Junction 25.

Made Ground is expected to be associated with construction of the M25 and A10, in particular, forming the embankments on which the network is built upon.

The superficial geology of the Enfield Silt Member is generally present throughout Junction 25. Undifferentiated River Terrace Deposits and Kempton Park Gravel Formation are also present in the surrounding areas with extensive Alluvium present to the east of the Junction 25 that is associated with the River Lee. Alluvium may be present along the New River to the west of the M25 Junction 25.

The bedrock geology is anticipated to comprise the London Clay Formation which is present throughout Junction 25.

A summary of the anticipated geology within Junction 25 is shown in Table 3-3 below.

Table 3-3 Summary of anticipated geology

Type	Period	Group	Formation	Member	BGS Description
Artificial Ground	-	-	-	Made Ground	Man-made superficial deposit with variable composition on natural ground surface. Expected to localised and associated with construction of the M25 and A10.
Superficial	Quaternary	-	-	Alluvium (Holocene)	Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present.
		Thames Catchment Subgroup	Maidenhead Formation	Enfield Silt Member (Devensian)	Varies from silts to clay. Commonly yellow to brown in colour and massively bedded. Rests on River Terrace Deposits.
				Kempton Park Gravel Member (Devensian)	Sand and gravel, locally with lenses of silt, clay and/or peat. Overlays London Clay Formation.
				Taplow Gravel Member (Wolstonian)	Sand and gravel, locally with lenses of silt, clay and/or peat. Overlays London Clay Formation.
		-	-	River Terrace Deposits (undifferentiated)	Sand and gravel, locally with lenses of silt, clay and/or peat.
Bedrock	Palaeogene	Thames Group	London Clay Formation	-	Mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. Commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occurs in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels.

3.9 Mining

The following sources were used to assess mined areas within the vicinity of Junction 25:

- British Geological Survey (BGS): 'Mining Access Portal' (accessed 08 June 2016).
- British Geological Survey (BGS): 'Coal Authority Interactive Map' (accessed 08 June 2016).
- British Geological Survey (BGS): 'Hertfordshire and NW London Boroughs Mineral Resources Map'.

The British Geological Survey 'Coal Authority Interactive Map' and 'Mining Access Portal' (BGS 2016e and 2016f) does not present data within Junction 25. Coal and deep mining activities are not expected within Junction 25.

The British Geological Survey 'Mineral Resources Map' (Benham et al., 2003) records one "inactive (including sites not yet worked), worked-out and/or restored site" mineral working sites within 500m of Junction 25. The identified inactive mineral working site Theobolds Lane (sand and gravel) is located 250m northeast of the northern extent of Junction 25 on the A10.

3.10 Public utilities

Public Utility companies have been contacted to ascertain whether any of their services lie within the existing road corridor or may be affected by the proposed works. These companies are summarised in PCF Stage 1 product - M25 Junction 25 Statutory Undertakers Estimates.

A summary of the existing utilities are:

- BT Openreach - Buried and overhead apparatus is shown running in the western verge of the A10, south of the roundabout.
- UKPN (electricity) – High Voltage apparatus is shown to run from 2 substations located west of the roundabout, in the verge, carriageway and road.
- National Grid (Gas) - Buried Liquid Petroleum apparatus is shown to run in the western verge of the A10, south of the roundabout and in the far eastern footpath of Great Cambridge Road.
- Thames Water (Water supply) - Buried 600mm potable water distribution main is shown running in the western verge of the A10, south of the roundabout, through the verge of the bridge and into the verge of the A10 north.
- Vodafone - An existing telecoms mast is shown to the west of the A10 to the south of the junction.
- O2 Telecoms Mast - An existing telecoms mast is shown to the west of the A10 to the south of the junction.
- GeneSYS – Existing National Roads Telecommunications Services (NRTS) telecoms are shown in the verges of the slip roads.

For more details of existing utilities in the area see drawing HE551518-ATK-HGN-ZZ-DR-D-0021 in Appendix A.

3.11 Environmental status

M25 Junction 25 lies within an area of urban fringe land to the north of London. There are a variety of surrounding land uses comprising open space, agricultural land (designated as grade 3 - good to moderate quality), roads and residential/light commercial/institutional properties. There are four Air Quality Management Areas (AQMAs) designated in the area and exceedances of limit values recorded. There are a number of Noise Important Areas within the study area and the wider area, the main ones being Holmesdale Tunnel and two at Waltham Cross. A number of noise sensitive buildings lie within 600m.

Although it lies within the greenbelt, the area is not of high landscape value and already has a number of major roads that detract from the visual environment. M25 Junction 25 itself has large areas of residential properties to the south east that could be affected by visual impacts from the improvements.

The River Lee Country Park is located approximately 1.2km away. The area immediately surrounding M25 Junction 25 is not of notable ecological value though there are internationally designated areas in the Lee Valley just over 2km to the north east.

3.12 Environment

The conditions presented in the sub-sections below are derived from the Environmental Study Scoping Report (ESSR) that was carried out in July 2016.

3.12.1 Noise

The land use within 600m of the M25 Junction 25 is generally residential, with commercial properties dispersed across the area and agricultural land to the north west of the junction. The closest residential buildings, which are sensitive noise receptors, are located at Bullsmoor Way and Great Cambridge Road, approximately 30m from the M25 Junction 25. There are several non-residential noise sensitive receptors within 600m of the junction, including Lea Valley High School, Western and West End Synagogue, Hurst Drive Primary School, Honilands Primary School, Capel Manor Primary School and Capel Manor College. Residential receptors near to M25 Junction 25 Improvements are shown in Figure 3-11.

A baseline noise survey has not been undertaken at this stage, however noise surveys were completed close to the study area in 2015 for a Smart Motorways scheme. Although the survey positions are outside of the study area they provide an initial overview of baseline noise levels in the area. The measured noise levels from the 2015 surveys are presented in Table 3-4 and a map of the measurement locations is shown in Figure 3-10. The dominant source of noise at the measurements positions was noted to be road traffic noise, from the M25 motorway.

Table 3-4 Noise Measurements for Smart Motorways

Measurement Address	Approximate distance to Junction 25	Survey Dates	LAeq,16hour, (07:00 – 23:00)	LAeq,8hour, (23:00 – 07:00)
26 Arlington Crescent, Waltham Cross	1km	30/01/15 – 09/02/15	71.1	67.4
Guys Lodge Farm, Whitewebbs Lane	1.5km	02/03/15 – 13/03/15	78.3	75.6

Figure 3-10 Smart Motorway noise monitoring locations

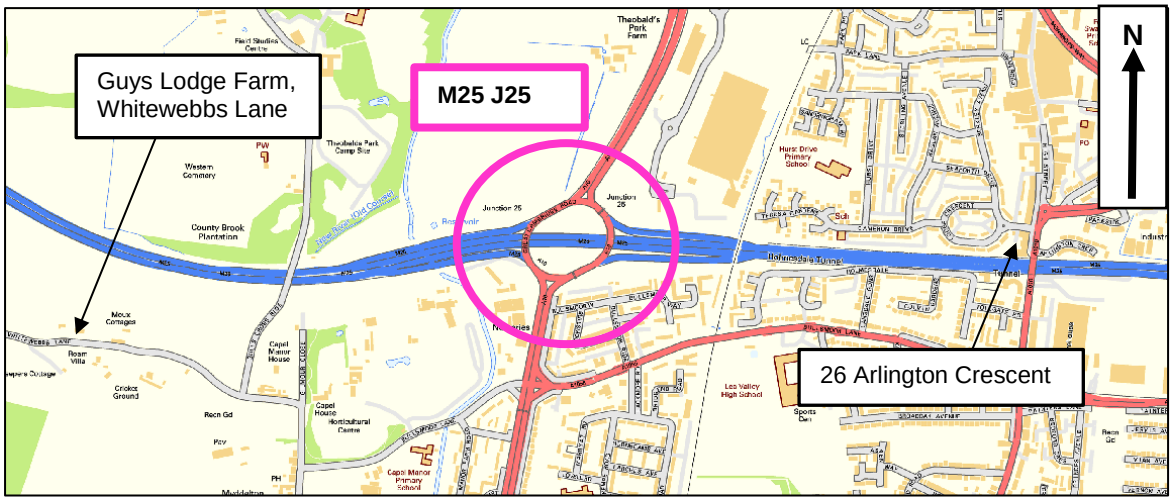


Figure 3-11 Residential locations near M25 Junction 25

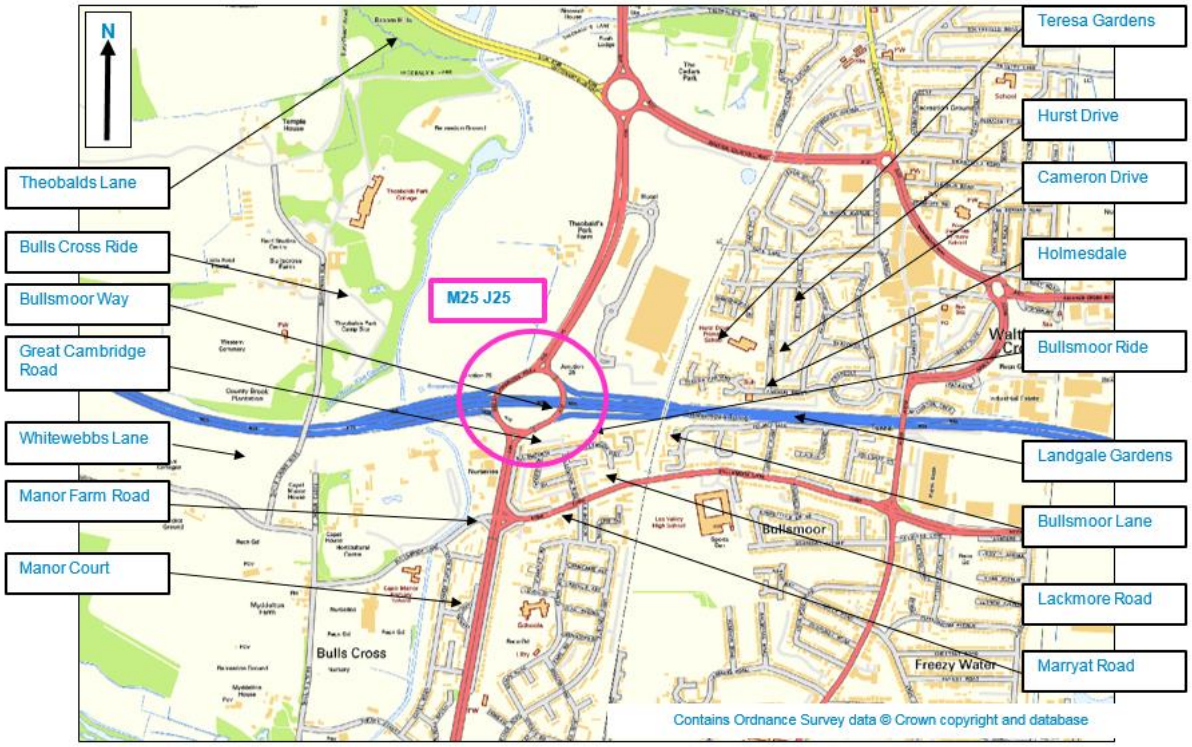
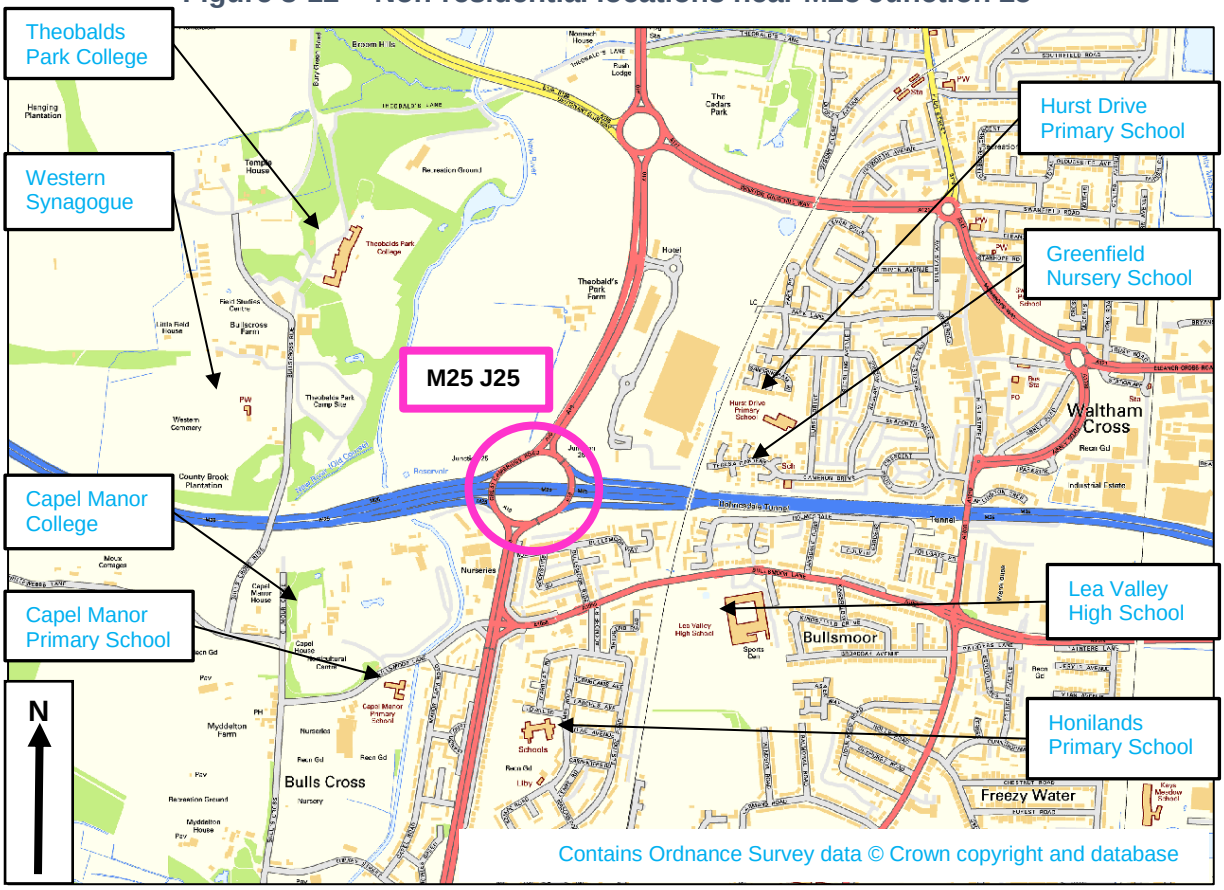


Figure 3-12 Non-residential locations near M25 Junction 25



Strategic noise maps were published during 2015 by Defra for major road and railway sources to meet the requirements of the Environmental Noise Directive (Directive 2002/49/EC) and the Environmental Noise (England) Regulations 2006 (as amended). The strategic noise maps for road traffic noise during the daytime (07:00-23:00) and night-time (23:00-07:00) periods are shown in Figure 3-13 and Figure 3-14. There are a number of Noise Important Areas within the study area and the wider area covering Waltham Cross and the Holmesdale Tunnel. These are centred on sections of the M25 and the A1010 leading to Waltham Cross Railway Station and shown on the figures below.

Figure 3-13 Defra Round 2 Environmental Noise Maps - Road Noise LAeq,16h (07:00-23:00)

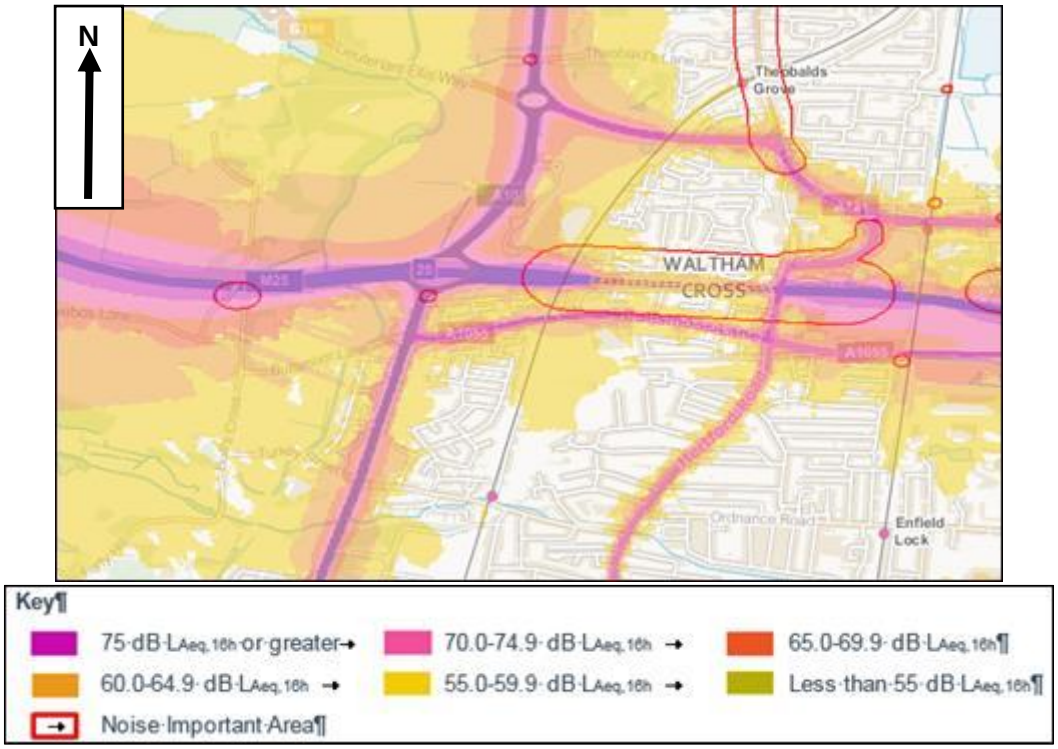
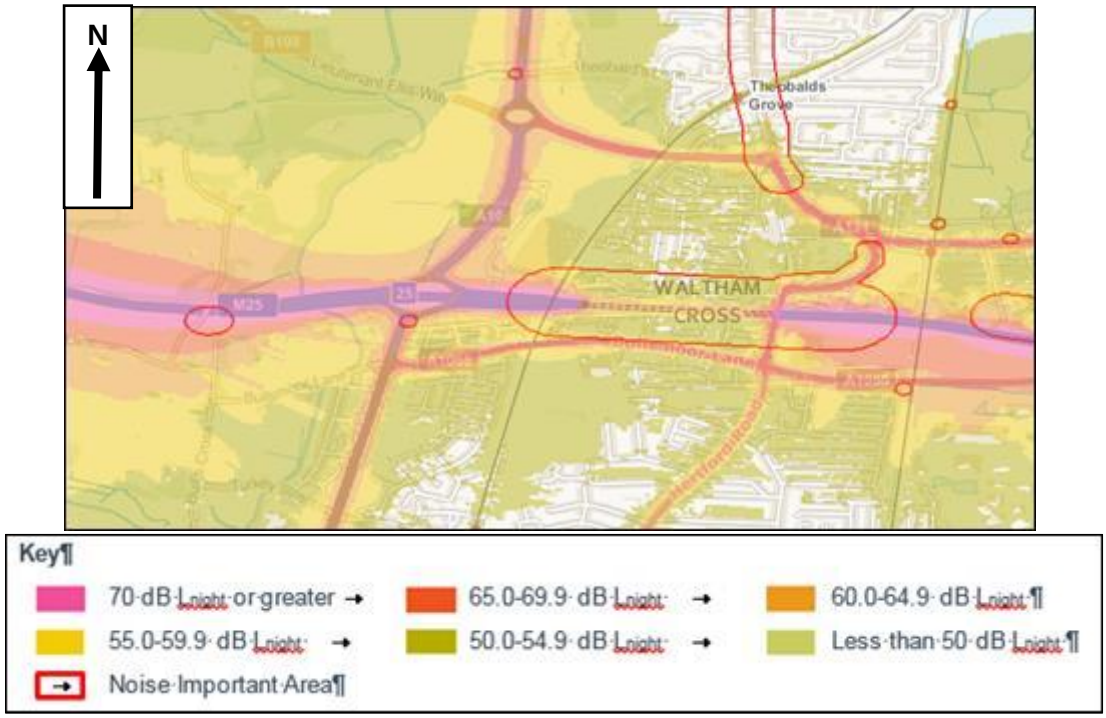


Figure 3-14 Defra Round 2 Environmental Noise Maps - Road Noise Lnight (23:00-07:00)



Road traffic noise from the M25 and A10 dominate the study area, particularly areas west of the A10 where the land is less developed and there are fewer obstacles screening road traffic noise. At the closest residential areas to the M25 or A10, the strategic noise maps show that daytime noise levels exceed 65dB LAeq,16h and night time noise levels are above 60dB Lnight. Lower noise levels are shown at the tunnelled section of the M25 at Waltham Cross, where road traffic noise levels at adjacent properties are at least 60dB LAeq,16h and 55dB Lnight.

3.12.2 Local air quality

Baseline data for the pollutants of concern (NO_2 and PM10) were compared to relevant ambient air quality criteria for the protection of human health, namely limit values set by the EU and transposed in to UK law by The Air Quality Standards Regulations 2010 and objectives set in the UK National Air Quality Strategy (AQS).

The local air quality criteria relevant to the air quality assessment for the proposed scheme options are summarised in Table 3-5.

Table 3-5 Relevant Air Quality Criteria (Human Health)

Pollutant	Criteria
NO_2	Hourly average concentration should not exceed 200 µg/m3 more than 18 times a year
	Annual mean concentration should not exceed 40 µg/m3
PM10	24-hour mean concentration should not exceed 50 µg/m3 more than 35 times a year
	Annual mean concentration should not exceed 40 µg/m3

M25 Junction 25 is on the boundary of London Borough of Enfield (LBE) with Broxbourne Borough Council (BBC).

The whole of LBE has been declared an AQMA due to exceedances of both the annual mean UK Air Quality Strategy (AQS) objective for NO_2 and the 24-hour mean UK AQS objective for PM10.

BBC has three AQMAs, all located along the M25 corridor. AQMA1 is located at the eastern limit of Holmesdale Tunnel and comprises residential properties, which are sensitive receptors, including Arlington Crescent, Parkside and numbers 13 to 21 High Street, Waltham Cross. It was declared for exceedance of the annual mean UK AQS objective for NO_2 and exceedances of the 24-hour mean UK AQS objective for PM10. AQMA2, declared for exceedances of the annual mean UK AQS objective for NO_2, is located at the western end of Holmesdale Tunnel and comprises residential properties, numbers 33 to 55 Teresa Gardens, Waltham Cross. AQMA3, Tile Kiln Cottage on Burnt Farm Ride, was declared due to exceedances of the annual mean UK AQS objective for NO_2. It is located within 200m of the M25, though over 3 kilometres west of M25 Junction 25, on the edge of the study area.

BBC propose to extend AQMA1 northwards as far as number 64 High Street, Waltham Cross, and east of the Abbey Road roundabout to include a number of residential properties, which are sensitive receptors on Abbey Road. BBC also propose to declare a further two AQMAs in Waltham Cross due to exceedance of the annual mean NO_2 UK AQS objective of 40 µg/m3. AQMA4 would include areas at the northern end of Abbey Road, and areas around the Monarch's Way Roundabout, including parts of Eleanor Cross Road. AQMA5 would comprise the Winston Churchill Way roundabout and Monarch's way. Both proposed AQMAs are approximately 850m and 780m from the western portal of Holmesdale Tunnel and the eastern A10 on-slip at M25 Junction 25 respectively.

Areas of elevated pollutant concentrations are indicated by BBC/LBE passive monitoring in Waltham Cross and Cheshunt (up to 77ug/m3 in 2014) and Defra's NO_2 PCM mapping on Waltham Cross High Street, south of Abbey Road, and south towards the A1055/A1010 intersection in Bullsmoor.

In terms of air quality receptors, to the north west of the junction lies agricultural land, to the south west lies Capel Manor the horticultural college. An industrial facility lies to the north east, and residential receptors extend south and eastwards of the junction and either side of the Holmesdale Tunnel. There are receptors very close to the westbound off-slip to the A10. Lea Valley High School and Hurst Drive Primary school are within 200m of the M25.

3.12.3 Landscape

M25 Junction 25 is located within the urban area of Waltham Cross to the east and a rural and wooded area to the west. There are no designated landscapes near Junction 25. River Lee Country Park is located approximately 1.2km away.

Forty Hall (Grade II) Registered Park and Garden (1.5km), Myddelton House (Grade II) Registered Park and Garden (1km) and Whitewebbs Country Park (1.5km) are all located near to Junction 25.

Main receptors include:

- Employees at the warehouse adjacent to M25 Junction 25.
- Residential properties located on Teresa Gardens and Cameron Drive to the east of M25 Junction 25.
- Residential properties along Bullsmoor Way adjacent to the south east of M25 Junction 25.
- Residential properties/businesses along Holmesdale to the south east of M25 Junction 25.

- Nurseries adjacent to the south west of M25 Junction 25.
- Capel Manor College to the south west of M25 Junction 25.
- Public Right of Way (PRoW) along New River to the north west of M25 Junction 25.
- PRoW between New River and M25 Junction 25.
- Theobald's Park Farm.
- Residential properties/businesses located on the corner of Bullsmoor Lane and A10 to the south of M25 Junction 25.

3.12.4 Townscape

Covered under 3.12.3 above.

3.12.5 Heritage and historic resources

M25 Junction 25 is located south west of Cheshunt in a semi urban landscape of modern development interspersed with sporadic settlement, which includes the historic centre of Churchgate. There are no Scheduled Monuments, World Heritage Sites, Registered Parks and Gardens, Registered Battlefields, or Grade I listed buildings within 500m of Junction 25.

The study area contains eleven designated heritage assets of high or medium value. In summary, these comprise:

- One Grade II* listed building
- Ten Grade II listed buildings

The designated assets located within the study area are listed in the Environmental Study Report (ESR). They are also mapped in Figure 7.1 in Appendix E of the ESR.

In addition to the designated assets, the study area also contains twenty-eight non-designated assets. These non-designated assets are of low or negligible value. The non-designated assets are listed in a gazetteer in Appendix E of the ESR. Non-designated assets are referred to with their HER asset numbers (containing HT for Hertfordshire or LO for Greater London) which correspond to those used in the gazetteer and Figure 7.1 in Appendix E of the ESR.

Within the study area there is also part of the Whitewebbs Hill, Bulls Cross and Forty Hill Archaeological Priority Area (DLO35150). Greater London Archaeological Priority Areas are defined areas where, according to existing information, there is significant known archaeological interest or high potential for new discoveries. This is considered a low value non-designated asset within itself, and also further indicates low risk potential for previously undiscovered archaeology within the surrounding area.

3.12.6 Biodiversity

The following statutory designated sites of international (SAC, SPA, Ramsar) or national (SSSI, NNR) importance for nature conservation are within 2km of M25 Junction 25:

- Lee Valley SPA and Ramsar Site - Designated for important populations of shoveler, gadwall and bittern
- Turnford and Cheshunt Pits SSSI - Former gravel pits of national importance for wintering and breeding birds, invertebrates and aquatic flora
- There are no statutory designated sites of local importance for nature conservation (LNR) within 2km of Junction 25
- There is one non-statutory designated site identified within 500m of Junction 25, referred to as a Sites of Metropolitan Importance (SMI) within Greater London - namely New River SMI which is a man-made waterway stretching from Hertfordshire to London supporting a range of aquatic plants, fish, birds and amphibians.

3.12.7 Habitats

There are no parcels of ancient woodland within 500m of the M25 Junction 25.

The main habitat on the motorway verges immediately adjacent to M25 is young mixed plantation woodland with pine, birch, sweet chestnut and other broadleaved trees. The southern (anticlockwise) motorway verge is identified as Lowland Mixed Deciduous Woodland Habitats of Principal Importance (HPI) on the MAGIC[16] website. There are patches of semi-improved (coarse) grassland with tall ruderal vegetation on the verge within 500m of the junction. The A10 verge north of the junction has semi-improved grassland, whereas the A10 south of the junction has reduced or no verges and is bounded by pavement and urban housing.

The New River, a canal originally constructed in the 17th Century is located approximately 250m east of the centre of the junction. This canal crosses the M25 from north to south via an aqueduct. The west bank of the canal is flanked by broadleaved woodland 400m to the north-west of the junction. This woodland is identified as Lowland Mixed Deciduous Woodland HPI on the MAGIC website.

3.12.7.1 Notable flora and fauna protected species

The desk study returned no recent records of Species of Principal Importance (SPI) that are plants, but identified one Red List Vulnerable species, wall bedstraw, which is also a London Biodiversity Action Plan (BAP) priority species, from within the OS 10km grid square that includes the junction area. Mistletoe, which is also a London BAP priority species has also been recorded within the local 10km grid square. There is a record of river water-dropwort, which is a Hertfordshire BAP priority species, from the New River, 430m from the centre of the junction. There are no other specific records for notable plants from within the 500m search area.

3.12.7.2 Invertebrates

The desk study provided 13 records of invertebrate SPI from within the local 10km grid square. White-letter hairstreak butterfly, which is an SPI, has been recorded at Theobalds Park, a part of which is within 500m of the junction, to the north-west.

3.12.7.3 Amphibians and reptiles

The desk study returned no specific records of amphibians or reptiles within 500m of the junction. However, suitable terrestrial habitat, along the hedgerows and on the motorway verge is present for amphibians, including great crested newt and reptiles. Great crested newts are European Protected Species and as such are protected under the Conservation of Habitats and Species Regulation 2010, as amended, and reptiles are also protected under the Wildlife and Countryside Act 1981, as amended.

There are potentially suitable breeding ponds for great crested newts on a hedgerow boundary and within the arable field in the north-west quadrant of the junction. The nearest pond is less than 50m from the motorway boundary, approximately 300m west of the centre of the junction. Surveys undertaken for the M25 J23-27 Management Motorway Scheme in 2012 found these ponds to be unsuitable for great crested newts.

Although no records of reptiles were returned from the data search, the semi-improved grassland habitat on the M25 motorway and A10 verges provides suitable habitat for common reptiles, particularly common lizard, grass snake, slow worm or adder.

[16] http://magic.defra.gov.uk/

3.12.7.4 Birds

The desk study identified a number of notable bird species that have been recorded within 500m of the junction, including skylark, Montague's harrier, lapwing and house sparrow, which are Species of Principal Importance (SPI). All wild birds are protected under the Wildlife and Countryside Act 1981, as amended. Barn owl and red kite have been recorded at Theobalds Park to the north-west of the junction. These species are listed on Schedule 1 of the Wildlife and Countryside Act as amended, and therefore afforded extra protection. The Lee Valley SPA and Ramsar site supports internationally important populations of wintering and breeding birds, notably shoveler, gadwall and bittern. The desk study identified woodland and scrub within the search area that may offer suitable nesting opportunities for breeding birds.

3.12.7.5 Bats

The desk study returned records of nine species of bats from within 5km of the junction. These are: common pipistrelle, soprano pipistrelle, Natterer's, whiskered, Daubenton's, brown long-eared, noctule, Leisler's and serotine. All bats are European Protected Species. The woodland, scrub and hedgerows may provide habitat for foraging bats and these features may also be used by bats for navigation whilst commuting between roosts and foraging areas. Trees with features suitable for roosting bats such as cavities, cracks or splits may be present within woodland on the verge or adjacent to the junction. There may also be suitable roosting sites within structures such as the motorway overbridges.

3.12.7.6 Hazel dormice

The desk study returned no records of dormice from within 500m of the junction. The hazel dormouse is a European Protected Species. The desk study identified mixed woodland and scrub on the motorway verge that may be suitable for dormice. However, the connectivity of the habitat to other suitable woodland is poor.

3.12.7.7 Otters and water voles

The desk study returned no records of otters or water voles from within 500m of the junction. Otter is a European Protected Species, whereas water voles are protected under the Wildlife and Countryside Act 1981, as amended. The New River, which is located 250m to the east of the junction may be suitable for otters or water vole.

3.12.7.8 Badgers

The desk study returned no records of badgers from within 500m of the junction. Badgers are protected under the Protection of Badgers Act, 1992, as amended.

3.12.7.9 Non-native invasive species

The desk study provided numerous non-native invasive species of plants listed on Schedule 9 of the Wildlife and Countryside Act 1981, as amended, from within 2km of the junction. These are provided in Section 8 of the environmental assessment report.

3.12.8 Water and environment

3.12.8.1 Surface watercourses

Two Water Framework Directive (WFD, 2000/60/EC) classified reaches are within 1km of the proposed scheme options. The New River (GB806100111) a man-made waterway which passes over the existing M25 on an aqueduct immediately to the west of the junction, flowing in a southerly direction. The New River is a man-made waterway and is designated as an Artificial Waterbody (AWB) as it is a strategic water transfer system. For an AWB, objectives are set for ecological potential and chemical status and are still required to aim to achieve good status. A Source Protection Zone (SPZ) is centred on the aqueduct where the New River crosses the M25, and extends to the south broadly centred on New River.

The Turkey Brook and Cuffley Brook (GB106038033180) waterbody is to the south of the junction, flowing in an easterly direction broadly parallel to the M25. New River is culverted

where it crosses over the Turkey Brook, just in excess of 1km from the junction. Turkey Brook and Cuffley Brook waterbody is not designated as an AWB or Heavily Modified (HMWB).

The predicted overall status for Turkey Brook and Cuffley Brook is for good, which is supported by a predicted good status for both physico-chemical and biological quality elements. Both waterbodies are designated as Protected Areas under the Nitrates Directive (91/676/EEC). No assessment of 'Specific Pollutants' is made for these waterbodies, suggesting that water quality is unlikely to be affected by these pollutants.

The other watercourse within 1km of the works, Theobalds Brook, is outside of the classified WFD stretches but is part of the Small River Lee (and tributaries) (GB106038033200) waterbody. The Theobalds Brook contributes to the overall quality and status of the waterbody, consequently, these 'other' watercourses are all considered to have an objective of good status.

3.12.8.2 Lakes and other water features

There are no WFD designated lakes within 1km of the existing alignment.

3.12.8.3 Groundwater

The existing alignment is underlain by a groundwater Source Protection Zones (SPZ) centred on the aqueduct where the New River crosses the M25. Environment Agency (EA) interactive mapping indicates that there are no bedrock aquifers in the study area, however there is a small Secondary A superficial aquifer.

Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The existing alignment is not underlain by any WFD groundwater body.

The potential inclusion of cuttings and earthworks in the proposed improvements means that groundwater is scoped in as further assessment is required.

3.12.8.4 Abstractions and discharges

According to the EA website there is one groundwater abstraction within 1km.

3.12.8.5 Flood risk

EA Flooding from Rivers interactive mapping shows that pockets of Flood Zone 2 are adjacent to the proposed works, immediately to the south of the Holmesdale Tunnel. Areas of Flood Zone 3 are also within 1km. These sources of flood risk include the following:

- Theobalds Brook
- Turkey Brook

3.12.8.6 Land contamination

There are two historic landfill sites within 1km of the proposed works.

3.12.9 Journey ambience

3.12.9.1 Motorised travellers: view from the road

The existing views from the road are described below:

- The view from the M25 is restricted by vegetation, elevated earthworks and retaining walls when looking north and south. When travelling along the M25 the various overhead bridge structures carrying the New River, Junction 25 roundabout, Lea Valley Line railway and portal to the Holmesdale Tunnel are prominent features.
- Views looking towards the roundabout on the northern and southern approaches of the A10 and slip roads from the M25 is of vegetation screening the motorway and junction.

- Views from Great Cambridge Road (service road) which runs parallel to the west of the A10 south of the roundabout junction include rows of trees between the road and the A10. The two roads are separated by a fence. Further views are across the A10 towards the garden centre complex which is screened by an intermittent wall and areas of vegetation.
- The A10 south of the Junction 25 roundabout is bordered by housing to the east and a garden centre complex land to the west. A pylon line crosses the road before the roundabout. A small field providing intermittent views to the vegetation beyond is located to the west of the junction with the A10 and roundabout.
- The A10 north of the Junction 25 roundabout is bordered by industrial use to the west and open arable land to the west, providing intermittent views.

In general, the views from the road for Motorised Travellers on the surrounding road network provide a varied experience, with intermittent views over the surrounding landscape comprised of a mixture of agricultural, residential and industrial use, planted vegetation and engineering structures.

3.12.9.2 Motorised travellers: driver stress

The M25 provides a continuous orbital route around Greater London. The M25 carries high volumes of traffic as described in Chapter 2 of this report, which cause disruption and delays to the surrounding road network particularly when emergency closures and lane closures of the motorway are imposed.

The M25 is a major national and inter-urban regional transport artery and is intrinsically linked to the performance of the surrounding highway network. Issues such as long peak hour queues have been reported on Junction 25 approaches and the circulatory carriageway, with the junction operating at over capacity with long queues and delays in both the AM and PM peaks. The junction is also amongst the top 10 motorway junction collision hot spots.

3.12.9.3 Non-motorised users

NMUs use the Junction 25 roundabout subway and footbridge which crosses the over the M25. All options include a new pedestrian and cycleway bridge is proposed to replace the existing subway and footbridge.

There are 13 existing Public Rights of Way (PRoW) of local importance within a 1km radius of Junction 25. All are classified as either footpaths or bridleways, more detail of these can be found in Section 5.11 of the environmental scoping report.

A cycle route runs along Great Cambridge Road following the residential street which follows the A10 in Enfield. The cycle route continues along the Junction 25 roundabout subway and footbridge to the north of the M25.

The existing M25, A10 and the surrounding road network affect NMUs enjoyment of existing PRoW. The motorway, dual carriageway and junction reduce the sense of isolation created when travelling in the rural areas in close proximity. In addition, these PRoWs will be affected by traffic noise and the visual intrusion of the road network.

The Junction 25 pedestrian and cycle crossing and the PRoW considered serve as both recreational routes and for travelling between the surrounding villages to access services or facilities.

3.12.9.4 Community severance

Several of the existing footpaths which traverse the area of land near Junction 25 provide a pedestrian link between Bullsmoor and Waltham Cross. Bullsmoor contains 3 schools (Lea Valley High School, Honilands Primary School and Capel Manor Primary School) and Waltham Cross contains 2 schools (Hurst Drive Primary School and Greenfield Nursery

School). Bullsmoor has a place of worship (St Johns Methodist Church) and Theobalds Park contains a place of worship and cemetery (Western and West End Great Synagogue and Cemetery). A small shopping parade is located along Bullsmoor Lane close to the junction with the A10 in Bullsmoor.

In addition to recreational use of the footpaths, they may be used by residents utilising the services provided by these community facilities.

3.12.9.5 Agricultural land

The area to the north west of Junction 25 is identified on Defra's Agricultural Land Classification (ALC) maps as Grade 3. The ALC maps, upon which the assessment is based, were created from surveys undertaken by Defra between 1989 and 1999, and have been treated with some caution, due to age of the report, in the absence of detailed site investigation survey results. It is considered likely that a proportion of this land will be Best and Most Versatile (BMV) Agricultural Land. From an aerial inspection, it appears that this land is largely comprised of arable fields.

3.12.9.6 Residential properties

Junction 25 is surrounded by a mixture of privately owned uses including agricultural, residential, commercial and industrial land:

- To the south east of Junction 25 roundabout are residential dwellings located along Bullsmoor Way and Great Cambridge Road.
- To the south west of Junction 25 roundabout are various commercial properties including Red Gates Nursery, Walton Lodge Veterinary Clinic and Waterworld Aquatics Centre along the A10.
- To the north east of Junction 25 roundabout are the Park Plaza industrial premises including the newsprinters print works located along Great Eastern Road.
- The areas to the south, east and north east are predominately residential containing the suburb of Bullsmoor in Enfield and the settlement of Waltham Cross.

3.12.9.7 Community land

There are a number of parks and formal open spaces within the 1km search area (Bulls Cross Field and Nursery, Elsinge Green, Aylands Link, Aylands Open Space and Holmesdale Tunnel Open Space). In Bullsmoor there is the Aylands Allotments and a playground within Aylands Open Space. None of these community facilities are located within the land adjacent to Junction 25. A local wildlife corridor is located along the New River in Broxbourne. There are no areas designated as Open Access Land under the Countryside and Rights of Way Act (2000).

3.13 Accessibility

3.13.1 Option values

Option and non-use values should be assessed if the scheme being appraised includes measures that will substantially change the availability of transport services within the study area. As no new transport options will be created by this scheme, option values have not been considered.

3.13.2 Severance

Several of the existing footpaths which traverse the area of land near Junction 25 include a pedestrian link between Bullsmoor and Waltham Cross. Bullsmoor contains three schools (Lea Valley High School, Honilands Primary School and Capel Manor Primary School) and Waltham Cross contains two schools (Hurst Drive Primary School and Greenfield Nursery School). Bullsmoor has a place of worship (St Johns Methodist Church) and Theobalds Park contains a place of worship and cemetery (Western and West End Great Synagogue and

Cemetery). A small shopping parade is located along Bullsmoor Lane close to the junction with the A10 in Bullsmoor.

In addition to recreational use of the footpaths, they may be used by residents utilising the services provided by these community facilities.

3.13.3 Access to the transport system

The borough of Broxbourne has regular rail services to London Liverpool Street with stations at Waltham Cross (2.1 km)[17], Cheshunt (3.5 km) and Theobalds Grove (1.9 km). To the north, the railway provides direct access to Cambridge and Stansted Airport.

The area benefits from good bus links to and from Waltham Cross bus station which serves as the main terminus and starting point for local bus routes, linking the locale with north London and Hertford. Waltham Cross has TfL services heading south towards Enfield via Hertford Road.

Similarly, the borough of Enfield has regular rail services to London Liverpool Street with stations at Turkey Street (1.6 km) and Enfield Lock (2.7 km). To the north, the railway connects Turkey Street with Theobalds Grove and Waltham Cross with Enfield Lock.

There are very few north/south bus routes linking the two boroughs of Enfield and Broxbourne. The routes identified are: 217 (Turnpike Lane - Waltham Cross via A10 and Bullsmoor Lane) and 317 (Enfield Town - Waltham Cross via A10 and Bullsmoor Lane).

There is a shared cycle path/foot path connecting the northern and southern arms of the A10. The path runs along the eastern side of the A10, north of Junction 25, passes under the Junction 25 roundabout, joins the inside of the eastern side of the roundabout for 150m before passing under Junction 25, connecting with the A10 south of Junction 25.

3.14 Integration

3.14.1 Transport interchange

M25 Junction 25 is not considered to fulfil a function for transport interchange.

3.14.2 Land use policy

Land use policy in the location of Junction 25 is governed by the following documents:

- Hertfordshire's Strategic Economic Plan - 2014
- Broxbourne Local Development Framework Core Strategy (LDF) - 2010
- London Enterprise Panel (LEP) - Jobs and Growth Plan for London - 2013
- London Plan (LP) - 2011 and Further Amendment to London Plan (FALP) - 2015
- The Enfield Plan Core Strategy (EPCS) - 2010 – 2025
- Upper Lee Valley Opportunity Area Planning Framework (OAPF) - 2013

The requirement for intervention at Junction 25 is consistent with many of these policies. A number of issues have been identified, including a reliance on the A10 local network, which does not have a north / south bus service through Junction 25 and suffers from congestion to connect employment and residential areas. A strong relationship between Hertfordshire and London is outlined in the Hertfordshire SEP, clearly dependent on good access through the M25, particularly at Junction 25 with congested infrastructure identified as a potential barrier. The Upper Lee Valley OAPF emphasises that good access to the M25 is essential in supporting freight movements and business aspirations.

[17] Distance from M25 Junction 25

The LEP, SEP, LP and LDF are in general support of new transport infrastructure in order to address existing and future issues that constrain economic development.

A key theme is the requirement to support a high degree of medium and longer term economic growth in the wider and immediate Junction 25 area. This is a consistent theme identified across a number of policy documents and spatial plans. In the wider area the orbital route is subject to considerable projected housing and employment growth, driven by a number of London Opportunity Areas and growth corridors. In the local area Junction 25 is in close proximity to growth areas in Hertfordshire and the North London OA at Upper Lee Valley.

3.15 Technology

The traffic signals at M25 Junction 25 run on a single traffic signal controller, which communicates via the National Roads Telecommunications Services (NRTS) network to the Urban Traffic Control (UTC) in-station located at the Highways England Regional Control Centre at Godstone. The site is currently configured at the in-station to run UTC Fixed-Time control. There is no Split Cycle Offset Optimisation Technique (SCOOT) data, nor SCOOT detectors configured in the in-station database.

The existing signal controller is a PEEK ELV PTC1, and is configured to run UTC as its highest level method of control. In the absence of UTC control, the controller is configured to operate Cableless Linking Facility (CLF) or Vehicle Actuated (VA) if selected on the manual panel. All four signalised nodes are connected back to the controller by existing cabling in standard duct and chamber network.

Recent validation of the traffic signal timings on site, in April 2016, have resulted in revised UTC Fixed-Time plans running, with improved green splits and offsets. As part of the validation, the UTC in-station timetable for implementing the new plans was amended to better reflect current traffic flows in each peak period, as at the time of the site visit. The new timings and timetable have also been locally written into the CLF in the controller, so that the site can mimic UTC operation, should it ever lose UTC control.

A new Siemens UTC in-station at Godstone has recently been installed. As a result of this, there is a programme in place to migrate all the traffic signals controlled by the in-station from the old system to the new one. The date for migration of Junction 25 has yet to be confirmed.

The current method of UTC Fixed-Time control is generally not suitable for a complex junction such as M25 Junction 25. SCOOT would be a better method of control at this junction. It would provide a more adaptive approach to traffic conditions and peak-time traffic flows. The traffic signals would be able to operate for a longer length of time before any new validation was required, compared to UTC Fixed-Time.

It is envisaged that the implementation of SCOOT operation at this site may be benefitted by the TfL owned Bullsmoor Lane junction, located 70m to the south, which is already running on SCOOT, under the TfL UTC in-station. It is possible SCOOT detector data could be sent from each site to the controller of the other site, and could be used in a beneficial way. The method and use of data transfer has yet to be agreed.

The main circulatory carriageway at the roundabout at Junction 25, is currently programmed to be re-surfaced in June 2016. As a result of the resurfacing all the current detection, including SCOOT detector loops, will be removed. Instead of reinstating the current SCOOT layout, a new SCOOT layout, with new loop positions will be installed. Other works, such as cable and duct repairs, with further slot cutting of new loops, not on the circulatory, also need to be completed before SCOOT validation, and following the in-station migration.

3.16 Maintenance and repair strategy statement

A Maintenance and Repair Strategy Statement will be prepared in PCF Stage 2.

3.17 Existing structures

A review of existing structures has been carried out. The available information from the Structures Management Information System (SMIS) has indicated that the structures assessments date back more than 20 years.

Widening of the M25 Junction 25 circulatory carriageway to provide three / four lanes throughout on the West and East Bridges imposes additional loading and would impact the existing structures' capacity. The existing inspection records of both of these bridges have reported recurring cracks in the surfacing, and long term cracks with corrosion stains in their deck soffits, plus water seepage and leaching through the deck soffit at parapet cantilevers.

The presence of a large service trough in the offside verge of the west bridge needs to be investigated for durability performance. When the carriageway is widened into the offside verge, the additional traffic lane will be closer to this service trough and its impact on the potential capacity of the bridge deck will need to be assessed.

There is also a drainage channel that runs along the offside verge of the east bridge. Previous inspections recommended that further investigation be carried out to determine if this is contributing to the presence of water seeping through the deck parapet cantilever.

A structural condition survey, testing and relevant investigation should be undertaken to allow bridge capacity assessments to be updated. This will inform the feasibility of carriageway widening.

3.18 Other relevant factors

No other relevant planning factors are currently noted.

4 Planning factors

4.1 Option constraints

A number of planning factors and related constraints exist which will impact on the development and choice of a preferred option:

4.1.1 Design

A highway solution at Junction 25 may require land to be acquired and require costs and timescales to be renegotiated.

Depending on the area of development, any proposal may become a Nationally Significant Infrastructure Project (NSIP) and therefore require a Development Consent Order (DCO).

Limited asset condition information is currently available.

4.1.2 Environment

The area to the south of the M25 is designated as an AQMA (Teresa Gardens, Arlington Crescent and LB Enfield) and there are Noise Important Areas close to the junction on the M25 (Waltham Cross and Holmesdale Tunnel).

The junction lies within the greenbelt and there are built up areas to the north east, south east and south west of the junction which could be affected by junction improvements. There are two small clusters of listed buildings some way distant to the north and southwest and a small stream to the west. There are no other significant environmental issues to consider around the junction.

Further details are noted in Sections 3.12.1 to 3.12.9 above and environmental constraints are shown in Appendix C.

4.1.3 Operation

The M25 is a strategic national and regional route therefore many of the movements through the junction are not local and cannot be influenced by the scheme.

The key pinch points affecting growth might be on the local network rather than just Junction 25. Highways England cannot control the management of the local road network.

The impact of the queue protection and congestion management system for the M25 J23-J27 project at Junction 25 is uncertain. Whilst the project will deliver capacity improvements on the M25 it will not address capacity issues at Junction 25, and could increase traffic through the junction. This needs to be considered.

It is assumed that the collaborative traffic management project will have agreed how signals will be controlled to manage traffic on local authority roads as well as on the strategic road network (and adjacent to the Holmesdale Tunnel) to the satisfaction of TfL and Hertfordshire.

5 Scheme options

5.1 Option development

PCF Stage 0 considered the available evidence, identified opportunities and constraints and aligned with Highways England Key Performance Specification Objectives (KPIs) and DfT Early Assessment Sifting Tool (EAST). A proportionate optioneering/sifting assessment was implemented in order to identify best performing solutions to take forward to PCF Stage 1. In summary, the assessment initially considered several Strategic Solutions before identifying and assessing Option Variants in further detail.

Overall scoring indicated that a 'Junction Improvement' option would be the most likely to address identified issues as well as considering feasibility, acceptability and delivering 'good value for money'.

Considering and building upon the previous Junction 25 proposal history, several 'Junction Improvement' Option Variants were considered incrementally. This includes Do-Nothing and five Junction Improvement Variant Options, described in Table 5-1.

Table 5-1 Description of Junction Improvement Options Considered

Option No.	Brief Overview of Option
0	- Signal improvements (part of the catch-up signal technology programme)
1	As Option 0 plus: - Widen the M25 J25 circulatory carriageway to three / four lanes throughout - Widen the A10(N) Southbound entry to the roundabout - Re-provide and improve the pedestrian/cycle facility that would be lost
2	As Option 1 plus: - Widen M25 Eastbound off-slip - Widen M25 Westbound off-slip - Segregated left turn lane from M25 West and A10 North
3	As Option 2 plus: - Segregated left turn lane from A10 South to M25 West - Widen A10(S) southbound on approach to Bullsmoor Lane junction to provide dedicated left turn lane between M25 and Bullsmoor Lane
4	As Option 3 plus: - Staggered junction on south side of Bullsmoor Lane (closure of Bullsmoor Lane (west) egress movements onto A10 and with only straight on movements from Bullsmoor Lane (east) permitted)
5	Flyover connecting A10 North and South

The options were assessed at a high level against Highways England KPIs and using a high level EAST criteria. In summary:

- All Options scored positively against the 'Making the Network Safer', 'Encouraging Economic Growth', 'Supporting the Smooth Flow of traffic' and 'Improving user Satisfaction' KPIs. Options 3, 4 and 5 scored particularly well, being likely to offer higher capacity, safety improvement and therefore should contribute towards improving road user satisfaction.

- Other than the 'Do Nothing' Option 0 and Option 1, the higher capacity created by Options 2 to 5 scored negatively in terms of 'Delivering Better Environmental Outcomes'. This reflects the potential impact on sensitive environmental areas (noise and air). Options 3, 4 and 5 also require land take.
- None of the schemes were considered to address 'Keeping the network in good condition' or 'Achieving real efficiency.'
- Against high level EAST headings Option 1, 2 and 3 score highest overall. In summary:
    - Options 1, 2 and 3 scored well in terms of offering solutions that are likely to be achievable, feasible, practical and 'good value for money'.
    - Options 4 and 5 are likely to be higher cost, have greater land take implications and therefore uncertainty.

Based on the available evidence at PCF Stage 0, overall scoring indicates that Options 1, 2 and 3 are likely to achieve the biggest contribution towards achieving the Highways England KPIs as well as offering solutions that are achievable, feasible, practical and 'good value for money'.

The full scoring is provided in Appendix B.

5.2 Interdependencies

The options described below are dependent on the successful implementation of a proposed signal improvement scheme (Catch-Up Programme, part of the Area 5 Traffic Signal and UTC Refresh Plan Programme), independent of the RIS programme. These works are planned to incorporate the upgrade of the signals at Junction 25 to SCOOT/MOVA, linking these with the signals at Bullsmoor Lane junction. It is understood that this will be implemented prior to the RIS.

5.3 Risks

In developing the scheme further a comprehensive project risk register will continue to be maintained as part of the management of the project. The delivery of the scheme will be dependent on these risks being appropriately managed so that scheme delivery is not impacted.

The M25 Junction 25 project is being undertaken in adherence to Highway England's Project Control Framework (PCF), governing the standards and processes required for the scheme to progress from inception to delivery. A Risk Management Plan (RMP) has been developed within this framework and will follow the process as shown in Annex 7 of the Risk Management Manual V2.

At this early stage the key potential risks are summarised in the PCF Stage 1 product – Risk Register and the Environmental Risk Assessment (ERA).

5.4 Option descriptions

5.4.1 General

Following the assessments carried out at PCF Stage 0, three options were developed that provide improvements at the junction:

- Option 1: widen the M25 J25 circulatory carriageway to three / four lanes throughout, widen the A10(N) Southbound entry to the roundabout, re-provide and improve the pedestrian/cycle facility that would be lost
- Option 2: Option 1 as described above plus widen the M25 East and West diverges, add segregated left turn M25 West to A10 North

- Option 3: Option 2 as described above plus segregated left turn A10 South to M25 West, widen A10(S) southbound on approach to Bullsmoor Lane junction to provide dedicated left turn lane between M25 and Bullsmoor Lane

Apart from Option 1, these options are not standalone schemes but can be implemented in an incremental manner, where the Option 2 scheme consists of all the works included in Option 1 plus those elements specific to Option 2 and furthermore Option 3 scheme consists of all the works included in Option 1 and Option 2 plus those elements specific to Option 3.

From current records, all options are likely to require land for construction of the scheme which falls outside of the current ownership of Highways England or associated highway authorities. There appears to be discrepancies in some land ownership details. There are locations where Highways England appears to own land beyond the highway boundary but not identifiable on the ground. And other areas where land within the highway does not appear to be in the ownership of Highways England. It would be prudent to reconcile these anomalies during development of the project.

The junction improvement options have been developed to address the transport scheme objectives and have been assessed at a high level against Highways England KPIs and high level EAST criteria.

The options have been developed to a point where it has been possible to identify the key design constraints, departures from standard, problems and risks, find opportunities and ensure the options are deliverable.

5.4.2 Option 1

The existing roundabout circulatory carriageway is formed by two 75m inside radius curves connected by two lengths of straight carriageway, approximately 65m length. The area of circulatory carriageway which is to be widened to provide an additional lane is shown on drawing HE551518-ATK-HGN-ZZ-DR-D-0001 in Appendix E.

Option 1 consists of minimal junction improvements. Junction 25 roundabout circulatory carriageway is widened to provide a minimum of three lanes throughout with an additional fourth lane between the A10 southbound entry and the A10 southbound exit from the roundabout. This is achieved by narrowing the existing hardened verge on the west bridge deck at the inside of the roundabout from approximately 6.2m to 4.6m. This provides three lanes across the bridge at width of 4m for each lane. Over the east bridge deck the existing hardened verge on the inside of the east bridge deck will be narrowed from approximately 6.2m to 3.0m. This will provide four 3.4m wide lanes across the bridge. In other locations the roundabout circulatory is widened by up to 3.5m into the central island to accommodate the additional lane.

For a 250m length of the A10 on the southbound approach to the roundabout it is proposed to regularise the lane widths to provide three 3.65m traffic lanes. This ensures a consistent road width is maintained between the junction and A10 to the north, currently the existing carriageway width varies over this length. Additionally to achieve the maximum capacity from the four lanes on the roundabout circulatory carriageway, the A10 southbound entry to the roundabout is widened by an extra lane for a length of 30m from the existing signalised junction.

5.4.2.1 Non-Motorised User Provision

At present there is an existing footway/cycleway route that provides a grade separated north/south route across the M25. The route passes beneath the roundabout circulatory carriageway in two locations through subways and crosses over the M25 on the inside of the eastern side of the roundabout adjacent to the circulatory carriageway. To accommodate the

circulatory carriageway widening the existing route across the eastern bridge would be removed.

At PCF Stage 0 it was proposed to construct a new pedestrian/cycle bridge to the east of the junction. During PCF Stage 1 the design of the bridge has been considered further and it has been determined that this is unlikely to provide the best solution. To enable a clear headroom of 5.8m over the slip roads the foot/cycle bridge would have a clear height of around 15m over the M25 carriageway. This would require more land take in the north east area next to the roundabout and there would also be an increase pedestrian journey time which may result in cyclists using the roundabout instead.

As a result, further design options have been considered as part of PCF Stage 1. These included at-grade crossings of the carriageways and an amended grade separated crossing – both at junction 25. In addition, both Broxbourne Borough Council (Broxbourne BC) and London Borough of Enfield (LB Enfield) have identified other walking and cycling facilities that could facilitate crossing the motorway adjacent to junction 25. All of these are described below.

Grade Separated Crossing

This option utilises the existing subways and builds a new pedestrian/cycle bridge in the inner area of the existing roundabout. This would require a foot/cycle bridge with a span of approximately 85m over the width of the M25 carriageways with a minimum headroom of 5.8m. Both subways would be cosmetically refurbished with the one in the north east section of the junction requiring a structural extension to account for the widening of the roundabout carriageway. There is a slight risk that more than expected structural works would be required if the existing subways are in poor condition.

A drawback of this proposal is that the existing underpasses and route through the roundabout do not conform to current guidance on personal security. The current route has given rise to concerns from users about their personal safety due to its isolated nature and lack of through visibility on the approaches to the underpasses.

To reduce these safety concerns the following measures could be taken:

- Upgrade lighting through the subways
- Maintain good drainage system
- Clear the vegetation next to the subways
- Install mirrors on blind bends
- Provide CCTV cameras
- Innovative and positive architectural design proposed to encourage users
- Routine maintenance carried out through the year

The cross-sections of the options are provided on drawing HE551518-ATK-HGN-ZZ-DR-D-0005, in Appendix D and Option 1 is shown in more detail on drawing HE551518-ATK-HGN-ZZ-DR-D-0001 in Appendix E.

At-Grade Crossings

Two at grade crossing routes for pedestrians and cyclists have been considered:

- The first route would leave the existing footway from the south east side of the roundabout to cross the M25 anti-clockwise diverge via the traffic signals at the top of the slip road. The route would continue along the eastern edge of the circulatory carriageway over the bridge and then cross the M25 clockwise merge before joining the existing footway to the north along the eastern verge of the A10. This is the shortest route for non-motorised users involving two carriageway crossings.

However, the crossing at the top of the M25 merge slip road would need to be controlled with signals. This will impact upon capacity at the roundabout whilst presenting safety issues with vehicles queuing back onto the circulatory carriageway. Additionally, drivers may not expect to have to stop at this location as they accelerate away from the roundabout to join the M25.

- The second route avoids crossing the M25 clockwise merge but involves crossing four carriageways. This option leaves the existing footway on the south east side of the roundabout to cross the M25 anti-clockwise diverge. The route then crosses the circulatory carriageway to the western inner verge of the circulatory carriageway and continues north across the bridge before crossing the circulatory carriageway onto the A10 central reserve splitter island to the north. The route continues across the A10 southbound entry to the roundabout and joins the existing footway in the eastern verge of the A10. The crossings of the roundabout would be via the proposed traffic signals.

These at-grade crossings provide a shorter and more direct route and would address the personal safety concerns of the grade separated route. However, they introduce disadvantages for non-motorised users and drivers as follows:

- Pedestrian/cyclist journey times would increase due to having to wait for green phases to cross at up to four separate signals.
- The signals will require push-button controls to allow safe passage for all users including those with disabilities. The NMU phases will impact upon the traffic capacity at the junction.
- There is a high risk of pedestrians/cyclists ignoring the traffic lights and crossing live carriageways leading to safety issues.
- The NMUs would need to cross wide carriageways, 4 lanes in most cases. This could present difficulties in completing the crossing to safety for those with impaired mobility.

Options suggested by local authorities

Both Broxbourne BC and LB Enfield have expressed a preference to provide walking and cycling facilities away from junction 25 due to the drawbacks of the existing underpasses, generally as described above. The following is a narrative of the routing aspirations as suggested by the local authorities.

LB Enfield is implementing a number of cycle routes within their borough to promote cycling and walking. Among of these routes, the following three would terminate in the vicinity of M25 junction 25:

West of junction 25:

a) **Greenway – Enfield Town Centre to Broxbourne**. This route could cross the M25 over the New River aqueduct. It is understood that LB Enfield has secured all required funding to implement this scheme.

East of junction 25:

b) **Greenway – Ponders End to Broxbourne**. This route would terminate at Langdale Gardens just south of Holmesdale Tunnel. It is due for completion in 2018.

c) **Mini-Holland – A1010 North**. This forms part of LB Enfield's package of cycle measures under their Mini-Holland programme. Subject to any announcements following public consultation (completed 23 September 2016), this route runs along the A1010 and terminates at its junction with A1055 Bullsmoor Lane / Mollison

Avenue. Funding is already secured as part of the TfL Mini-Holland programme and is due for completion in 2018.

It is understood from Broxbourne BC that they have a desire to extend these routes into their borough, although there is no design or funding currently in place.

Further liaisons will be held with both local authorities to identify a suitable way forward on the walking and cycling provisions, including an agreed approach as to how Highways England would deliver improvements to existing NMU facilities.

5.4.2.2 Earthworks

It is proposed to use strengthened earthworks on steepened slopes next to the structures as well as along the A10 southbound entry between the junction and realigned footpath. This lowers the risk in having unexpected design constraints such as utilities, ground conditions or more structural work required. The rest of the earthworks next to the inner circulatory carriageway and the south east part of the roundabout are expected to be a 1:3 slope.

5.4.2.3 Landtake

North-east of the junction land take will be required to widen the A10 on the approach to the roundabout and to realign the footpath. Land required is shown on drawing HE551518-ATK-HGN-ZZ-DR-D-0018 in Appendix E.

5.4.3 Option 2

Option 2 comprises the proposal outlined in Option 1 with the addition of widening to the M25 eastbound and westbound diverge slips to three lanes along with a segregated left turn lane between the M25 eastbound diverge slip and the A10 northbound.

On the M25 anti-clockwise carriageway, four traffic lanes pass through the Holmesdale Tunnel. Lane 1 is marked as a left dedicated lane to exit onto the diverge to Junction 25. At the exit from the tunnel, the dedicated diverge lane becomes a lane drop layout. This lane splits into two lanes once on to the slip road. At the entry to the Junction 25 roundabout the nearside lane widens to two lanes for approximately 25m giving three lanes at the entry to the roundabout. For this design option it is proposed to extend this third lane up to approximately 160m in advance of the roundabout entry. This will be achieved by widening into the nearside verge and existing earthworks cutting slope by approximately 4.5m. Just beyond the exit from the western tunnel portal is located a railway overbridge. The abutments to this bridge are extended as a wingwall / retaining wall parallel to the slip road. In order to avoid impacting on the existing walls the additional third lane is proposed to start beyond this wingwall. At this location, the earthworks are still in fairly deep cutting. A mass concrete gravity retaining wall up to 4.5m height will be required in order to accommodate the additional width of carriageway.

The existing M25 eastbound diverge is a two lane slip road where the taper starts below the Bulls Cross Ride overbridge. The slip road then passes below the New River aqueduct before rising up to the Junction 25 roundabout with the A10. On the approach to the roundabout the nearside slip road lane splits into two lanes around 25m in advance of the entry to the roundabout giving three lanes at the entry to the circulatory carriageway.

It is proposed to provide a segregated left turn lane from this diverge slip to the A10 north of the roundabout. This dedicated left turn would commence approximately 220m upstream of the circulatory carriageway.

The segregated left turn lane will allow free flow of traffic from the M25 to the A10 northbound. It would be constructed as a single 6m wide carriageway marked out as a 3.5m wide lane with hatching in accordance with the design standards and segregated from the roundabout circulatory carriageway by a 2m wide physical island.

This option is shown in more detail on drawing HE551518-ATK-HGN-ZZ-DR-D-0002 in Appendix F and cross-sections on drawing HE551518-ATK-HGN-ZZ-DR-D-0005 in Appendix D.

5.4.3.1 Earthworks

Alongside the M25 eastbound off-slip segregated left turn, it is proposed to construct strengthened and steepened earthworks to minimise the required land take. On the M25 westbound diverge, the slip road west of the existing retaining wall for the railway bridge is in a cutting. It is envisaged that a concrete retaining wall will be required to accommodate the widening.

5.4.3.2 Landtake

North-west of the junction land take will be required to widen the M25 eastbound off-slip and to construct the segregated left turn lane.

At this stage, it would appear that an area of land north-west of the roundabout is not in the ownership of Highways England although the road is public highway. It has been assumed that this land will need to be purchased via a compulsory purchase order (CPO), subject to confirmation of the highway boundary.

Land required is shown on drawing HE551518-ATK-HGN-ZZ-DR-D-0019 in Appendix F.

5.4.4 Option 3

Option 3 comprises the proposals outlined in Options 1 and 2 with the addition of widening the A10 southbound between Junction 25 and Bullsmoor Lane to provide an additional lane. In addition, a segregated left turn lane between the A10 northbound and the M25 westbound merge slip is proposed along with widening of the M25 westbound merge slip to accommodate the segregated left turn lane.

The existing cross-section for the A10 southbound between the M25 Junction 25 and Bullsmoor Lane is three lanes. In addition to the three southbound lanes, a 170m long dedicated right turn lane to Bullsmoor Lane west is provided. A short dedicated left turn lane into the A1055 Bullsmoor Lane east, approximately 35m long, is also provided at the traffic signalised junction. Immediately to the east of the A10 along this length is a two-way service road providing access to residential properties along the A10. The service road is separated from the A10 by a hardened verge between approximately 2 to 4m wide which has a pedestrian type guardrail adjacent to the A10 nearside edge of carriageway separating the two roads.

In order to reduce queueing from the Bullsmoor Lane junction reaching back to the M25 Junction 25 roundabout junction, an additional lane will be provided southbound. This will extend the existing left turn lane at the Bullsmoor Lane junction back to the M25 junction. In order that the impact of this lane on the existing infrastructure is reduced, the central reserve on the A10 will be moved west and widening provided on the west of the A10. This will reinstate the three existing northbound lanes and will require the acquisition of the land outside of the highway boundary.

Widening the A10 to the west will mean that a service road to the residential properties on the east of the A10 will remain unaffected and A10 traffic will not be brought any closer to residential properties.

A segregated left turn lane will be constructed to allow free flow of traffic from the A10 northbound to the M25 westbound. This would be achieved by constructing a single 6.5m wide carriageway reduced down to a 3.5m wide lane with hatched road markings in accordance with the design standards. This lane will be segregated from the roundabout circulatory carriageway by a 2m physical island.

At the point the segregated left turn merges with the M25 westbound merge slip, two lanes are required on the slip road. Currently the slip road has a single lane with a hard shoulder. The slip road will require widening as the standard cross-section for a motorway two lane merge also includes a hard shoulder. It is proposed that a Departure from Standard is then applied to reduce the two lanes on the slip road down to a single lane before the merge nosing at the end of the slip road, owing to existing constraints on the site. To secure the required visibility along the segregated left turn the verge will require widening.

The New River aqueduct is situated west of the Junction 25 crossing above the slip road westbound merge with the M25. To fit the standard cross-section beneath it, the sloping south abutment revetment will need to be replaced with retaining wall.

In the south west quadrant of the roundabout, there is an access to the adjacent field which also serves to access the aqueduct. It is proposed to replace this sub-standard arrangement with a new access from Bullsmoor Lane junction west.

This option is shown in more detail on drawing HE551518-ATK-HGN-ZZ-DR-D-0003 in Appendix G and cross-sections on drawing HE551518-ATK-HGN-ZZ-DR-D-0005 in Appendix D.

5.4.4.1 Earthworks

Along the M25 westbound merge slip road beyond the segregated left turn the existing earthworks are still in a deep cutting and most likely strengthened and steepened earthworks will be required to support the widening. The Aqueduct crosses over the width of the slip road carriageway with a minimum headroom of 5.5m. Under the aqueduct it is proposed to replace the southern abutment revetment with a retaining wall. Next to the maintenance access track to the aqueduct along the A10 and the segregated left turn, it is proposed to construct an earthwork slope of 1:3.

5.4.4.2 Landtake

South west of the junction land take is required along the realigned A10 carriageway, segregated left turn and westbound merge with the M25. Land will be required to provide the required visibility along the segregated left turn as well as along the realigned access road to the aqueduct.

Land required is shown on drawing HE551518-ATK-HGN-ZZ-DR-D-0020 in Appendix G.

5.4.4.3 Access roads

Option 3 affects the existing access road to the aqueduct which is currently directly off the roundabout circulatory carriageway between the A10 northbound entry and the M25 westbound exit from the roundabout. The segregating island of the left turn lane blocks off the access and although it may be feasible to maintain the access from the segregated lane it would be severely restricted. An option to provide access has been developed that utilises an existing junction south-west of the Bullsmoor Lane junction and provides a service/access road parallel to the A10.

In liaison with the landowner, it may be possible to provide access through the adjacent development area which would reduce the extent of dedicated land need for this maintenance access.

6 Engineering assessment

6.1 Junction 25 engineering and design option constraints

Engineering and design constraints are provided in more detail in Section 5.1 of the PCF Stage 0 Report. This includes the need to consider the following in achieving design standards:

- The impact on pedestrians and cyclists, for example the proposed length of widening on the A10 southbound entry is constrained by the impact upon the adjacent pedestrian / cycleway route.
- There are other physical constraints such as the circulatory roundabout bridge structures, service bays, earthwork embankments, the railway overbridge walls, the Bulls Cross Ride overbridge and the existing service road on the east of the A10 that may impact upon design.
- Extension of earthworks embankments may be required to accommodate road restraint systems. Where widening of existing earthworks is required it is likely to need steepened or reinforced solutions rather than conventional earthworks due to possible land constraints around the junction.
- A number of utilities have been identified that will require diversion. This includes TfL assets that may be affected on the A10 corridor approach.

6.2 Structures

As part of these proposals the existing bridges on the M25 Junction 25 roundabout circulatory carriageway, new foot/cycle bridge, aqueduct and subways need to be subjected to structural assessment. This is to ascertain that the scheme proposals are feasible and constructible.

6.2.1 Junction 25 east and west circulatory carriageway bridges

A review of the existing information for the Junction 25 east and west circulatory carriageway bridges indicated that these bridge assessments date back more than 20 years. Design standards used to prepare these assessments have since been updated.

It is proposed to revise the carriageway layout over the structures. Therefore the load configurations used in the previous assessments will no longer be relevant. There are also various durability defects that compels an updated special assessment inspection to be organised to assess the bridges to the current standards and take into account any deterioration that may have adversely affected their required durability for proposed design life in the intervening period.

These bridge structures have large service bays near the edges of the decks. Widening of the carriageway by utilising the available width of the verges may impact on the potential capacity of the bridge decks by reducing the capacity at the edges of the decks. This may require the reconstruction of the edges of the decks where the service bays are located.

Structural condition surveys, testing and investigation need to be carried out and updated bridge capacity assessments prepared to inform the design for the proposed widening of the circulatory carriageway over these two road bridges on M25 Junction 25 roundabout.

6.2.2 Subways

A reconnaissance inspection of these subways has been undertaken. This did not find any structural deficiencies to preclude the construction of the required subway structure extensions. This premise would however need to be confirmed during the preliminary design stage by undertaking special inspections to facilitate structural assessment of these existing subways.

6.2.3 New foot/cycle bridge

The proposed foot/cycle bridge would span across the M25 within the centre of the roundabout. Lengths of new footway/cycleway will connect this new bridge to the ends of the extended subways. These transitional lengths will likely require retaining walls or reinforced earth to retain the existing embankments.

6.2.4 New River aqueduct

A level survey will be required to check that sufficient headroom is available to accommodate the proposed widened merge slip road. In addition, an investigation will be required to assess any impact on the substructure elements of the existing viaduct abutment. This will require excavating the fill to expose the abutment foundation.

6.3 Drainage

The proposed surface water system will be designed in accordance with DMRB HA 33/96 to prevent flooding of the highway during a 1 in 5 year storm.

The proposed drainage system for the improvement works will be provided using either a kerb and gully system or combined kerb drains. It is proposed to connect the new drainage systems to existing.

The need for surface water attenuation will be determined in the preliminary design stage. It is proposed to provide this storage using linear storage systems within the highway.

6.4 Lighting

Safety is a priority and the lighting design shall take into consideration the safe maintainability of all assets and show compliance with CDM 2015 and IAN 69/15 – *Designing for Maintenance.*

On the Highways England network the lighting design shall be carried out in accordance with the Design Manual for Roads and Bridges, Volume 8, Section 3, TD34/07 - *Design of Road Lighting for the Strategic Motorway and All Purpose Trunk Road Networks*. An appraisal in accordance with TA 49/07 - *Appraisal of New & Replacement Lighting on the Strategic Motorway & All Purpose Trunk Road Network* – will be performed if it is required.

On the remaining road network the requirements of the local maintaining authority shall be agreed and implemented.

On all road networks particular attention shall be paid to the requirements of the maintainer/owner of the asset to enable integration with their existing assets and systems. This will include but not be limited to determining:

- preferred products/suppliers
- preferred light source
- Central Management System
- Surge Suppression Devices
- cable network type, private or DNO

Particular attention will be paid to the sustainability of the lighting design concentrating on energy reduction and reduced light pollution in accordance with Institute of Lighting Professionals - *Guidance Notes for the Reduction of Obtrusive Light GN01:2011* - whilst providing an efficient maintainable design. This will include considering the following:

- Part Night Lighting
- Dimming
- Constant Light Output
- Adaptive lighting

The lighting classes shall be chosen and designed in accordance with BS5489-1:2013 - *Code of practice for the design of road lighting. Lighting of roads and public a*menity areas and BS EN 13201-2:2015 - *Road lighting. Performance requirements* - and agreed by the maintainer/owner.

Conflict areas will be designed in accordance with the recommendations of the Institution of Lighting Professionals, Professional Lighting Guide 02, *The Application of Conflict Areas on the Highway.*

The use of passively safe equipment, to reduce the severity of injury in the event of a collision, shall be assessed and implemented in accordance with BS EN 12767:2007 - *Passive safety of support structures for road equipment — Requirements, classification and test method* and the recommendations of the Institution of Lighting Professionals Technical Report 30.

The electrical design will be undertaken in accordance with BS7671.

The new lighting will tie in with existing lighting and electrical cable network.

6.5 Summary of C3 estimates

New Roads and Street Works Act (NRSWA) C3 budget estimates were obtained for Option 3 as this option combines the improvements from all other options therefore gives the most complete information relating to statutory undertakers budget estimate.

A summary of the responses and associated costs is provided in Table 6-1 below.

Table 6-1 C3 utility companies' budget estimates

Utility Company	COSTS (excl. VAT and NRSWA discounts)	Description of works from C3 returns	Date response received
BT Openreach	£25,706.98	Diversion of existing Openreach apparatus	04/04/16
National Grid (Gas)	£46,711.12	To abandon 174.5m of 180mm PE main and 77.5m of 125mm PE service. Laying 156m of 125mm PE main. Disconnecting 2 No. Services and transferring 3 No. Services.	18/05/16
Thames Water (Water Supply)	£2,138,100	Connection No. 1 1) Install line stop on 20" steel main to shut off leg of main 2) Lay emptying valve complex with 100mm sluice valve x4 3) Tees for valve complex will require 2x600x100 tees with 2x100 mm equal tees 4) 2 washouts to enable emptying and flushing Connection No. 2: over bridge temp. 1) Install line stop on 600 mm DI main. 2) Install u/p tee 3) Install rider main with W/O 4) Pressure test and chlorinate Connection No. 3 1) Lay emptying valve complex with 100mm sluice valve x4 2) Tees for valve complex will require 2x600x100 tees with 2x100 mm equal tees. 3) 2 washouts to enable emptying and flushing Connection No. 4 1) Line stop x2 on 600 mm main with under-pressure tees x 2 with 710 mm PE short term rider pipe 2) Install 600x600 mm tee 3) Install 2x600 mm sluice valves 4) Install 600x80 off tee with washout General to full diversion Main laying length of approximately 520m Anchor rings to be used on pipe for full diversion length Thrust blocks to be designed at detailed design stage Pressure test and chlorination of main	27/05/16
UK Power Networks	£550,000	Divert cables affected by scheme proposals	12/07/16

A summary of the responses for utility companies with plants in the area that are not affected by the proposals are provided in Table 6-2 below.

Table 6-2 C3 utility companies not affected

Utility Company	COSTS (excl. VAT and NRSWA discounts)	Description of works from C3 returns	Date response received
CA Telecom COLT	-	Not affected	01/06/16
Thames Water (Sewer)	-	Not affected	01/06/16

Responses are still outstanding for the utility companies listed in Table 6-3 below.

Table 6-3 Outstanding C3 utility companies

Utility Company	Category
Vodafone Mast	Telecoms
O2 Mast	Telecoms
GeneSYS	Telecoms/Electricity

The information detailed above is current at the dates identified and the level of detail that the schemes are currently progressed. Further estimates will need to be sought when further design is undertaken.

It is possible that existing services will be altered and additional services may be placed in the area in the future in light of potential future developments and therefore appropriate repeat searches should be undertaken in accordance with NRSWA guidance as the scheme develops.

For more details of C3 see PCF Stage 1 product – Statutory Undertakers Estimate.

7 Traffic analysis

7.1 Introduction

The M25 Junction 25 Improvements scheme is expected to provide largely local benefits relating to the improved performance of the roundabout, reduced queuing on the slip roads approaching the gyratory as well as along the A10 and M25.

Transport modelling is a key requirement for the study in terms of comparing Options and supporting the cost benefit analysis of the scheme, including the economic and environmental assessments. At PCF Stage 1 this necessitates understanding the predominant local scheme impacts as well as the influences across the wider road network.

Considering the requirement of the transport model to support the operational, economic and environmental assessments, a number of existing local and strategic modelling tools were identified as well as others that are currently under development (see ASR v1.4 section 5.3.2 for further details).

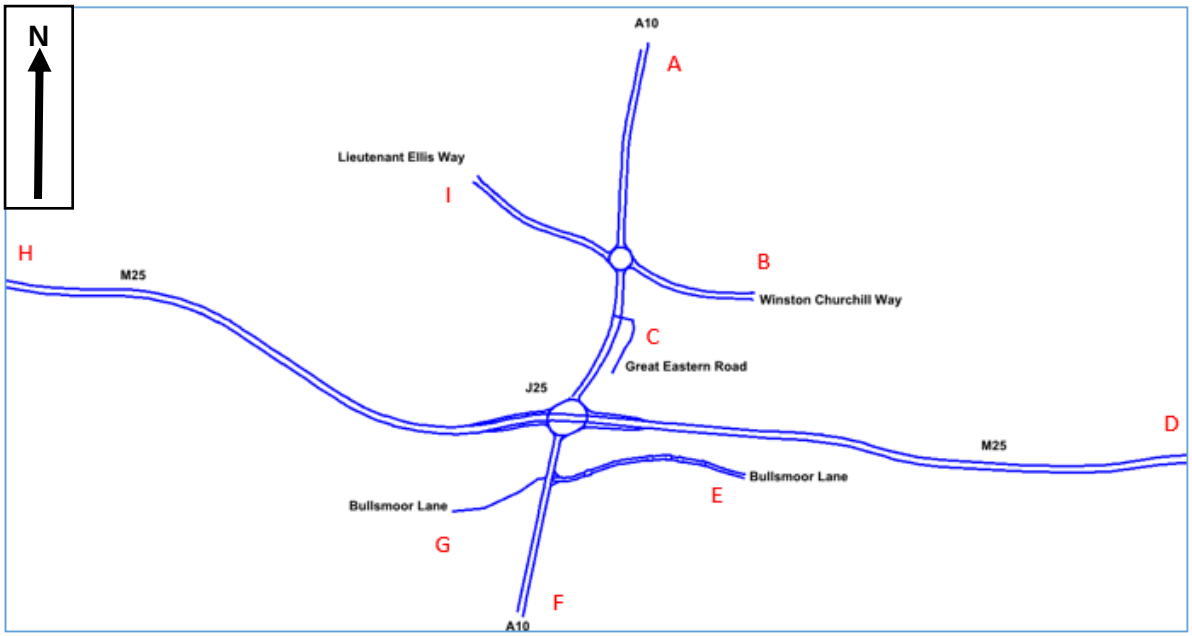
The modelling framework for PCF Stage 1 comprised of developing a local / operational tool in the short term which can be used at later PCF Stages to suitably demonstrate junction operation. Subsequent PCF Stages will also utilise one of the strategic models which are anticipated to be available beyond PCF Stage 1. This modelling framework was discussed and agreed with TAME as per the ASR (v1.4).

The current M25 Junction 25 LinSig model (see ASR section 5.3.2.1) and a VISSIM model (see ASR section 5.3.2.2) were identified as being the most appropriate starting point for modelling and evaluation of the localised benefits associated with the proposed scheme options.

These models required expanding geographically. The zoning system coding for the updated VISSIM Base Year model is shown in Figure 7-1 with the traffic entry and exit points being:

- Zone A – A10 North
- Zone B – A121 Winston Churchill Way
- Zone C – Great Eastern Road
- Zone D – M25 East
- Zone E – Bullsmoor Lane East
- Zone F – A10 South
- Zone G – Bullsmoor Lane West
- Zone H – M25 West
- Zone I – B198 Lieutenant Ellis Way

Figure 7-1 M25 Junction 25 VISSIM zoning plan



The models required updating with a number of additional data sources as described below.

7.2 Traffic data

To support the development of the VISSIM Base Year model and PCF Stage 1 economic and environmental assessments a number of data sources were utilised. The most up to date and complete dataset was sought, utilising data from known sources, studies and models.

7.2.1 Data sources

Table 7-1 provides a list of the key data sources identified and described in the TDCR. The notation is used to cross reference throughout the TDCR and Local Model Validation Report (LMVR), which report fully on all data collected. Key volumetric and journey time data is shown in Figure 7-2 to Figure 7-8.

The data collected for PCF Stage 1 was proportionate to the level of modelling required. Where data gaps were identified, additional data was sourced to supplement data already obtained, ensuring that a dataset has been obtained that is fit for purpose. Additional quality checks were undertaken to ensure the data is representative for the model Base Year (November 2014).

Table 7-1 Key data sources and units

ID	Network Location	Source / Description	Date	Units
Volumetric link flows				
L4	M25 J25 mainline clockwise (between on and off-slips)	Highways England / TRADS database – ATC traffic count	Oct - Dec 2014	Classified 24 hr vehicle count (15 minutes segmentation)
L5	M25 J25 mainline clockwise (between on and off-slips)	Highways England / TRADS database – ATC traffic count	May - Dec 2014	Classified 24 hr vehicle count (15 minutes segmentation)
L6	M25 J25 mainline clockwise (between on and off-slips)	Highways England / TRADS database – ATC traffic count	Oct - Dec 2014	Classified 24 hr vehicle count (15 minutes segmentation)
L7	M25 J25 mainline anticlockwise (between on and off-slips)	Highways England / TRADS database – ATC traffic count	Nov - Dec 2014	Classified 24 hr vehicle count (15 minutes segmentation)
L8	M25 J25 mainline anticlockwise (between on and off-slips)	Highways England / TRADS database – ATC traffic count	Nov - Dec 2014	Classified 24 hr vehicle count (15 minutes segmentation)
L16	A10 (N)	Broxbourne BC / JMP - ANPR & OD survey	18 Jun 2013	Unclassified 12 hr vehicle count (15 minutes segmentation)
L18	A10 (N)	Hertfordshire CC - ATC traffic counts	Sep - Dec 2015	Classified 24 hr vehicle count (15 minutes segmentation)
Volumetric turning counts				
T1	M25 J25 / Bullsmoor Lane	Highways England / CPS - OD survey junction turning counts	11 and 17 Dec 2014	Classified 12 hour turning counts (15 minutes segmentation)
T2	M25 Junction 25	Broxbourne BC / JMP - junction turning counts	1 Dec 2010	Classified 12 hour turning counts (15 minutes segmentation)
T3	Bullsmoor Lane	TfL - junction turning counts	22 Mar 2011	Classified 8 hour turning counts (15 minutes segmentation)
T4	Great Eastern Road	Broxbourne / Mouchel - junction turning counts	18 Jun 2013	Classified 6 hour turning counts (15 minutes segmentation)
T5	Goffs Oak Rbt	Broxbourne / Mouchel - junction turning counts	16 Nov 2010	Classified 12 hour turning counts (15 minutes segmentation)
Journey times				
J4	M25 between J24 and J26	Highways England - Segmented journey time and speed data	Sep to Nov 2014	Segmented journey times (s) and speeds (kph)
J5	Various covering M25 and A10	TomTom – Segmented journey time and speed data	Sep to Nov 2014	Peak periods and selected other time period journey times (s) and speeds (kph)
Queues				
Q1 / Q2	M25 J25 / Bullsmoor Lane	Highways England – queue survey	11 and 17 Dec 2014	Classified 12 hr queue counts (vehicles)
Q4	Goffs Oak Rbt	Broxbourne BC / Mouchel – queue survey	1 Dec 2010	Classified 6 hr queue counts (metres at minute intervals)
Signals				
S1	M25 Junction 25	Highways England - Traffic Signal Controller, Work Specification and Config Forms	22 Aug 2008	N/A
S2	Bullsmoor Lane	TfL - Timing Sheet and ASTRID data	23 Oct 2015	N/A
S3	Great Eastern Road	Hertfordshire CC - Traffic Controller Configuration Form	21 Jan 2011	N/A

Volumetric data (link and turning count) from a number of sources is summarised geographically in Figure 7-2 to Figure 7-3.

Figure 7-2 Volumetric dataset – link count data sources and locations

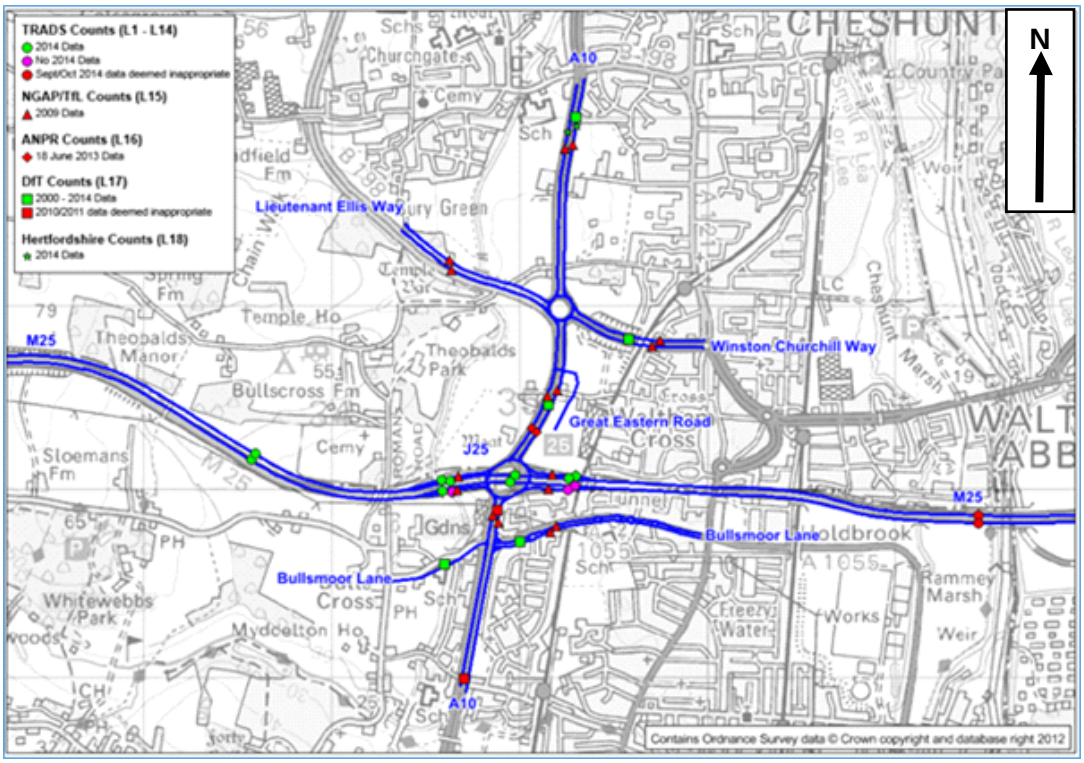
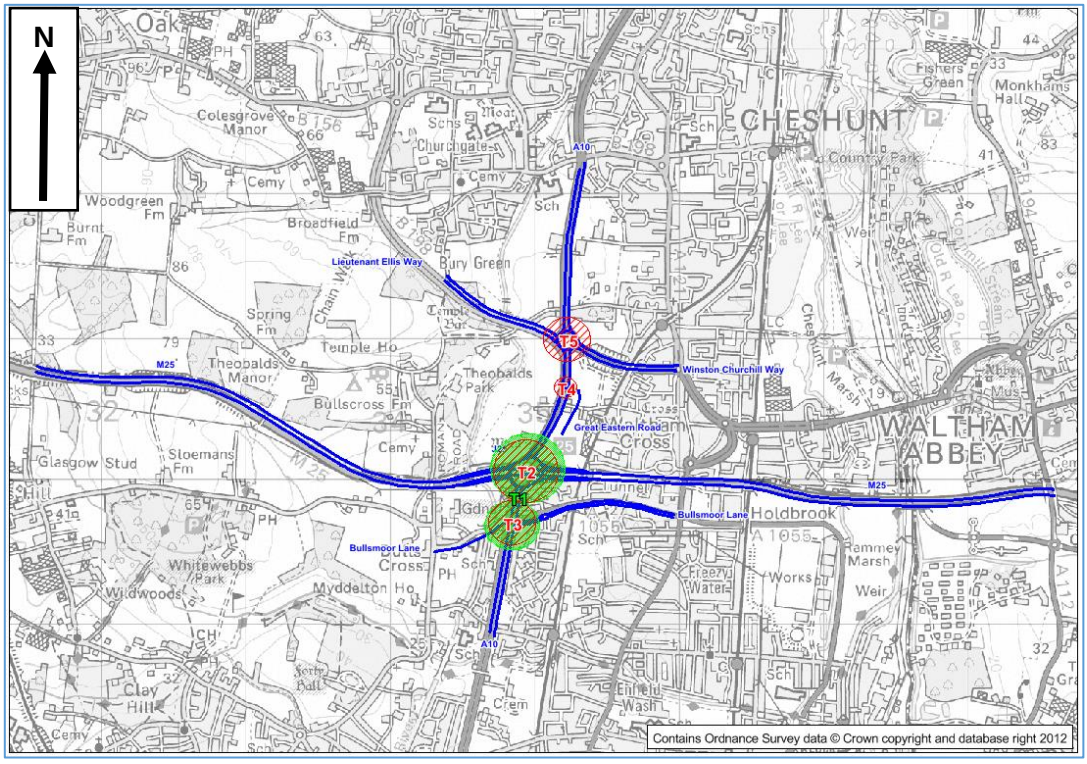


Figure 7-3 Volumetric dataset – turning count data sources and locations



Journey time data, sourced from TomTom (J5), is summarised geographically in Figure 7-4 to Figure 7-8.

Figure 7-4 Journey time routes (from A10 N)

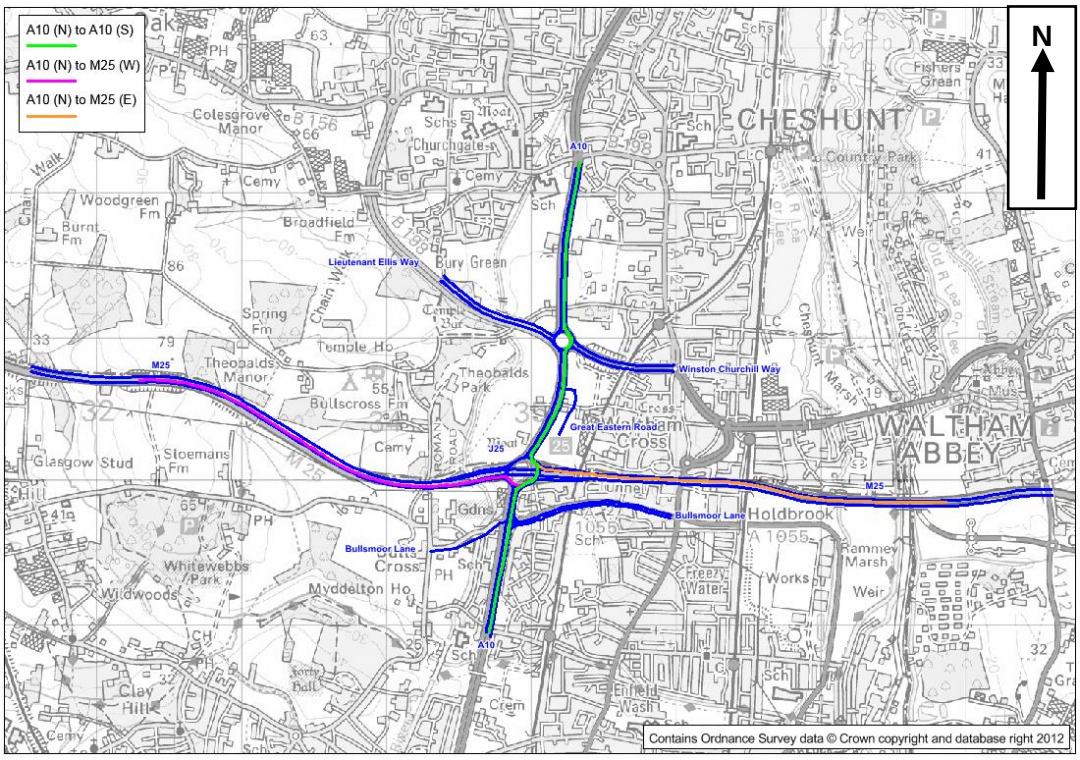


Figure 7-5 Journey time routes (from A10 S)

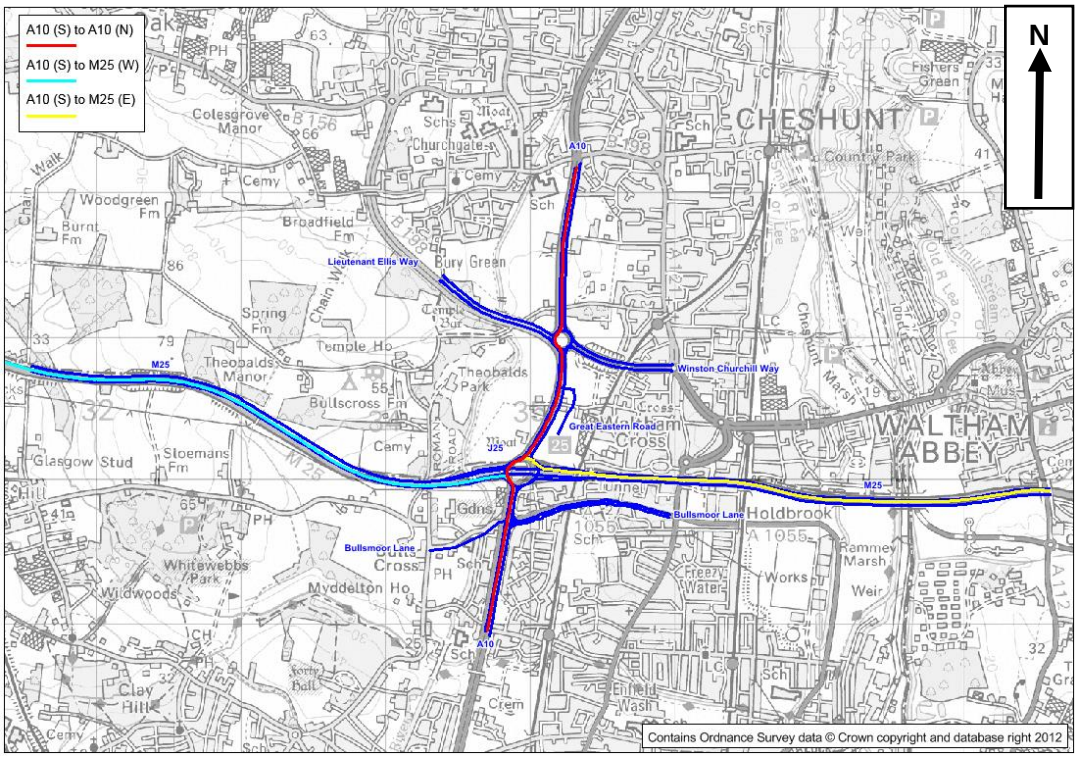


Figure 7-6 Journey time routes (from M25 E)

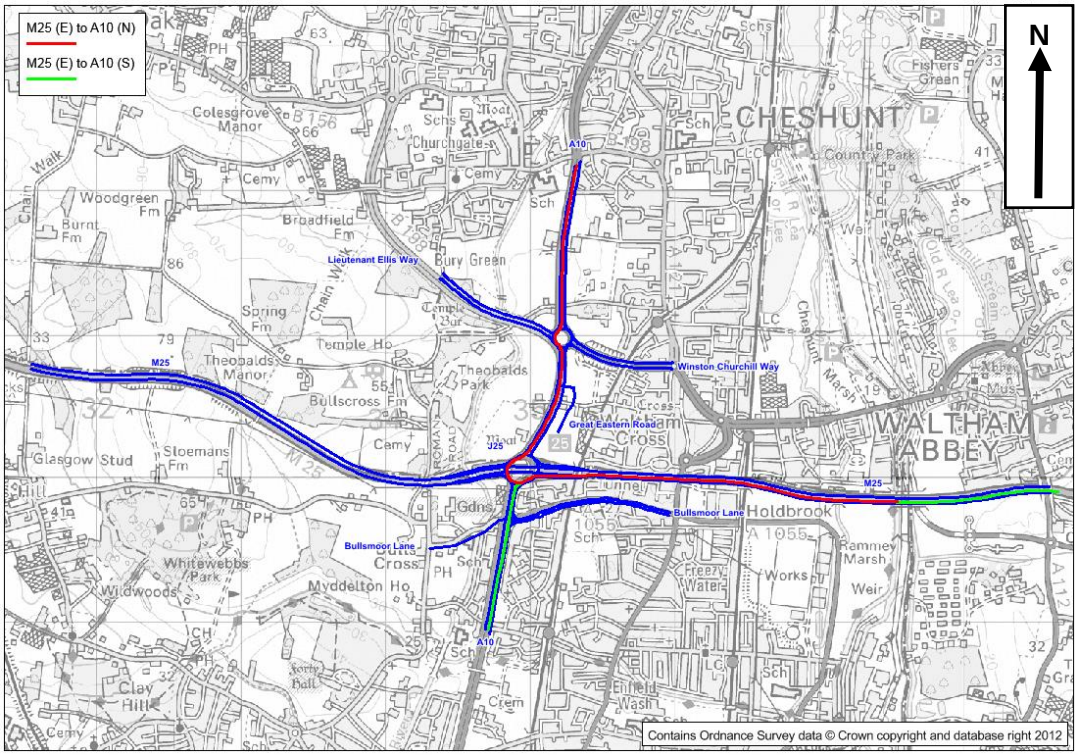


Figure 7-7 Journey time routes (from M25 W)

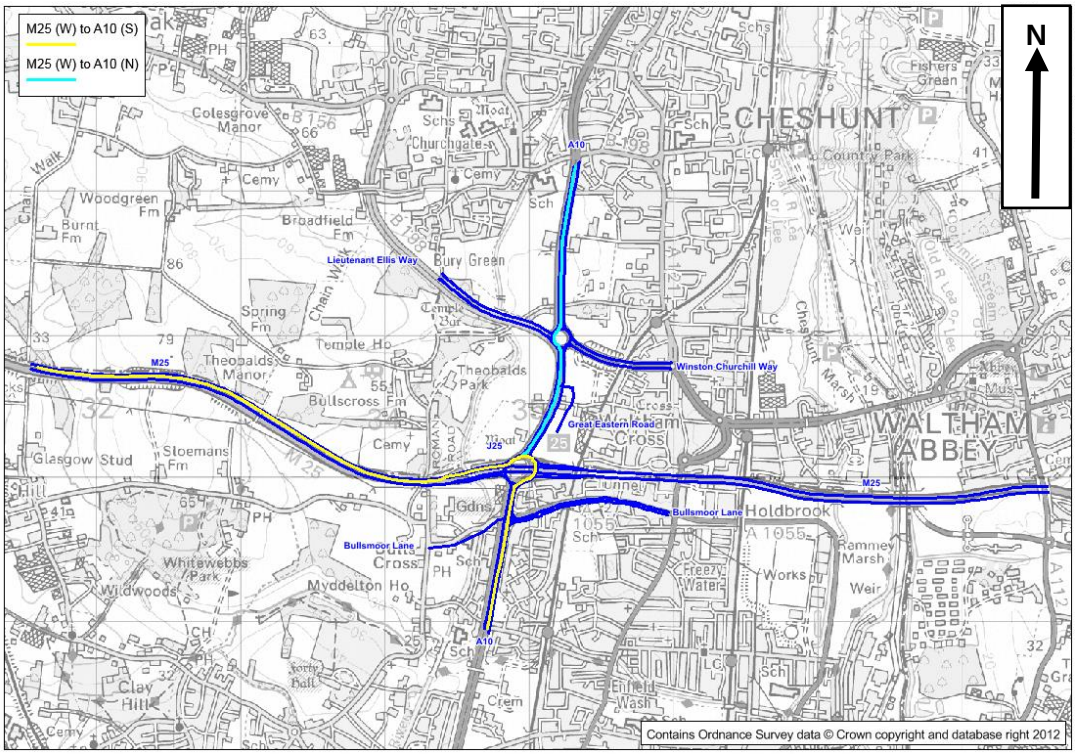
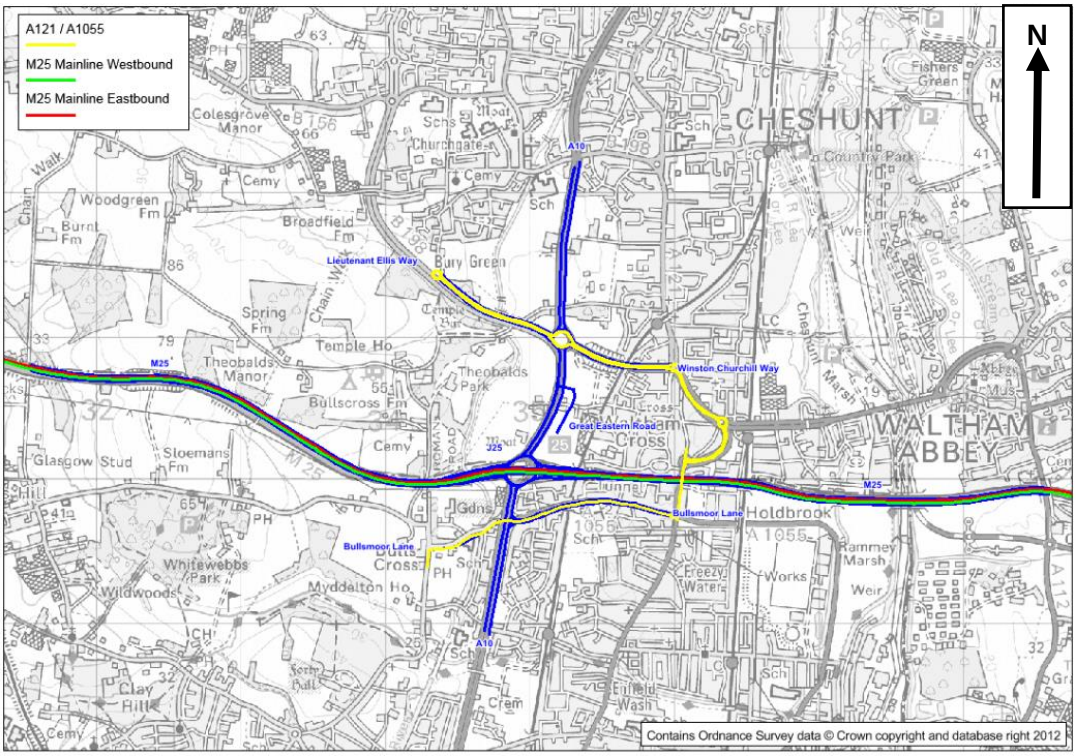


Figure 7-8 Journey time routes (M25 mainline and A121/A1055)



7.3 Traffic analysis

7.3.1 Base year model development

The LMVR produced as part of the Base Year traffic model development aimed to:

- Demonstrate that the model accurately reproduces an existing, independently observed situation
- Summarise the accuracy of the base from which the forecasts are to be prepared.

The VISSIM model was validated using a static model assignment in which routes are manually input based on pre-defined matrices.

Modelled time periods as defined in section 3.3 above were:

- AM peak hour - 07:30 – 08:30
- PM peak hour - 16:00 – 17:00
- IP peak hour - an average of the period 10:00 – 16:00.

Two user classes: 'lights' - cars/taxis/light goods vehicles (LGVs) and 'heavies' - OGV1/OGV2 were derived from the observed traffic count data and assigned on the routes within the network for the peak hours defined in section 3.3.

In summary, the purpose of the base VISSIM model is to replicate accurately existing conditions so that the model can then be used for the future year assessment of the Junction 25 Improvement Scheme options. Key elements of the modelling process were:

- Coding the network in VISSIM, including coding of links and connectors using aerial mapping and Google Street view, signal timings and detectors, reduced speed areas, priority rules, desired speed decisions and gradients. It should be noted that the ramp metering on the M25 Junction 25 eastbound on-slip was not included in the model as the system has been switched off and is not currently operational.
- Developing demand matrices using classified traffic data adjusted to a 2014 base for consistency including matrix estimation to balance any discrepancies in the data. It should be noted that flows were assigned as hourly flows into VISSIM and not split into 15 minute intervals. This was due to the fact that the count data sources used covered a number of years/months. Additionally, the turning count data used in the models demonstrated a very consistent 15 minute profile across the identified AM and PM peak hours. With VISSIM assuming a flat profile for the hour assignments a degree of variation due to differing arrival rates over the 16 ransom seeds is already accounted for. Accordingly the approach adopted was considered appropriate.
- The VISSIM model was largely developed using default parameters, as advised in the Highways England's Interim Advice Note 36/01. However, during the model calibration process, these parameters were reviewed and some were adjusted to better fit the observed driver behaviour and operating conditions.
- Model validation was based on best practice advice and guidance. Modelled and observed traffic flows and journey times were compared for all turning movements and routes in the model respectively. Both have been shown to meet the DMRB criteria for acceptability for all time periods (see Table 7-2).

Table 7-2 Validation summary

Validation Element	AM Peak		Inter Peak		PM Peak	
Flow	96%	45/47*	96%	45/47*	91%	43/47*
Journey Time	87.5%	14/16**	87.5%	14/16**	87.5%	14/16**

* Number of turning movements with GEH < 5 out of total number of turning movements
** Number of journey time routes within +/- 15% or 1 minute out of total number of journey time routes

The LMVR recognised that certain movements / journey times were less well modelled than others. More specifically at Goffs Oak Roundabout the model does not replicate the same level of congestion as observed in the PM Peak hour. This is due to the free flow characteristics and the difficulty in modelling roundabout movements and interactions between opposing flows. As such a degree of caution should be attached in interpreting modelled outcomes.

However, overall the model is considered fit for purpose, providing a robust representation of the base year (2014) traffic conditions within the modelled network. The model can be used with confidence to forecast the likely traffic impact of the Junction 25 Improvement Scheme options.

7.3.2 Forecasting - option testing

Forecast reference cases (DM) and the three options (DS1, DS2 and DS3) were developed to produce traffic data outputs to support environmental and economic assessment of the options for the following years:

- 2022 ('opening year')
- 2037 ('design year')

Sensitivity tests were also carried out to represent the minimum and maximum potential economic benefits of the DS options. The low growth sensitivity test was undertaken on the 'worst performing' option, whilst the high growth sensitivity test was undertaken on the 'best performing' option.

7.3.2.1 Forecasting methodology

The ASR (v1.4) proposed that the study utilise demand data from the Broxbourne Saturn model, including flows and forecast changes in flows / trip distribution from the network assignment model. However, the NGAP forecast year reference cases were available and favoured due to:

- Being more up to date (Base Year 2015) than the Broxbourne model (Base Year 2013)
- Having two forecast years (2021 and 2031) as opposed to one for Broxbourne (2029)
- Having all three time periods (Broxbourne does not model the Inter peak).

A combination of NGAP, NTM and TEMPRO forecasts were used to develop future year growth factors. The forecasting approach was discussed and agreed with TAME and is detailed further in the Traffic Forecasting Report (TFR).

It should be noted that the NGAP reference case forecast models have not been finalised and are still under review by AECOM. Atkins have not had full access to all model files and have therefore not been able to undertake a detailed review of the model development and forecasting process. As the NGAP model has not been developed with a specific focus on representing Junction 25, the results should be taken with some caution. However it is understood that the model has been developed in line with WebTAG guidelines and the forecasts are therefore considered fit for purpose i.e. PCF Stage 1 modelling requirements.

7.3.3 Assessment - key findings

7.3.3.1 2022

Based on the NGAP growth and distribution assumptions, the DM network (signal improvements only) will struggle to cope with the additional growth by 2022 across all time periods.

The DS1 (Option 1), as with the DM, is unlikely to cope with the additional growth. Benefits are restricted due to none of the approach arms being widened, limiting possible traffic

throughput at Junction 25. This demonstrates that a more substantial scheme is required to tackle the congestion issues at the M25 Junction 25 (and Bullsmoor Lane).

DS2 and DS3 perform substantially better than the DM and DS1 in the AM and PM peak periods:

DS2 (Option 2) provides substantial benefits in the study area across a number of indicators:

- Overall DS2 performs at similar levels to the Base Year network performance indicators despite there being 8 years' worth of growth in the network and the network being able to process higher flows.
- Substantial increases in the numbers of vehicles processed across most of the network.
- The best performing scenario for a few journey time routes and comparable with the DS3 on a number of others.

DS3 (Option 3) provides additional benefits:

- The DS3 performs slightly better than DS2 across all performance indicators and is the best performing across all options.
- Higher numbers of processed vehicles are forecast across most of the network than for DS2.
- Is the best performing scenario for journey times along most routes, generally improving journey times compared to the Base Year despite increased vehicle throughput.

7.3.3.2 2037

The 2037 assessment is similar to that for 2022 across all time periods and indicators. The DM and DS1 are insufficient to cope with the additional growth by 2037 across all time periods.

Similarly DS2 and DS3 are the better performing options, with DS3 performing marginally better in the AM and Inter peaks and to a greater extent in the PM peak.

In the AM peak, DS3 and DS2 generally maintain key network characteristics between 2022 and 2037, such as average vehicle speed, average travel time and average delay, whilst increasing the number of vehicles processed.

In the PM peak, the number of vehicles processed increases but the performance of both options reduces between 2022 and 2037, for example:

- The DS3 average network speed reduces from 34 mph to 30 mph and average delay per vehicle increases from 1.5 minutes to 2.2 minutes.
- The DS2 average network speed reduces from 32 mph to 28 mph and average delay per vehicle increases from 1.9 minutes to 2.7 minutes.

As for 2022, DS3 is the best performing option for the vast majority of journey time routes, with DS2 forecast to perform similarly to DS3 for most routes.

7.3.4 Sensitivity analysis

The 'worst performing' option was identified as being the DS1 and the 'best performing' the DS3. Both low and high growth sensitivity tests were also undertaken for the DM for the economic assessment. The results for the sensitivity tests show that:

- The DM and DS1 2022 and 2037 low growth scenarios are forecast to perform better than the equivalent core scenarios.
- The DM and DS3 2022 and 2037 high growth scenarios are forecast to perform worse than the equivalent core scenarios. It should be noted that the high growth

scenarios result in latent demand (vehicles that are unable to enter the network due to congestion).

7.4 Summary

In summary the 2037 assessment is similar to that for 2022 across all time periods and indicators i.e. the DM and DS1 are insufficient to cope with the additional growth by 2037 across all time periods. DS2 and DS3 are the better performing options, with DS3 performing marginally better in the AM and Inter peaks and to a greater extent in the PM peak.

In the AM peak, DS3 and DS2 generally maintain key network characteristics between 2022 and 2037, although the performance of both options reduces between 2022 and 2037 in the PM.

Further analysis to assess the associated benefits / disbenefits of the scheme options and sensitivity tests as part of the economic and environmental assessments are provided in sections 8 and 12 respectively.

All information contained in this chapter can be found in more detail in the Stage 1 TDCR, LMVR and TFR.

8 Economic assessment

8.1 Overview

The economic assessments for each improvement option for M25 Junction 25 were carried out in line with Department for Transport (DfT) and Treasury guidance as detailed on the DfT Transport Appraisal website[18] and in the Transport User Benefit Appraisal (TUBA) guidance[19].

The wider economic impacts of the improvements (including regeneration potential) have not been considered in the assessment as they are not considered to be significant in this area, a view supported by Highways England for PCF Stage 1. These impacts will be reconsidered in PCF Stages 2 and 3.

The economic assessment process has been documented in more detail in the Economic Assessment Report (EAR). This chapter provides a summary of the approach adopted for the economic assessments, together with the underlying assumptions and the results.

8.2 Overview of economic assessment process

8.2.1 Costs and benefits considered

The economic assessment of the M25 Junction 25 options was based on the use of outputs from the VISSIM model in conjunction with industry standard appraisal software, focusing on four areas of impact:

- **The impacts of each option on travel times and vehicle operating costs** for trips using the junction. These impacts were estimated on the basis of the forecast change in travel conditions caused by each option compared to a Do Minimum scenario. Conditions in each scenario were forecast using the VISSIM model, with model outputs (travel demand, time and distance matrices) used to calculate travel user benefits and indirect tax benefits using the DfT's TUBA program, v1.9.6
- **The impacts of each option on road accidents at the junction** were estimated using COBALT v2013.2 (parameters v2016.1) and changes in traffic levels by road link forecast by the VISSIM model
- **The impacts of the construction** on travel times and delay for journeys within and through the study area; indicative estimates of scale were made largely using QUADRO 4.14, base year traffic flows and early assumptions on likely traffic management measures
- **The costs of construction**, accounting for works, land acquisition, preparation and supervision costs.

8.2.2 Forecast years and appraisal period

For each option, estimates of each element of the scheme's costs and benefits after opening were made for three modelled time periods (AM peak, Inter Peak and PM peak), for two modelled forecast years:

- 2022 ('opening year')
- 2037 ('design year') – 15 years after opening

[18] http://webtag.org.uk
[19] TUBA User Guidance and User Manual, Version 1.9.6, prepared by Atkins on behalf of the DfT, 2015. TUBA is the DfT's bespoke software for carrying out economic assessments of the impacts multi-modal transport schemes.

The TUBA and COBALT analyses provided assessments of impacts over a 60 year appraisal period after scheme opening (2022 to 2081), using outputs from all three time periods and both years provided by the model. No further growth in demand or benefits was assumed after 2037 (apart from real growth in values of time and fuel costs, in line with WebTAG).

The assessment of impacts of construction on travel times provided a representation of impacts during the construction period, with the relevant duration identified for each anticipated element of traffic management.

8.3 TUBA assessments

8.3.1 Overview of TUBA process

The impacts of the options on travel times and vehicle operating costs for trips using the junction after scheme opening were assessed using the DfT's TUBA programme.

TUBA is bespoke software developed on behalf of the DfT to estimate the impacts of transport schemes in terms of the costs and benefits experienced by users and providers of the transport system and the associated indirect taxation impacts. All impacts are considered in monetary terms.

TUBA estimates costs and benefits experienced by users and providers of the transport system by comparing transport conditions in a Do Something scenario against conditions in a Do Minimum scenario. To this end, for highway schemes such as the M25 Junction 25 scheme, TUBA uses information from the transport models to:

- Calculate user benefits by vehicle type and for each element of journey cost (i.e. travel time and vehicle operating costs - fuel and non-fuel)
- Calculate the changes in the indirect tax income received by the government (for highway schemes this primarily reflects levels of indirect taxation incurred on fuel cost).

For the Junction 25 assessments, the user and provider related costs and benefits estimated in each year by TUBA were combined with estimates of accident savings (calculated in a parallel process described below) and costs and discounted to 2010 values (using a discount rate of 3.5% for the first 30 years from the appraisal year and 3.0% thereafter).

8.3.2 Input parameters and assumptions

The EAR sets out the key assumptions and parameters used for running each of the M25 Junction 25 TUBA assessments, along with their sources. Most of the values adopted were based on the guidance given in TUBA, although local data was used where available and relevant, in particular:

- Vehicle Type Proportions: The 'lights' vehicle demand matrix within VISSIM is split between cars and LGVs for each input arm for the model runs on the basis of splits identified from traffic counts (as described further in the Forecasting Report). Estimates of the relative proportions of other goods vehicles 1 and 2 in the 'heavies' vehicles matrices were derived from observed classified counts at the junction.
- Annualisation Factors: These were used to convert estimates of demand related costs and benefits experienced during the three modelled hours (AM peak hour (07:30-08:30), inter-peak hour (average hour between 10:00 and 16:00) and PM peak hour (17:00-18:00) into estimates of total annual costs and benefits in 12 hour working week days for each modelled year. The factors were based on an assumption of 253 working days per year and comparison of relative levels of demand in the shoulder periods around the main peak hours in the peak periods, identified from Highways England 2014 traffic count data at the junction.

8.3.3 Input matrices

Alongside the parameters files, the key input to each TUBA assessment was a series of matrices representing numbers of trips and travel distance and time for movements through the junction for each vehicle type in each time period, modelled year and scenario.

The matrices were originally produced using VISSIM by treating each entry/exit as an origin/destination zone as shown in Figure 7-1. Two adjustments were then made to the matrices provided by VISSIM:

- 'Unmet demand' was added to the demand matrices output by VISSIM. It should be noted that this demand was added to the output matrices using the assumption that vehicles unable to enter the network experience the same journey time and delay on a given movement as the average for journeys on the same movement that do make it into the network in the modelled time period. This is considered to be conservative as the delay is likely to be much higher.
- Travel times were capped to include a maximum delay of 300 seconds per vehicle.

The trip matrices output by VISSIM as a default only represent trips that make it onto the model network within the modelled hour, therefore excluding any that remain to be discharged onto the network. The numbers still waiting to be discharged are recorded by network entrance point as 'unmet demand'. This demand was added to the output matrices using the assumption that the distribution of the unmet trips from each origin to destination was equivalent to the distribution for trips that made it onto the network during the hour.

Travel delays were capped to 300 seconds because the high levels of demand in forecast years lead to high levels of queuing and associated delays in the Do Minimum scenario which are then alleviated by the options tested, leading to high levels of benefit in the economic assessment. It is considered that the high Do Minimum delay levels are partly a consequence of the current modelling framework which does not fully allow for rerouting or retiming which would both be potential responses to mitigate the levels of delay forecast.

The forecasts do allow for the level of rerouting forecast by the NGAP strategic model but due to the difference in characteristics of the models and their base years, it is likely that the NGAP model does not forecast the same high levels of delay at M25 Junction 25 as the VISSIM model, which would in turn reduce the level of rerouting away from the junction that it forecasts.

The adoption of the delay cap is intended to provide a conservative assessment of economic impacts and to reflect the assumption that trips using the junction would find an alternative route (or journey timing) with equivalent total cost once delay at the junction reached the cap level.

The threshold of 300 seconds was adopted because a number of base year AM peak movements experience delays of over 300 seconds, suggesting that the level of delay is already tolerated and therefore should be a conservative assumption of levels that will be tolerated in future years. Tests using an alternative caps of 200 and 400 seconds were also undertaken and are reported in the EAR but did not alter the key messages from the assessment.

8.4 Safety assessment

The DfT's COBALT spreadsheet was used to provide a simple assessment of the impact of each of the options on accident costs.

Accident rates across the modelled network were based on default national average rates by road type defined within COBALT. The assessment assumed no changes in accident rates

by link type as a result of the options. Therefore all accident benefits forecast resulted from changes in traffic travel distance and link type arising from the scheme.

Consistent with the TUBA assessment, the COBALT assessment considered impacts over a 60 year appraisal period, drawing on traffic flow information from the VISSIM models for 2022 and 2037 and assuming no further growth in traffic or benefits beyond 2037 (apart from an allowance from continued growth in the real value of accidents, in line with WebTAG).

8.5 Reliability assessment

Journey time reliability is reduced by the existence of journey time variability that drivers are unable to predict. The M25 Junction 25 scheme is likely to improve operational resilience, which in turn is expected to lead to improved journey time reliability.

However, journey time reliability impacts are currently difficult to represent and quantify. Highways England's MyRIAD tool has been developed to measure the effects of changes in incident related journey time variability on motorways but is only able to capture reliability variations in relation to motorway widening schemes and technology improvements on links and is therefore not applicable in this case.

8.6 Construction and maintenance costs

8.6.1 Capital costs of schemes

Cost estimates for each option have been produced by the Highways England Commercial Estimating Team. Each estimate covers the costs of works, impacts on utilities, land acquisition, and preparation/ supervision. Cost estimates are provided in Appendix H.

8.6.2 Risk and optimism bias allowances

On the basis of guidance from Highways England, the cost estimates received have been assumed to need no further adjustment to account for risk and optimism bias.

8.6.3 Do minimum costs

All Do Something costs were assumed to be net of Do Minimum costs and therefore no specific Do Minimum costs were assumed for the assessment.

8.6.4 Maintenance costs

Operational and maintenance costs have not been included at this stage as they will be minor in comparison to the main scheme implementation costs. They will be considered further in subsequent stages.

8.6.5 Costs for use in economic assessment

The Present Value Costs (PVC) for each option was estimated for use in the assessment based on the cost forecasts and spend profiles provided by the Highways England Commercial Estimating Team in 2010 factor costs. The costs were converted to market prices and discounted to a 2010 base year, as required for appraisal.

8.6.6 Impacts of construction and maintenance works on travel times

Construction of each of the scheme options would involve a programme of traffic management on the live highways including lane closures, hard shoulder closures and speed limits.

Outline plans of the current early views of the phases of traffic management likely for each option have been developed, identifying the nature of restriction, timing and duration of each traffic management phase.

The monetary value of the impact of these measures on road users (i.e. the impacts of users experiencing increased journey times due to traffic management) was assessed using

QUADRO models of the traffic management (and a simple, indicative spreadsheet model for a weekend closure of the M25 mainline), assuming the base year traffic flow levels.

It should be noted that all of the assessments of construction delay are necessarily approximate at this stage, reflecting both the early stage of scheme design, and hence the planning of the traffic management phases. Additionally, QUADRO is a fairly crude modelling tool for estimating impacts on road users, only representing limited options available for drivers affected by construction works.

As the option designs develop further there will be scope to refine and optimise the planned traffic management arrangements and their timescales, potentially decreasing their impact. Future user delay estimates could include the use of a strategic model rather than QUADRO which would allow a more detailed representation of available route choices and their implications for congestion levels and journey times.

8.7 Economic assessment results

8.7.1 Transport economic efficiency, public accounts and summary analysis tables

Table 8-1 summarises the economic impacts of each of the options assessed.

The PVB excluding construction impacts show that benefits in Options 3 generates the largest PVB, approximately 25% greater than the PVB generated by Option 2. However, the largest differential is between Option 2 and Option 1 with Option 2 generating a PVB that is more than four times as large as the Option 1 PVB.

Further analysis of the benefits, presented in more detail in the EAR, shows that the patterns of benefits are also similar between options, particularly Options 2 and 3, with the following key characteristics:

- Time savings dominate the benefits in each option - vehicle operating costs equate to less than 10% of the total PVB and accident impacts equate to less than 0.15% of the total PVB in each case:
    - The vehicle operating cost impacts are the net effect of increases in travel distance due to the new junction arrangements and more fuel efficient speeds
    - Accident impacts are slightly positive in each case, reflecting the net impact of assumed changes in junction link type and changes in travel distance associated with the Do Something options.
- Benefits for business users are significantly greater than those accrued by commuters and other trips, accounting for over 65% of Economic Efficiency of the Transport System (TEE) benefits in each option. This reflects a number of influences including the fact that:
    - LGV and HGV benefits are included in the business benefit total
    - Business values of time per car trip are approximately three to four times greater than the values for car trips for commuting and other purposes respectively.
- Over half of benefits are accrued by car trips. Remaining benefits are split in fairly even proportions between LGVs, OGV1 and OGV2. This pattern reflects the net impact of the number of trips made by vehicle type, the value of time per vehicle (including allowances for vehicle occupancy) and the proportions of each vehicle making each of the affected movements.
- Benefits are focussed on a limited number of movements, particularly between M25 West and M25 East (both directions).
- Benefits are offset to an extent by disbenefits on some movements. This is particularly apparent in 2037 in Option 1 where the optimisation of signals at the

junction improves levels of delay at the junction on average but causes some redistribution, particularly through increased queuing on the eastbound off-slips from the M25 which ultimately lead to queues onto the M25 mainline in the peak periods, affecting the journey times for the high volume of through trips.

- The majority of benefit arise in the Inter peak period, accounting for about 45% of benefits in Options 2 and 3 and 70% in Option 1.
    - AM benefit levels are very similar to Inter peak levels for Options 2 and 3 but much lower for Option 1, reflecting the fact that the displaced delay on to the eastbound off-slips from the M25 is the most severe in this time period
    - PM peak benefits account for only 15% to 20% of benefits in all three options, reflecting lower flows and lower Do Minimum congestion than in the AM peak and a reduced level of scheme impact.

Table 8-1 Analysis of Monetised Costs and Benefits Table (AMCB) summary for options (PV, £000s, 2010 prices & values)

Option	Option 1	Option 2	Option 3
Accidents	£90	£100	£15
Economic Efficiency: Consumer Users (Commuting)	£4,414	£32,654	£42,891
Economic Efficiency: Consumer Users (Other)	£19,999	£77,179	£101,049
Economic Efficiency: Business Users and Providers	£53,431	£229,730	£279,104
Wider Public Finances (Indirect Taxation Revenues)	-£7,622	£1,303	£945
Present Value of Benefits (PVB)	£70,312	£340,966	£424,004
Broad Transport Budget	£19,535	£22,727	£32,054
Present Value of Costs (PVC)	£19,535	£22,727	£32,054
Net Present Value (NPV)	£50,777	£318,239	£391,950
Benefit to Cost Ratio (BCR)	**3.6**	**15.0**	**13.2**

8.7.2 Reliability

As outlined above, estimates of the monetary value of reliability impacts of the options have not been assessed at this stage, due to the recognised current difficulty in quantifying reliability impacts.

However an assessment of incident records provided by Highways England for the junction for the period between January 2013 and July 2016 provides evidence that improving capacity at the junction (and therefore improving resilience to accommodate the impacts of incidents) has the potential to have a significant impact on reliability. In current conditions, incidents such as breakdowns and collisions which lead to a reduction in available capacity on the roundabout can lead to considerable queuing and delay and associated deterioration in journey time reliability.

The data provided shows than an average of 63 recorded[20] incidents occur per month, of which 60% occur within busier time periods (07.00 to 19.00 weekdays and 12.00 to 18.00 weekends) during which flows are likely to be higher and impacts of incidents more

[20] The incident record is not fully comprehensive and so the estimates of incident numbers presented are likely to be conservative

significant. Over one-third of incidents influence the network for more than an hour, increasing the likely scale of their impact on reliability.

8.7.3 Noise, air quality and greenhouse gases

Impacts on noise, air quality and greenhouse gases are being appraised but not monetised for PCF Stage 1.

8.8 Sensitivity tests

Table 8-2 presents the summary AMCB Figures for Option 1 and Option 3 run with the core traffic growth scenario and low and high traffic growth sensitivity tests (derived in line with WebTAG, as described in the TFR) respectively.

The purpose of these tests was to evaluate whether Option 1 (the option with lowest levels of benefits) would continue to give benefits if traffic levels did not grow as anticipated, and whether Option 3 (generating the greatest levels of benefits) had enough capacity to accommodate a higher level of growth without a rise in congestion and fall in benefits.

The Option 1 low growth sensitivity test performs more strongly than the core growth scenario. This reflects the fact that in a lower growth scenario the offsetting impacts of the redistribution of delay (particularly on the eastbound off-slips from the M25) is much less severe and therefore offsets the direct scheme related benefits to a much lesser extent than in the core scenario.

The Option 3 high growth sensitivity test suggests that the option would be able to accommodate higher levels of growth, leading to an increase in benefits as a greater number of trips each experience higher levels of delay in the Do Minimum benefit from the implementation of the option.

Table 8-2 AMCB summary for traffic growth sensitivity tests (PV, £000s, 2010 prices & values)

	Option 1		Option 3	
	Low	Core	Core	High
Present Value of Benefits (PVB)	£76,510	£70,312	£424,004	£474,023
Present Value of Costs (PVC)	£19,534	£19,535	£32,054	£32,054
Net Present Value (NPV)	£56,976	£50,777	£391,950	£444,552
Benefit to Cost Ratio (BCR)	**3.9**	**3.6**	**13.2**	**14.8**

8.9 Summary

Economic assessment of the impact of the M25 Junction 25 options after opening was undertaken using information on trip numbers, time and distance through the junction for each vehicle type, time period and modelled year as forecast by the VISSIM model. These outputs were then used in conjunction with the DfT's TUBA and COBALT programmes, assessing transport economic efficiency and accident savings respectively. The resultant estimate of impacts over a 60 year appraisal period shows that all three options perform strongly in economic terms, generating BCRs that can be considered to represent High Value for Money (Option 1) or Very High Value for Money (Options 2 and 3). However, the scale of benefits varies considerably between options, with the PVB associated with Options 2 and 3 exceeding the PVB for Option 1 more than fourfold.

This differential arises primarily because a large proportion of the Do Minimum congestion at the junction arises from delay at the signalised pinch-points at the top of each off-slip from the M25. Option 1 does not offer a significant increase in capacity for traffic flow through these pinch-points and so cannot alleviate as much congestion as Options 2 and 3.

Additionally the more limited nature of the improvement in Option 1 means that the benefits achieved for some movements are generated at the expense of a (smaller) increase in delay on other movements. In particular the optimisation of signals at the junction improves levels of delay at the junction on average but causes some redistribution, particularly through increased queuing on the eastbound off-slips from the M25 which ultimately lead to queues onto the M25 mainline in the peak periods, affecting the journey times for the high volume of through traffic.

It should be noted that the current modelling (VISSIM) does not model full re-routing and variable demand modelling (VDM) responses to the scheme options. This could potentially overstate the BCR and may also change the ranking of options 2 and 3. Strategic modelling will be undertaken in Stage 2 together with updated VISSIM modelling to better capture potential changes occurring due to the scheme options.

9 Safety assessment

9.1 Impact on road user

The project is currently being developed in PCF Stage 1 where the design process is considering a number of improvement options. Design objectives for the scheme are focussed around relieving congestion and making the network safer for the users. Refer to section 2 for further details.

It has been noted that there were 28 collisions at the junction (including the slip roads), averaging 5.6 per year. There was one collision in 2010, peaking at 11 in 2011 with 6 collisions in the last 2 years.

One of the key objectives of this scheme is to improve capacity and reduce congestion through the junction. During peak hours queueing onto the slips could contribute towards collisions. All of the options under consideration have been designed to increase capacity at M25 Junction 25 as well as providing additional capacity on the A10 by widening.

All three options include for elements of junction widening, segregated left turn facilities and improvements to the A10. These improvements should relieve congestion and contribute towards addressing safety issues associated with high traffic volumes.

Within the junction improvements contemplated, designs consider visibility splays, additional space for street furniture, safety fencing, guardrails etc. to ensure accordance with current standards. Any relaxations or departures from these are fully documented and any safety implications assessed.

A proposed new foot/cycle bridge over the M25 carriageways with associated subway refurbishment and upgrade works should enhance personal safety concerns of pedestrian/cyclists as well as slightly shorten their journey distance.

9.2 Impact during construction and operation

In compliance with the Construction Design and Management Regulations (CDM) 2015 the health and safety risks associated with the construction and future use of the proposed options have been considered. Where possible these risks have been eliminated by altering the design. However, where elimination is not possible measures to reduce the risks have been considered.

The top five risks from the CDM 2015 health and safety risk register are summarised in Table 9-1.

Table 9-1 Top five health and safety risks

Risk No	Risk Description	Impact	Response	Proposed Response Measure	Risk Owner
1.	High voltage cables present in area	Injuries and incidents	Safety in design	High voltage cables must be clearly identified. Contractor has to complete all diversions prior start of any other work. Enforce hand dig around Utilities	Contractors
2.	Working in close proximity to live traffic	Potential for personnel to be struck by moving vehicles	Risk management	The Traffic Management design will be completed in accordance with the TSM Chapter 8 Part 1: Design	Contractors
3.	Slip road closure and carriageway width reduction	Potential for congestion and accidents	Risk management	Consult with the police, local authorities and other interested parties for all traffic management proposals. Consider road closures in preference to any other form of traffic management	Designer
4.	Risk of conflict between vehicles, pedestrians and cyclists during construction phase	Injuries and incidents	Risk management	Segregate pedestrians and cyclists from vehicles using physical barriers and temporary crossings	Designers
5.	Working above members of the public and operatives	Disruptions to both junction and M25 motorway Incidents involving working at height above M25	Risk management	The Contractor is to submit a Method Statement and a Safe System of work outlining how this will be minimised	Contractor

9.3 Road safety audit

HD 19/15 requires the Stage Road Safety Audit (RSA) to be carried out after completion of preliminary design. This is therefore not required at this stage of the scheme development. A formal Road Safety Audit will be carried out during PCF Stage 3: Preliminary Design.

9.4 Non-motorised user (NMU) audit

Government policy encourages the consideration of the needs of NMUs when undertaking scheme design. The Design Manual for Roads and Bridges (DMRB) V5 S2 Part 5 “Non-Motorised User Audits (HD42/05)” provides a standard for undertaking audits of NMUs on trunk roads. An M25 Junction 25 Improvements NMU Context Report will be produced at the end of Stage 1 (NMU surveys to be carried out in September 2016 in school term time). Therefore it is not possible to accurately identify desire lines or conflict points.

The Context Report will be followed by Audit Reports at regular stages (preliminary design, detailed design and post-opening) which provide detail on how the scheme design incorporates the requirements of NMUs in response to the scheme objectives.

10 Technology assessment

10.1 Introduction

This section provides an overview of the Technology Infrastructure and Equipment in relation to the options described in Section 5. A desktop study of the route was carried out to identify the existing technology assets on the M25 Junction 25.

The existing communications equipment within the scheme area includes:

- Portal Gantries equipped with Variable Mandatory Speed Limit (VMSL) Indicators and Motorway Signal Mark 4 (MS4) Message Signs
- Verge mounted / cantilever MS4 Message Signs
- Post mounted VMSL indicators at entries to entry slip roads
- Emergency Refuge Areas with Emergency Roadside Telephones (ERTs)
- Low light Pan/Tilt/Zoom (PTZ) CCTV cameras for surveillance purposes
- Meteorological Systems (Fog and Ice Detection)
- Motorway Incident Detection and Automatic Signalling (MIDAS) (incident detection)
- Existing Ramp Metering (RM) Equipment recalibration and adjustment as specified by the RM Task Force
- Traffic Monitoring System
- Speed Enforcement Equipment.

The existing technology equipment is to be retained where possible and / or reinstalled according to Highways England standards.

Any future design work, which could affect existing communication infrastructure should be carried out in accordance with:

- IAN 161/15 – Smart Motorways
- Motorway Signalling - TD46/05
- NMCS TA 72/97 – System Design
- Infrastructure Design - TA 77/97
- MIDAS - TD45/94
- Emergency Telephones - TA73/97
- CCTV - TD17/85 – Criteria for the provision of closed circuit television on motorways
- NRTS Technical Documents – Relevant standards and procedures
- Manual of Contract Documents for Highway Works (MCHW).

10.2 Motorway Incident Detection and Automatic Signalling (MIDAS)

MIDAS is an established technique used to advise drivers of slow moving or queuing traffic ahead. It is deployed on a proportion of the motorway network in England.

The existing MIDAS system to be retained where possible and / or reinstalled according to Highways England standards i.e.

- HD 20/05 Detector Loops for Motorways, Clause 3.13 states: "*On exit slip roads, the loops shall be sited between 10m upstream from the final signal gantry or route confirmatory sign and a maximum of 50m downstream of the soft nose of the diverge, that is, the point of complete physical separation from the main carriageway or, if provided, within 10m of exit slip signals*".
- Clause 3.14 states: *"On entry slip roads the loops shall be sited downstream of entry slip signals at a minimum distance of 100m from the convergent point with the*

motorway"…..*"Where Ramp Metering is employed, it is important that the loops are sited where lane changing is at a minimum*".

- Clause 3.15 states: "*Entry slip and exit slip loops shall be sited in line plus or minus 50m with the carriageway loops*".

Due to junction modification an existing MIDAS loops on the on– and off- slips of the junction could be potentially affected. The exact number and location of the MIDAS sites will be identified after the preferred option is selected. It should be noted that Ramp Metering system is located at the junction (see section 10.9.2 below).

For all three options, the M25 MIDAS sites will require assessment to meet the Highways England requirement due to the proposed junction modifications.

10.3 Signs

For all three options, the signs at the junction require assessment to meet the operation and requirement due to the junction modification. This potentially includes existing direction signs on the on– and off- slips of the junction.

Any signs affected by the scheme require relocation according to Highways England standards.

10.4 Signals

All signal gantries on the approach to and at the junction are located in accordance with IAN 161/12 – Managed Motorways – All Lanes Running.

At this stage, no impacts have been identified for Option 1 and Option 2. For Option 3 existing post mounted Entry Slip Signal (ESS) sites at the junction merge could potentially be affected. Reinstallation of the ESS must be carried out in accordance with the requirements specified in IAN161/15.

10.5 Emergency roadside telephones

No impact on the existing ERTs has been identified at this stage.

10.6 CCTV

There are an existing PTZ 2nd Generation CCTV cameras located at the junction to provide 100% coverage of the motorway and associated slip roads and junction.

The existing cameras are mounted on gantries and / or on 15m masts.

All CCTV sites are capable of performing in low light level conditions as specified in the latest Highway England standards.

The existing camera sites must be retained or reinstalled according to Highways England standards to provide the required coverage. The design of these sites should be carried out in accordance with MCH 2554 and TD 17/85, additional guidance will be adhered to as specified in IAN 161/15.

CCTV sites should be evaluated during the course of the design lifecycle.

10.7 National Traffic Information Service (NTIS) assets

Monitoring site locations (including ANPR cameras and loops) are to be confirmed in conjunction with the National Traffic Information Service (NTIS).

All the existing NTIS loops will be assessed to understand the scope of works required in order to maintain these sites.

10.8 Distribution network operator (DNO) supplies

The requirement for additional DNO supplies will be assessed when the preferred option has been selected.

10.9 Fog detector

No impact on the existing Meteorological Systems has been identified at this stage.

10.9.1 RCC systems and sub systems

The Motorway Communications Systems are controlled from Highways England's Regional Control Centre East (RCC(E)), located at South Mimms (M25 Junction 23), which operates an Highways England National Motorway Communication System Mark 2 (NMCS2) Control Office Base System (COBS) with associated Sub Systems.

There are a number of systems employed, all of which interface with the RCC. The key systems are:

10.9.1.1 Command and Control (CC)

This system allows the operator to control an incident in real time through communication with the road user and other on road resources responding to the event. Communication is made via the ICCS and Airwave systems (see below).

10.9.1.2 Integrated Communications Control System (ICCS)

This system allows the Operator to control a number of communication systems from a single terminal using a touch sensitive screen. Radio and Telephony are the two main forms of communication.

10.9.1.3 Highways Agency Traffic Management System (HATMS)

The HATMS utilises several different sub systems to allow an operator to:

- Set signs and signals using the Message Sign Sub system (MSS) and the Signal Sub system (SS)
- Receive information from the Motorway Incident Detection & Automatic Signalling sub system (MIDAS)
- Obtain information regarding CCTV resources at any given location using the CCTV Base Station.

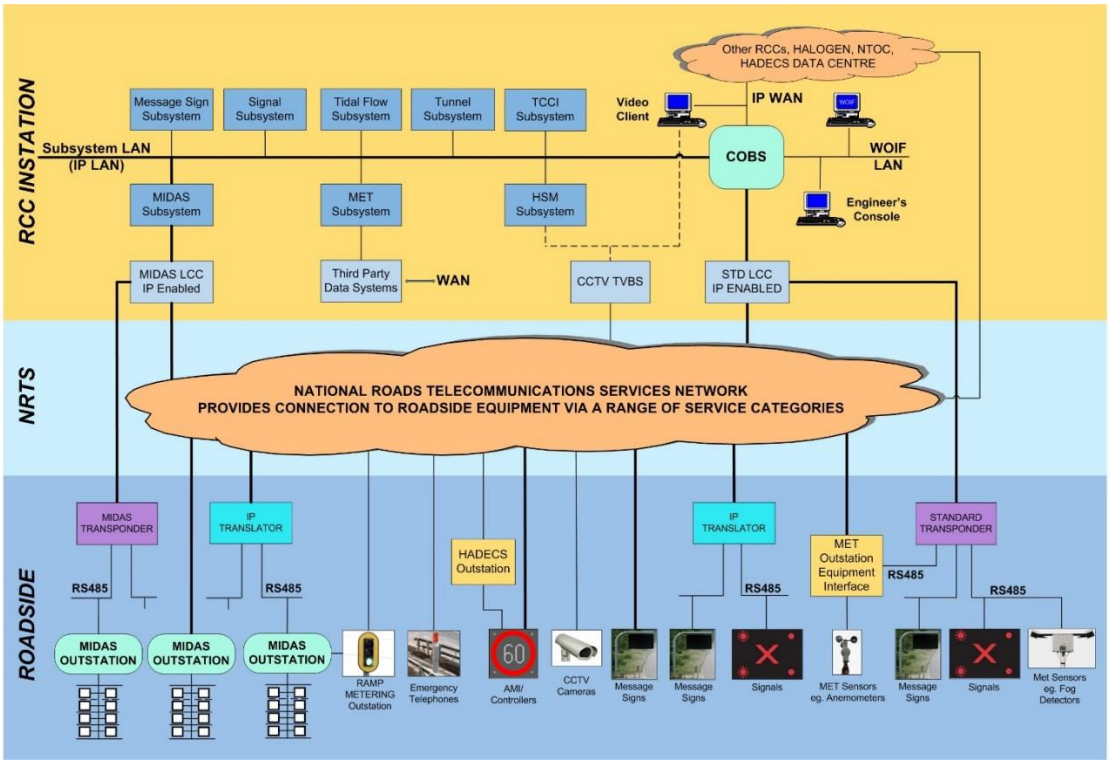
10.9.1.4 Other Systems

- CCTV – allows images from on road cameras to be displayed within the control room on the DDS and/or the Operators desks
- Telephony – for general voice communication
- Radios – for communication with on-road resources
- Dynamic Display System (DDS) – to allow on road CCTV cameras to feed images back to the RCC Control Room displays
- Telephone Text Controller – This allows foreign drivers at the roadside to communicate with the RCC in their own language via the ERT text display
- NRTS (National Roads Telecommunications Services) – this is the service provider which provides the connections for the roadside equipment
- Meteorological Subsystem (MET) which controls Fog Detectors and Anemometers.

For resilience purposes some of these systems have back up equipment and in the event of a complete failure the RCC can fall back to another region who then takes control.

The diagram in Table 10-1 shows how all of the systems interface with the RCC, also known as the instation. It should be noted that the drawing is not scheme specific and shows all interfaces.

Table 10-1 RCC System Interfaces with Roadside Equipment



10.9.2 Communications network

In line with Highways England instructions, all technology should apply Internet Protocol (IP) equipment and adopt NRTS IP services for the outstation to instation communications link. Existing infrastructure would be re-used where practicable.

The scheme contractor will be responsible for installing the ducts. The NRTS Company will be responsible for providing the required communications connections for each new technology site, and also for the existing equipment sites which need to be reinstalled.

A minimum verge width of 2.2m will be needed to accommodate the communications ducting and chambers in order to meet the chamber access requirements of the NRTS civil and roadside infrastructure specifications.

10.10 Ramp Metering (RM)

A single Ramp Metering site is located at Junction 25 on the eastbound merge slip. Following the tunnel refurbishment the RM was perceived to cause issues and driver confusion and for this reason the system has been switched off and is not currently operational. However it is proposed to maintain the existing provision.

No new RM technology is envisaged.

11 Maintenance assessment

11.1 Maintenance and repair strategy for civils infrastructure

Safe access for maintenance is essential to protect roadside workers. Access is likely to be required along the entire length of the route to carry out maintenance or repair to existing or new infrastructure. Drainage for instance, will need to be maintained on a regular basis. The design of any new footway or shared path should consider access and movement of equipment or an alternative means of safe access provided. All maintenance activity will be carried out at night, so lighting provision will assist in providing a safer working environment.

Where existing infrastructure, such as bridge structures are retained, this will need to be maintained and safe access will need to be provided. Planted areas will also need to be regularly managed and access to bridge supports for inspection and maintenance purposes should also be considered.

To encourage pedestrians and cyclists to use subways, routine maintenance will need be carried out throughout the year.

11.2 Maintenance and Repair Strategy for road side technology

In the scheme area the Regional Technology Maintenance Contractor (RTMC) is working under the supervision of Connect Plus, who have been appointed as Service Manager for the contract. Through the engagement with Connect Plus, the maintenance requirements of any changes to the equipment maintained by the RTMC shall be captured and agreed.

A PCF document to outline the maintenance and repair strategy will be produced in the preliminary design stage to capture additional maintenance and repair requirement for roadside technology equipment.

12 Environmental assessment

As part of PCF Stage 1, an Environmental Study Report (ESR) has been prepared to provide a broad overview of the environmental constraints and relative environmental benefits associated with the three options. The ESR identifies the further assessment requirements at PCF Stage 2 to confirm a determination on significance as the scheme design progresses through the PCF stages as well as any likely mitigation requirements and opportunities for enhancement.

The ESR covers the following Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 topics:

- Air quality
- Cultural heritage
- Landscape
- Nature conservation
- Geology and soils
- Materials and waste
- Noise and vibration
- People and communities
- Road drainage and the water environment

A summary of the findings is outlined below.

12.1 Option 1

12.1.1 Air quality

The traffic model for the opening year has shown that there are likely to be a number of roads affected with Option 1 including an increase in traffic, indicating a potential increase in pollutant concentrations at nearby receptors including the AQMA: M25 west of J25; A10 south and north of J25; A1055 Bullsmoor Lane west of the A10 south; Bulls Cross south of Bullsmoor Lane.

12.1.2 Cultural heritage

The construction and operation will not give rise to any direct significant effects on the cultural heritage resource. The construction of Option 1 would impact on the setting of the Grade II listed buildings at Theobalds Park Farm, which would result in temporary slight adverse effects. Impacts on the setting of the Grade II* listed Capel House would also result in a temporary slight adverse effect.

12.1.3 Landscape

No significant landscape effects have been identified both in the construction and operational stage due to the small scale of Option 1. Only a slight alteration to the landscape character is expected in the construction and operational stage. No significant visual effects have been identified during the construction and operational stage due to the minor alteration of inconspicuous characteristics of the views.

12.1.4 Nature conservation

No potential significant effects on nature conservation features have been identified. Option 1 may potentially impact on legally protected species during construction, and therefore the presence of protected species must be taken into account throughout the design and construction process, so that mitigation measures can be identified that will reduce or avoid impacts on these species. There would be some small losses of low value habitat within and adjacent to the highway boundary.

12.1.5 Geology and soils

There is potential for impacts associated with varying ground conditions that may be encountered; and to human and/or controlled waters receptors associated with potential sources of contamination within or in close proximity to Option 1. Examples include localised deposits of Made Ground and other potentially contaminative land uses, including an infilled pond on the north-west quadrant of the site, nearby petrol filling stations and nearby industries such as historical nurseries and brewers. Unless mitigated, piling works during construction has the potential to release contaminants into the surrounding environment via surface water runoff/ groundwater penetration.

12.1.6 Materials and waste

Key effects associated with Option 1 include:

- Potential excess material use / waste generation if wastes are not reused / recycled where practicable
- Potential for the disposal of large quantities of excavated materials, if the materials are found to be hazardous and thus not suitable for reuse
- Increased waste arisings associated with widening existing carriageways and bridges
- Increased waste arisings associated with the construction of the pedestrian / cycle footbridge
- Increased waste arisings associated with the refurbishment of subways
- Increased demolition waste arisings associated with the narrowing of the existing hardened verge
- Increased excavation waste arisings due to the creation of embankments

Option 1 is likely to have the least effect of all of the options.

12.1.7 Noise and vibration

All construction activities have the potential to cause some disturbance at nearby noise and/or vibration sensitive receptors, with demolition works and piling works (for new viaducts and retaining walls) giving rise to some of the highest noise levels dependent on the methods chosen. In the Opening Year of the scheme, a short-term noise decrease of minor impact magnitude has been predicted at the eastbound M25 off-slip at Junction 25 as a result of changes to the traffic volume, average speed, or fleet composition. Negligible changes in Basic Noise Level are predicted elsewhere in the short-term. Negligible changes are predicted throughout the study area in the long-term (Design Year). The widening of the southbound entry (to the north east of the roundabout) will position the widened road slightly closer to the nearby residential receptors in Waltham Cross, although these buildings will still be over 300m away. There is potential for minor or negligible changes in noise level in the local Noise Important Areas close to the junction.

12.1.8 People and communities

The construction and operation of Option 1 is likely to have the least significant effect compared to Options 2 and 3 on all the identified receptors under this option and would result in temporary and permanent adverse effects ranging from negligible to major adverse during construction. However, effects on identified NMUs are only likely to be negligible adverse in operation while the Great Cambridge shared footpath and cycleway is likely to be a major benefit due to the improvements in amenity of users of that NMU route.

It is assumed residential receptors will be affected by this option the least of the three options. The impact on motorised traveller's views from the road will depend on the design and landscaping mitigation of the option but it is assumed a loss of current vegetation screening will be required for the proposed improvements. Driver stress is expected to be temporarily adversely impacted by the construction works, however is expected to reduce

during operation through increased traffic flows and a more efficient road network reducing driver frustration.

12.1.9 Road drainage and the water environment

Based on the modest scale of Option 1 and the modified nature of the water environment, it is considered there should be no significant effects to the water environment. However, Option 1 would involve cuttings and therefore there is potential for impacts on the Secondary Aquifer within the Source Protection Zone. Option 1 is the least environmentally damaging for the water environment during both construction and operation.

12.2 Option 2

12.2.1 Air quality

The traffic model for the opening year has shown that there are likely to be a number of roads affected with Option 2 including an increase in traffic, indicating a potential increase in pollutant concentrations at nearby receptors including the AQMA: M25 west of J25; A10 south and north of J25; A1055 Bullsmoor Lane west of the A10 south; Bulls Cross south of Bullsmoor Lane. In addition with option 2 the M25 east of J25, A1055 Bullsmoor Close east of the A10, and the B198 Lieutenant Ellis Way between St Mary's High School roundabout and the B198 / A121 / A10 roundabout are expected to have an increase in traffic. With Option 2 the A10 northbound off-slip is expected to have a decrease in traffic, with a potential decrease in pollutant concentrations at any nearby receptors.

12.2.2 Cultural heritage

The construction and operation will not give rise to any direct significant effects on the cultural heritage resource. The construction of Option 2 would impact on the setting of the Grade II listed buildings at Theobalds Park Farm, which would result in temporary slight adverse effects. During operation, potentially a permanent slight beneficial effect on the setting of the same buildings, due to improved traffic flow is predicted. Impacts on the setting of the Grade II* listed Capel House would also result in a temporary slight adverse effect.

12.2.3 Landscape

No significant landscape effects were identified either in the construction or operational stage due to the small scale of Option 2 and only a slight alteration to the landscape character is expected. Few visual receptors have been identified as being potentially significantly affected during the operational stage mainly due to the close proximity of the receptors to Option 2 and open views towards the M25 Junction 25 from Theobald's Park Farm and from PRoW's along the New River.

12.2.4 Nature conservation

No potential significant effects on nature conservation features have been identified. Option 2 may potentially impact on legally protected species during construction, and therefore the presence of protected species must be taken into account throughout the design and construction process, so that mitigation measures that will reduce or avoid impacts on these species can be identified. There would be some small losses of low value habitat within and adjacent to the highway boundary

12.2.5 Geology and soils

The impacts for geology and soils are as per Options 1 and 3. There is potential for impacts to associated with varying ground conditions that may be encountered; and to human and/or controlled waters receptors associated with potential sources of contamination within or in close proximity to Option 2, such as localised deposits of Made Ground and other potentially contaminative land uses, including an infilled pond on the north-west quadrant of the site, nearby petrol filling stations and nearby industries such as historical nurseries and brewers.

Unless mitigated, piling works during construction have the potential to release contaminants into the surrounding environment via surface water runoff/ groundwater penetration.

12.2.6 Materials and waste

A summary of the key effects associated with Option 2 are summarised below:

- Potential excess material use / waste generation if wastes are not reused / recycled where practicable
- Potential for the disposal of large quantities of excavated materials, if the materials are found to be hazardous and thus not suitable for reuse
- Increased waste arisings associated with widening existing carriageways and bridges
- Increased waste arisings associated with the construction of the pedestrian / cycle footbridge
- Increased waste arisings associated with the refurbishment of subways
- Increased demolition waste arisings associated with the narrowing of the existing hardened verge
- Increased excavation waste arisings due to the creation of embankments

12.2.7 Noise and vibration

All construction activities have the potential to cause some disturbance at nearby noise and/or vibration sensitive receptors, with demolition works and piling works (for new viaducts and retaining walls) giving rise to some of the highest noise levels dependent on the methods chosen. The proposed demolition of a retaining wall adjacent to the westbound diverge is likely to exacerbate impacts at Bullsmoor Way, Bullsmoor Gardens and Bullsmoor Ride, which are 80-200m away from the proposed works. During the operational phase of the scheme, the following impacts are predicted:

- Short-term noise increases of minor impact magnitude at the eastbound carriageway of the M25 prior to Junction 25 (which passes through Important Area 5716 at Bulls Cross Ride).
- Short-term noise increases of minor impact magnitude at the westbound diverge where an additional lane is proposed, affecting approximately 150 residential buildings at Bullsmoor Way, Bullsmoor Ride and Bullsmoor Gardens. The westbound diverge is located within Important Area 1186 and is approximately 390m from Important Area 13660. The noise levels at these buildings could increase further due to the proposed height reduction of the retaining wall.
- Short-term and long-term noise increases of major impact magnitude at the proposed segregated left turn lane from the eastbound M25 to northbound A10. However, the nearest noise sensitive receptors to this road link are over 200m at Bullsmoor Way and Important Area 13660, located at the opposite quadrant of the Junction 25 roundabout.
- Short-term noise increases of minor impact magnitude were predicted at Bullsmoor Lane due to changes in traffic in the Opening Year compared with the Do Minimum scenario.

12.2.8 People and communities

The construction and operation of Option 2 is likely to have a greater effect on all the identified receptors compared to Option 1 however, this increase is unlikely to be significant due to the relatively small increase in proposed improvement works. Similar to Option 1, the improvements would result in temporary and permanent adverse effects ranging from negligible to major adverse during construction. NMUs are only likely to experience negligible adverse effect during operation while the Great Cambridge shared footpath and cycleway is likely to be a major benefit. It is likely that some small areas of private land will

be required which will have potential to effect a development site at Park Plaza Plot D and result in the loss of agricultural land at Theobalds Park Farm.

The impact on motorised traveller's views from the road will depend on the design and landscaping mitigation but it is assumed some loss of current vegetation screening will be required but this will not change views significantly. Driver stress is expected to be temporarily adversely impacted by the construction works, however is expected to reduce during operation through increased traffic flows and a more efficient road network reducing driver frustration.

12.2.9 Road drainage and the water environment

The modest scale of Option 2, the design provisions outlined in IAN161/15 (November 2015) and the modified nature of the water environment, it is considered there are likely to be no significant effects to the water environment. Option 2 would require cuttings and therefore there is potential for impacts on the Secondary Aquifer within the Source Protection Zone.

12.3 Option 3

12.3.1 Air quality

The traffic model for the opening year has shown that there are likely to be a number of roads affected with Option 3 including an increase in traffic, indicating a potential increase in pollutant concentrations at nearby receptors including the AQMA: M25 west of J25; A10 south and north of J25; A1055 Bullsmoor Lane west of the A10 south; Bulls Cross south of Bullsmoor Lane. In addition with option 3 the M25 east of J25, A1055 Bullsmoor Close east of the A10, and the B198 Lieutenant Ellis Way between St Mary's High School roundabout and the B198 / A121 / A10 roundabout are expected to have an increase in traffic. With Option 3 the A10 northbound off-slip is expected to have a decrease in traffic, with a potential decrease in pollutant concentrations at any nearby receptors.

12.3.2 Cultural heritage

The construction and operation of Option 3 will give rise to significant effects on the Grade II* listed Capel House. These are temporary and permanent moderate adverse effects as a result of impacts on the asset's setting. The construction and operation of the option would impact on the setting of the Grade II listed buildings at Theobalds Park Farm and the Grade II listed Bulls Cross Lodge, which would result in temporary slight adverse effects. During operation a potentially permanent slight beneficial effect on the setting of Theobalds Park Farm is predicted, due to improved traffic flow. The option would also impact on the setting of Grade II listed buildings adjacent to Capel House resulting in temporary and permanent slight adverse effect. There is the potential for impacts on unknown buried archaeology as a result of its truncation or removal. Option 3 is the least favoured of the options on Cultural Heritage terms.

12.3.3 Landscape

No significant landscape effects are identified either in the construction or operational stage due to the small scale of the Option 3. Only a slight effect on the landscape character is expected in the construction and operational stages. Few receptors have been identified as significantly affected during construction stage as only a partial deterioration of their views is expected. Only one receptor was identified as being significantly affected during operational stage and proposed planting could be implemented that would mature to accommodate most of the proposed scheme within the existing landscape. Option 3 has the most landscape and visual effects of the three options under consideration.

12.3.4 Nature conservation

As with Option 1 and 2, no potential significant effects on nature conservation features have been identified. Option 3 may potentially impact on legally protected species during

construction, and therefore the presence of protected species must be taken into account throughout the design and construction process, so that mitigation measures can be identified that will reduce or avoid impacts on these species. There would be some small losses of low value habitat within and adjacent to the highway boundary

12.3.5 Geology and soils

As with Options 1 and 2, there is potential for impacts associated with varying ground conditions that may be encountered; and to human and/or controlled waters receptors associated with potential sources of contamination within or in close proximity to the Option 3, such as localised deposits of Made Ground and other potentially contaminative land uses, including an infilled pond on the north-west quadrant of the site, nearby petrol filling stations and nearby industries such as historical nurseries and brewers. Unless mitigated, piling works during construction have the potential to release contaminants into the surrounding environment via surface water runoff/ groundwater penetration.

12.3.6 Materials and waste

A summary of the key effects associated with Option 3 are summarised below:

- Potential excess material use / waste generation if wastes are not reused / recycled where practicable
- Potential for the disposal of large quantities of excavated materials, if the materials are found to be hazardous and thus not suitable for reuse
- Increased waste arisings associated with widening existing carriageways and bridges
- Increased waste arisings associated with the construction of the pedestrian / cycle footbridge
- Increased waste arisings associated with the construction of maintenance access track
- Increased waste arisings associated with the refurbishment of subways
- Increased demolition waste arisings associated with the narrowing of the existing hardened verge
- Increased excavation waste arisings due to the creation of embankments

12.3.7 Noise and vibration

All construction activities have the potential to cause some disturbance at nearby noise and/or vibration sensitive receptors, with demolition works and piling works (for new viaducts and retaining walls) giving rise to some of the highest noise levels dependent on the methods chosen. The proposed demolition of a retaining wall adjacent to the westbound diverge is likely to exacerbate impacts at Bullsmoor Way, Bullsmoor Gardens and Bullsmoor Ride, which are 80-200m away from the proposed works. During the operational phase of the scheme, the following impacts were predicted short-term noise increases of minor impact magnitude was predicted at:

- Short-term noise increases of minor impact magnitude at the eastbound carriageway of the M25 prior to Junction 25 (which passes through Important Area 5716 at Bulls Cross Ride).
- Short-term noise increases of minor impact magnitude at the westbound diverge where an additional lane is proposed, affecting approximately 150 residential buildings at Bullsmoor Way, Bullsmoor Ride and Bullsmoor Gardens. The westbound diverge is located within Important Area 1186 and is approximately 390m from Important Area 13660. The noise levels at these buildings could increase further due to the proposed height reduction of the retaining wall.
- Short-term and long-term noise increases of major impact magnitude at the proposed segregated left turn lane from the eastbound M25 to northbound A10. However, the nearest noise sensitive receptors to this road link are over 200m at Bullsmoor Way

and Important Area 13660, located at the opposite quadrant of the Junction 25 roundabout.

- Short-term noise increases of minor impact magnitude were predicted at Bullsmoor Lane due to changes in traffic in the Opening Year compared with the Do Minimum scenario.
- Short-term noise increase of minor impact magnitude at the northbound A10 located north of Junction due to changes in traffic.
- Short-term and long-term noise increase of major impact magnitude at the segregated left turn lane from A10 northbound to M25 westbound merge affecting noise sensitive receptors located south west of the Junction 25 roundabout.
- Short-term noise increase of minor impact magnitude from widening the southbound A10 to accommodate an extra lane, with the impact concentrated at the merge onto the A10 from the M25.

12.3.8 People and communities

The construction and operation of Option 3 is likely to have the greatest effect on all the identified receptors compared to the other options. This increase is likely be significant due to the increased scale of the proposed improvement works and because they are located south of Junction 25, close to sensitive receptors. Similarly, the improvements would result in temporary and permanent adverse effects ranging from negligible to major adverse during construction. NMU are only likely to experience negligible adverse effects in operation while the Great Cambridge shared footpath and cycleway is likely to be a major benefit due to the improvements in amenity of users of that NMU route.

This option requires the largest land take over and above the previous options and would result in the potential loss of commercial business along Great Cambridge Road (Waterworld Aquatics Centre) while significantly effecting a planning application site at Kingswood Nurseries. It is assumed residential receptors will be affected the most of the three options due to these improvements being south of Junction 25. The impact on motorised traveller's views from the road will depend on the design and landscaping mitigation of the option but it is assumed a loss of current vegetation screening will be required under this option for the proposed improvements and it is likely views will change significantly under this option, especially along Great Cambridge Road south of Junction 25. Driver stress is expected to be temporarily adversely impacted by the construction works, however is expected to reduce during operation through increased traffic flows and a more efficient road network reducing driver frustration.

12.3.9 Road drainage and the water environment

Option 3 is by a small margin potentially the most environmentally damaging for the water environment and road drainage, based on the larger scale, the nature of works proposed and possible modifications required to the substructure of a strategic water resources asset (the New River aqueduct which is a classified watercourse under the Water Framework Directive). As with Option 2, Option 3 would require cuttings and therefore there is potential for impacts on the Secondary Aquifer in the Source Protection Zone.

12.4 Summary

Due to the incremental nature of the options, Option 1 would be the least environmentally damaging option in terms of nature conservation, cultural heritage, landscape and water environment. However, Option 1 would not provide opportunities for enhancement for biodiversity and landscape through land take and therefore from an enhancement perspective, Option 1 and then Option 2 would be the least preferred. All options will result in adverse impacts to noise sensitive receptors to varying degrees.

Option 3 is considered to be the least preferred in terms of impacts on people and communities, this option requires the largest land take over and above the previous options and would result in the potential loss of commercial business along Great Cambridge Road (Waterworld Aquatics Centre) while significantly effecting a planning application site at Kingswood Nurseries.

The traffic model for the opening year has shown that there are likely to be a number of roads affected with an increase in traffic, indicating a potential increase in pollutant concentrations at a number of nearby receptors.

Note that all information contained in this chapter can be found in more detail in the PCF Stage 1 - Environmental Study Report (ESR), additionally an Assessment of Implications on European Sites (AIES) and Environmental Risk Assessment (ERA) were also produced.

13 Assessment summary

13.1 Appraisal Summary Tables (AST)

Appraisal Summary Tables for Option 1, 2 and 3 can be found in Appendix I.

13.2 Summary of consultation with public bodies

13.2.1 Consultation to date - PCF Stage 1

Projects in the RIS programme require both informal engagement and formal consultation. The M25 Junction 25 Public Consultation Strategy Report (August 2016) has identified the key audiences that need to be engaged with as the options and designs progress. These are listed in the plan and a live stakeholder tracker (including individual names / titles and details of discussions) is also maintained. Key stakeholders that could influence or have a strong interest in the scheme include London Borough of Enfield, Broxbourne District Council, Hertfordshire County Council and Transport for London.

A number of stakeholder events have taken place to date as detailed in the M25 Junction 25 public consultation strategy report section 8.3, including:

- Stakeholder workshop (June 2016) – the session included background to the PCF process and a timeline for each project, a project update and discussions around future communications. Stakeholders were invited to submit comments to the project team via email.
- Value management workshop (July 2016) - the purpose was to review the options being considered and to undertake initial option assessment to confirm those to be taken forward for further investigation during the remainder of the Option Selection stage.
- Web-project page on Highways England website live (http://www.highways.gov.uk/roads/road-projects/m25-junction-25-improvements/) (August 2016) - provides a one point of information for stakeholders, public and media

On balance key stakeholders are generally supportive of the scheme.

13.2.2 Next stage of consultation - PCF Stage 2: Winter 2016/17

Face to face engagement will be via a series of stakeholder and customer engagement events to share scheme progress and gather refinements to outline scheme designs and options. All stakeholders and customers will be invited to submit comments and evidence to the project team.

13.3 Comparison of options

This chapter of the TAR summarises and highlights the key findings of the assessment of the options for the M25 Junction 25 Improvements. The differences between alternative options are highlighted and discussed in order to present justifications for shortlisting options for further consideration in PCF Stage 2.

13.3.1 Value Management Workshop

A value management review has commenced under PCF Stage 1. This entailed a value management workshop to review the options being considered to deliver the M25 Junction 25 scheme objectives, and to undertake an initial assessment of the options to assist the selection of option to be taken forward to PCF Stage 2 - Option Selection. In considering the value offered to the project, each option was subject to a qualitative assessed in turn during

the workshop (see Table 13-1). To achieve this the following questions were considered in relation to each of the identified options using the 7 point scoring system:

- How technically feasible is the option when compared to the other options being considered?
- How well does the option deliver each of the six project objectives when compared to the other options being considered?
- How easy would the implementation of this option be when compared to the other options being considered?

This value assessment forms a good basis to identify the strongest options in terms of value against the desired objectives and outcomes, for taking forward to PCF Stage 2 (Table 13-1). In addition, it is important to consider the affordability of each option alongside value to confirm the selected options for PCF Stage 2.

By a small margin, Options 2 is shown to offer the highest overall score. It offers the greatest value in achieving the project objectives, and in terms of implementation.

Table 13-1 Summary of the overall performance of Junction 25 RIS1 options

Option	Feasibility	Objectives	Implementation	Overall Score	RIS Costs
Option 1	6	3	5	**14**	Within budget
Option 2	4	5	6	**15**	Within budget
Option 3	2	6	4	**12**	Slightly over

Key to assessment scoring:

6 = Delivers the best of the options

5 = Not quite the best

4 = Nearer best than worst

3 = Between best and worst

2 = Nearer worst than best

1 = Not quite the worst

0 = Does not deliver

13.3.2 Summary of Assessments

The following summarises the option comparisons contained in this report.

13.3.2.1 Constraints

- Option 3 requires incrementally more land take compared to Option 2 and 1. Option 1 land take is minimal whilst Option 2 and 3 are likely to require a CPO.
- The local AQMA (Teresa Gardens, Arlington Crescent and LB Enfield) and Noise Important Areas close to the junction will be impacted upon by all options.

13.3.2.2 Engineering

- Option 1 consists of minimal junction improvements and is overall the more feasible option

- Option 2 and 3 require incrementally greater improvements, additional earthworks etc. Option 3 affects the existing access road to an aqueduct which is currently directly off the roundabout circulatory carriageway between the A10 northbound entry and the M25 westbound exit from the roundabout.
- For Option 3 the slip road will require widening as the standard cross-section for a motorway two lane merge also includes a hard shoulder. It is proposed that a Departure from Standard is then applied to reduce the two lanes on the slip road down to a single lane before the merge nosing at the end of the slip road, owing to existing constraints on the site.

13.3.2.3 Traffic

- Option 1 is insufficient to cope with the additional growth by 2037 across all time periods. Option 2 and Option 3 are the better performing options, with Option 3 performing marginally better in the AM and Inter peaks and to a greater extent in the PM peak.
- In the AM peak, Option 3 and Option 2 generally maintain key network characteristics between 2022 and 2037, although the performance of both options reduces between 2022 and 2037 in the PM.

13.3.2.4 Economic

- The estimate of impacts over a 60 year appraisal period shows that all three options perform strongly, generating BCRs that can be considered to represent High Value for Money (Option 1) or Very High Value for Money (Options 2 and 3). However, the PVB associated with Options 2 and 3 exceeds the PVB for Option 1 more than fourfold.
- Option 1 does not offer a significant increase in capacity for traffic flow through these pinch-points and so cannot alleviate as much congestion as Options 2 and 3.

13.3.2.5 Safety

- All three options include for elements of junction widening, segregated left turn facilities and improvements to the A10 which should relieve congestion and contribute towards addressing safety issues associated with high traffic volumes.
- Option improvements consider visibility splays, additional space for street furniture, safety fencing, guardrails etc. to ensure accordance with current standards.
- A proposed new foot/cycle bridge over the M25 carriageways with associated subway refurbishment and upgrade works should enhance personal safety concerns of pedestrian/cyclists as well as slightly shorten their journey distance.

13.3.2.6 Technology

- No discernible difference between options at this stage.

13.3.2.7 Maintenance

- No discernible difference between options at this stage.

13.3.2.8 Environment

Table 13-2 below compares the environmental impacts of the options.

Table 13-2 Summary of environment assessment AST results

Criteria	Option 1	Option 2	Option 3
Noise	Negligible	Potential minor increase	Potential minor increase
Air quality	Potential increase in pollutants	Potential increase in pollutants	Potential increase in pollutants
Townscape	Neutral	Slight adverse	Slight adverse
Heritage	Slight adverse	Slight adverse	Moderate adverse
Biodiversity	Slight adverse	Slight adverse	Slight beneficial
Water environment	Moderate adverse	Moderate adverse	Moderate adverse

- Option 1 would be the least environmentally damaging option in terms of nature conservation, cultural heritage, landscape and water environment. However, Option 1 would not provide opportunities for enhancement for biodiversity and landscape through land take and therefore from an enhancement perspective, Option 1 and then Option 2 would be the least preferred.
- All options will result in adverse impacts to noise sensitive receptors to varying degrees.
- Option 3 is considered to be the least preferred in terms of impacts on people and communities, including noise; this option requires the largest land take over and above the previous options and would result in the potential loss of commercial business along Great Cambridge Road (Waterworld Aquatics Centre) while significantly effecting a planning application site at Kingswood Nurseries.
- There are likely to be a number of roads affected with an increase in traffic, indicating a potential increase in pollutant concentrations at a number of nearby receptors for all options.

13.3.2.9 Summary

Table 13-3 summarises the above, providing a visual comparison of the 3 options. Note that there is no scale or weighting attributed to each.

Table 13-3 Comparison of options summary

Criteria	Option 1	Option 2	Option 3
Constraints	✓✓✓	✓✓	✓
Engineering	✓✓✓	✓✓	✓
Traffic	✓	✓✓	✓✓✓
Economic	✓	✓✓	✓✓✓
Safety	✓	✓	✓
Technology	-	-	-
Maintenance	-	-	-
Environment	✓✓✓	✓✓	✓

14 Programme

An outline programme has been produced for the Junction 25 improvements scheme from PCF Stage 1 through to the start of works and can be found in Appendix J.

Table 14-1 provides a summary of key milestones within the updated programme for M25 Junction 25.

Table 14-1 Proposed timeframe for options, development and construction phases

Milestone	From	To
SGAR 1	October 2015	October 2016
Undertake non-statutory public consultation	January 2017	February 2017
SGAR 2	November 2016	June 2017
SGAR 3	July 2017	June 2018
SGAR 4	July 2018	May 2019
SGAR 5	May 2019	March 2020
SGAR 6	March 2020	June 2021
SGAR 7	July 2021	June 2022

15 Conclusion and recommendations

This TAR draws together and summarises the technical analysis undertaken as part of the M25 Junction 25 PCF Stage 1, drawing on a range of multi-disciplinary supporting documents that have been referenced throughout.

In December 2014 the Department for Transport (DfT) published the Road Investment Strategy (RIS) for 2015-2020. The work confirmed the case for the need for an improvement at M25 Junction 25, and considered the options available to take forward to the options identification stage. The scheme is defined as an "*upgrade of the junction between the M25 and the A10 at Cheshunt, providing greater capacity for traffic*."

Assuming that a signal improvement would proceed (part of the catch-up signal technology programme), an optioneering process identified three junction improvement options at Junction 25.

- Option 1: widen the M25 J25 circulatory carriageway to three / four lanes throughout, widen the A10(N) Southbound entry to the roundabout, re-provide and improve the pedestrian/cycle facility that would be lost
- Option 2: Option 1 as described above plus widen the M25 East and West diverges, add segregated left turn M25 West to A10 North
- Option 3: Option 2 as described above plus segregated left turn A10 South to M25 West, widen A10(S) southbound on approach to Bullsmoor Lane junction to provide dedicated left turn lane between M25 and Bullsmoor Lane

The preferred scheme is to begin construction in 2020 and be open to traffic by 2022.

15.1 Need for the junction improvement

The M25 and Junction 25 have a strategic significance, supporting local, sub-regional and national traffic and the need to address existing and future issues at Junction 25 is well established. Potential improvements at the junction have been indicated in several previous studies.

Accordingly a number of existing issues have been identified at Junction 25 including:

- Queueing back from junction onto mainline/Holmesdale Tunnel inhibits strategic M25
- function
- High number of complaints (HAILs) raised mostly related to signal reliability and performance
- Poor junction performance (delays, reliability and queues)
- Comparatively high collision frequency identified at Junction 25
- Poor quality pedestrian/cycle facilities through Junction 25 inhibit potential usage
- Lack of spare junction capacity to support projected population and employment, inhibiting opportunities for all
- Sensitive environmental receptors identified in the vicinity of the Junction 25 associated with high traffic volumes, delay and a high proportion of HGV noise

Future economic growth and development is expected across LB Enfield, Broxbourne and Hertfordshire and the wider London area.

Whilst a degree of uncertainty always exists over economic growth, it is apparent that a high scale of growth is forecast across the immediate and the wider study area that will increase traffic on the entire orbital route and wider SRN. Junction 25 will potentially be most affected by growth in Broxbourne and Enfield and well as that associated with the Hertfordshire LEP and the Upper Lee Valley Opportunity Area.

This projected growth and related traffic increase will exacerbate existing problems at Junction 25; this has been demonstrated by traffic modelling undertaken in PCF Stage 1.

It is understood that the Signal Improvement Scheme will proceed prior to the RIS scheme, however evidence suggests that this is only a short term solution and that a longer term option to reduce traffic related impacts is required.

In summary the options identified each contribute to address the scheme objectives:

- Traffic modelling has demonstrated that junction performance would improve across all time periods and in 2022 and 2037.
- The economic assessment demonstrated High Value / Very High Value BCRs which included accident reduction benefits.
- Environmental assessments have demonstrated that possible adverse impacts could be managed through mitigation and opportunities for enhancement have been identified
- Pedestrian and cycle facilities would be improved.

This would contribute towards reducing queueing, average delay, smoothing the flow of traffic and would help support planned local and regional growth. In combination and alongside the Signal Improvement Scheme these factors would help to improve customer satisfaction and contribute towards reducing customer complaints.

15.2 Recommendation of options for progression to PCF Stage 2 / public consultation

This PCF Stage 1 TAR sets out the current conditions and performance of M25 Junction 25 highlighting the need for improving the junction. The TAR summarises the traffic operational and safety issues with the current highway arrangement and confirms the case for improvements at this junction with a set of issue led project specific objectives.

The surrounding environment and key issues and constraints have also been identified, including environmental, technical and operational issues.

Three options have been identified to address the problems and achieve the project specific objectives. The extent to which these achieve the objectives, and offer value for money has been discussed earlier in previous chapters, based on the traffic, environmental and economic assessments.

It is therefore recommended that both options 1 and 2 are taken forward to PCF Stage 2 and Public Consultation. Option 3 is not to be taken forward for further consideration for two main reasons: a) although it is predicted to deliver a Very High value BCR, its capital expenditure is likely to exceed the budget limit of £30M, based on assumptions used in PCF Stage 1; b) both options 1 and 2 are more dedicated at delivering improvements for A10 at Cheshunt, making them more closely aligned to project objectives.

Appendix A –
Existing utilities

DO NOT SCALE

Millimetres 0 10 100

DO NOT SCALE

MOBILE PHONE MASTS

Scale 1:2000
50m 0m 50m 100m

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

Maintenance / Cleaning
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

Use
None

Decommissioning / Demolition
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

KEY

- F WATER — FOUL WATER
- FWA — FOUL WATER ABANDONED
- S WATER — SURFACE WATER
- WATER — WATER
- GENSYS — ELECTRICAL
- VIRGIN — TELECOM'S VIRGIN
- BT O — TELECOM'S BT OVERHEAD LINES
- BT U — TELECOM'S BT UNDERGROUND LINES
- UK POWER UNDERGROUND LINES
- UK POWER OVERHEAD EXTRA HIGH VOLTAGE CABLES (EHV) 22,000 TO 132,000 VOLTS
- UK POWER UNDERGROUND EXTRA HIGH VOLTAGE CABLES (EHV) 22,000 TO 132,000 VOLTS
- TRANSPORT FOR LONDON
- TELEGRAPH POLE
- TRANSPORT FOR LONDON CCTV
- TRANSPORT FOR LONDON TRAFFIC LIGHTS
- MOBILE PHONE MASTS
- REFER TO SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX

NOTES

1. UTILITIES RECORDS CURRENT AT JULY 2015
2. UTILITIES SHOWN IN CORRIDOR OF INTEREST ONLY
3. LOCATIONS OF PLANT SHOWN ARE APPROXIMATE

Rev	Drawn / Des	Checked	Approved	Date
P01	JD	JAV	S.R.H	27/06/16
First Issue				
P02	JD	S.R.H	S.R.H	01/07/16
First Issue				

Description

Drawing Status: WORK IN PROGRESS — Suitability: S0

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Client: highways england driving forward

Project Title: REGIONAL INVESTMENT PROGRAMME M25 J25 IMPROVEMENT

Drawing Title: EXISTING STATUTORY UNDERTAKERS PLAN

Scale	Designed / Drawn	Checked	Approved	Authorised
1:2000	JD	S.R.H	S.R.H	KB
Original Size	**Date**	**Date**	**Date**	**Date**
A1	30/06/16	30/06/16	30/06/16	01/07/16

Drawing Number: HE551518-ATK-HGN-ZZ-DR-D-0021 — Revision: P02

Plotted: Jul 01, 2016 - 3:28pm by: KELL9073

Appendix B –
PCF Stage 0 variant options scoring

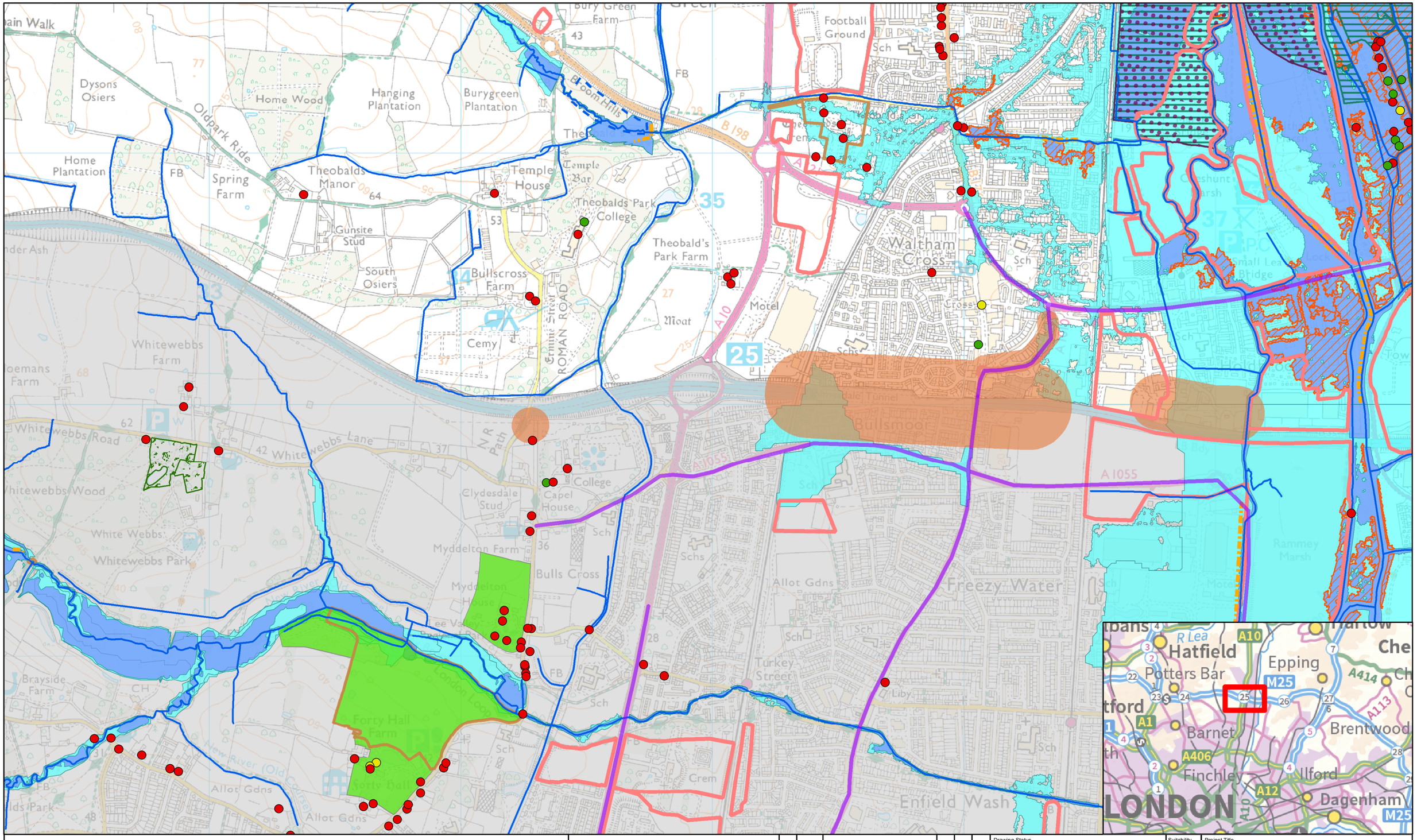
Table 15-1 Summary of variant options vs Highways England KPIs

Option	Score			Comments	Ranking
	KPIs	EAST	Overall		
Option 0 : Do-Nothing	3	6	**9**	**Making the network safer:** Queuing back could be reduced in short term, also improved signal reliability.	**5**
				Delivering better environmental outcomes: Some short term reduction in congestion and an increase in vehicle speeds could occur	
				Encouraging Economic Growth: Longer term traffic increases associated with growth could reduce performance of junction. Unlikely to support any notable future growth.	
				Improving user satisfaction: Users travelling between M25 and local roads could experience reduced congestion. Longer term likely to experience worsening congestion.	
				EAST – Likely to support limited amount of short term growth; unlikely to support growth longer term. Should provide short term improvements by contributing to addressing transport objectives, being practical, feasible and deliverable.	
Option 1 : Do Minimum	6	7	**13**	**Making the network safer:** Potentially a degree of reduced risk of weaving collisions which could reduce collision frequency and severity.	**3**
				Delivering better environmental outcomes: Likely to Increase traffic speeds; potential increasing noise (many residents live in one of 3 Important Areas for Noise). No land take required.	
				Helping cyclists, walkers and other vulnerable users: New ped/cycle route/crossing likely to improve personal security, safety & journey ambiance.	
				Encouraging Economic Growth: Some additional capacity will likely reduce vehicle delay, supporting growth.	
				Supporting the smooth flow of traffic: Some reduced collision severity (KSI) could reduce incident clearance time.	
				Improving user satisfaction: New ped/cycle route could improve user satisfaction & encourage new users. Those travelling between J25 & local roads should experience reduced congestion/collision risk. Air quality could be marginally improved.	
				EAST - Likely to support degree of short term growth; unlikely to support growth longer term. Should provide short term improvements by contributing to addressing transport objectives, as likely to be practical, feasible and deliverable.	
Option 2 : No Land Acquisition Required	8	6	**14**	**Making the network safer:** Potentially reduced risk of weaving collisions and queueing which could further reduce collision frequency and severity.	**2**
				Delivering better environmental outcomes: Likely to further increase traffic speeds incrementally increasing in noise (many residents live in one of 3 Important Areas for Noise). Some land take of adjacent highway land required.	

				Helping cyclists, walkers and other vulnerable users: New ped/cycle route/crossing likely to improve personal security, safety & journey ambiance. .	
				Encouraging Economic Growth: Additional capacity will likely reduce vehicle delay, supporting economic growth.	
				Supporting the smooth flow of traffic: A degree of reduced collision severity (KSI) could reduce incident clearance time.	
				Improving user satisfaction: New ped/cycle route should improve user satisfaction & encourage new users. Those travelling between J25 & local road network should experience more substantial congestion / collision risk reduction. Air quality could be marginally improved.	
				EAST - Could support a degree of short term projected growth whilst not necessarily able to support longer term growth. Provides improvements by addressing transport objectives. Likely to be practical, feasible, deliverable.	
Option 3: Land Acquisition Required	11	4	**15**	**Making the network safer:** Potentially a reduced risk of weaving collisions and queueing which should reduce collision frequency and severity.	**1**
				Delivering better environmental outcomes: Likely to be a further increase traffic speeds incrementally increasing in noise (many residents live in one of 3 Important Areas for Noise). Some land take required outside highway boundary.	
				Helping cyclists, walkers and other vulnerable users: New ped / cycle route/crossing likely to improve personal security, safety & journey ambiance.	
				Encouraging Economic Growth: Additional capacity (including at Bullsmoor Lane) would likely reduce vehicle delay, supporting economic growth.	
				Supporting the smooth flow of traffic: Reduced collision severity (KSI) could reduce incident clearance time.	
				Improving user satisfaction: New ped / cycle route should improve user satisfaction & encourage new users. Those travelling between J25 & local road network should experience more noticeable congestion / collision risk reduction. Air quality should improve.	
				EAST - Should support projected short term growth whilst encouraging a degree of longer term growth. Provides improvements by addressing transport objectives Likely to be practical, feasible and deliverable, despite requiring some land take.	
Option 4: Long Term	10	1	**11**	As per Option 3; the staggered at Bullsmoor Ln junction is not anticipated to have any additional impact at J25. Cannot be delivered in RIS1 timescales and therefore is longer term option.	**4**
				EAST – Should support projected short term growth whilst encouraging longer term growth. Provides improvements by addressing some of transport objectives although may have impacts in vicinity of sensitive environmental sensors. The staggered junction at Bullsmoor Lane cannot be delivered in the required timeframe and therefore is a longer term option.	
Option 5: Flyover	8	-2	**6**	**Making the network safer:** Potentially reduced collision frequency / severity at J25 and reduced risks associated with queuing back onto the M25 Holmesdale Tunnel.	**6**
				Delivering better environmental outcomes: Likely reduced congestion and increased traffic speeds; potentially significant increases in noise (many residents & businesses will be affected).	

				Encouraging Economic Growth: Likely to be substantial capacity on gyratory created by removing N/S traffic movements which could reduce the average delay and support and encourage economic growth (unclear if A10 or Bullsmoor Lane capable of accepting extra flow of traffic from flyover downstream).	
				Supporting the smooth flow of traffic: Reduced collision severity (KSI) could reduce incident clearance time.	
				Improving user satisfaction: Road users travelling between J25 and local road network and N/S A10 movements likely to experience reduced congestion. Air quality likely to marginally improve.	
				EAST - Should support short term and encourage a longer term projected growth. Provides improvements by addressing some of transport objectives although there are many residents and businesses adjacent to the Bullsmoor Lane junction which are likely to be affected by significant environmental impacts (noise). It is unclear if the A10 or Bullsmoor Lane downstream of the junction are capable of accepting the extra flow of traffic from the flyover.	

Appendix C –
Environmental constraints plan



- Grade I listed building
- Grade II listed building
- Grade II* listed building
- PCM Links
- Detailed River Network
- Important Areas for Noise
- Land Fill Site (Historic)
- Scheduled Monument
- Special Protection Area (SPA)
- Site of Special Scientific Interest (SSSI)
- Parks & Gardens
- Ancient Woodland
- Flood Defence
- Flood Storage Area
- Areas Benefiting from Flood Defenses
- Flood Zone 3
- Flood Zone 2
- Air Quality Management Areas

CLIENT NAME: Highways England

LICENCE NUMBER: 100018928

Meters
0 100 200 400 600

Rev.	Date	Description	By	Chk'd	App'd
P01	24.09.15	ISSUED FOR INFORMATION	AT	HM	NW

Drawing Status: FOR INFORMATION

Suitability: S2

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Client: highways england

Project Title: ROAD INVESTMENT STRATEGY
M25 J25

Drawing Title: ENVIRONMENT CONSTRAINTS MAP
Page 1 of 1

Scale	Designed	Drawn	Checked	Authorised
1:14000	AT	AT	HM	NW
Original Size	Date	Date	Date	Date
A3	24/09/15	24/09/15	24/09/15	24/09/15

Drawing Number: HE551518 - ATK - EGN - 0001
Project: M25J25 - Originator: DR - Volume: EN - Location - Type - Role - Number

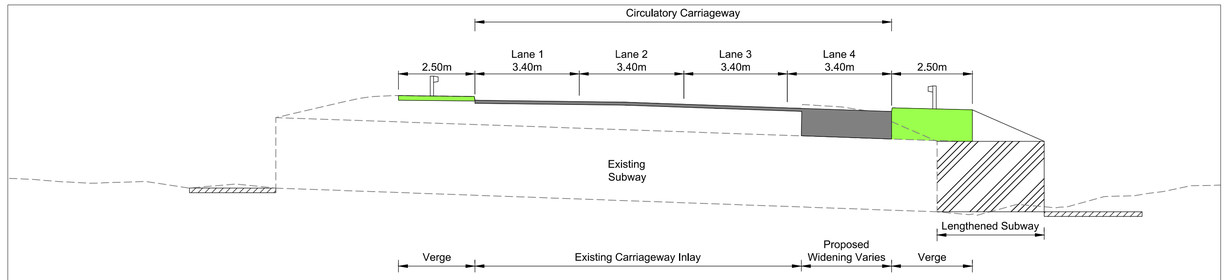
Project Ref. No.: 5141146

Revision: P01

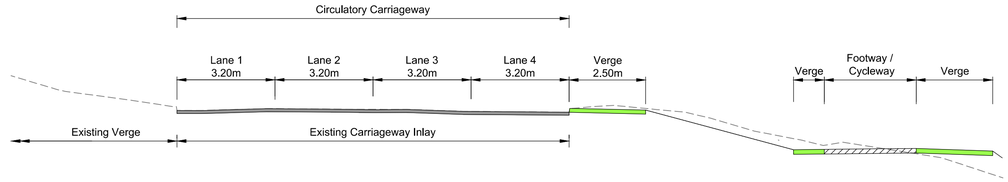
Appendix D –
Option cross sections

DO NOT SCALE

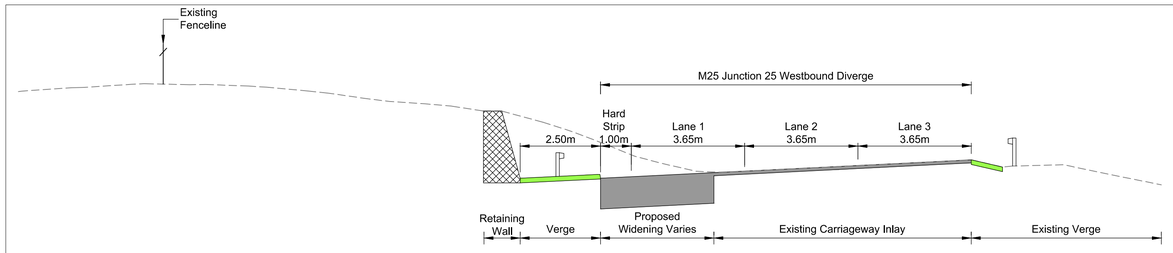
Millimetres 0 10 100



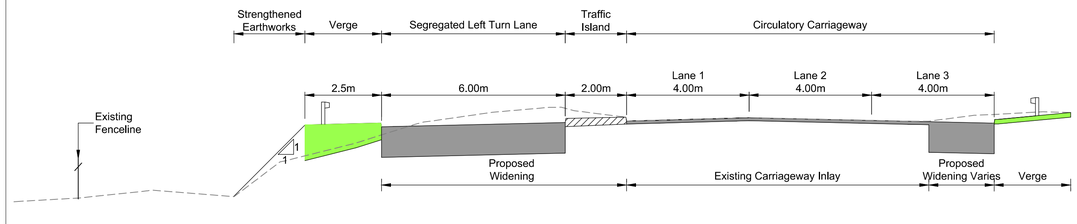
SECTION A - A
OPTIONS 1, 2 AND 3
NORTH-EAST CIRCULATORY



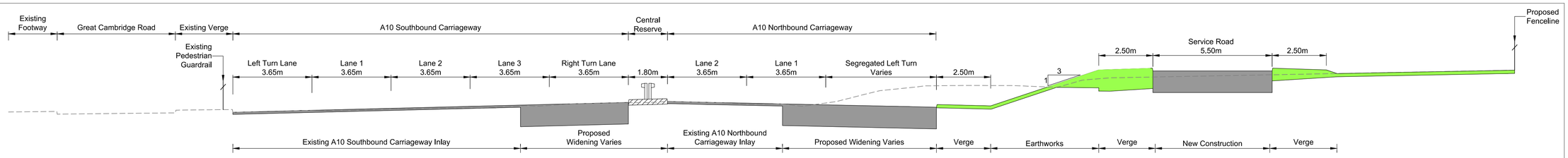
SECTION B - B
OPTIONS 1,2 AND 3
SOUTH CIRCULATORY



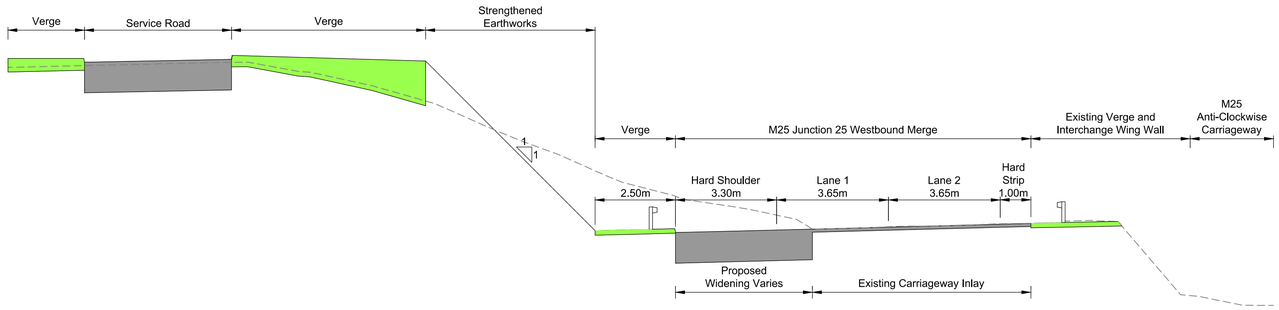
SECTION C - C
OPTIONS 2 AND 3
M25 JUNCTION 25 WESTBOUND DIVERGE



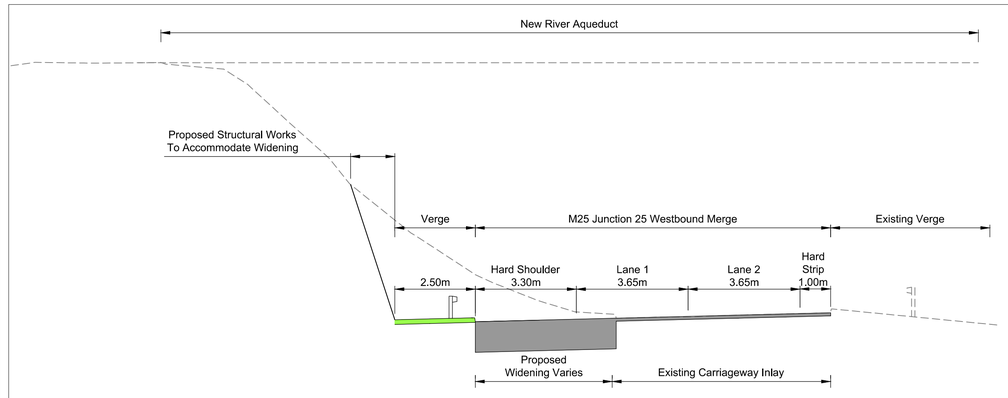
SECTION D - D
OPTIONS 2 AND 3
NORTH CIRCULATORY



SECTION E - E
OPTION 3
A10 GREAT CAMBRIDGE ROAD



SECTION F - F
OPTION 3
M25 JUNCTION 25 WESTBOUND MERGE



SECTION G - G
OPTION 3
M25 JUNCTION 25 WESTBOUND MERGE

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

Maintenance / Cleaning
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

Use
None

Decommissioning / Demolition
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

Key

- Proposed Carriageway Construction
- Proposed Footway Construction
- Proposed Earthworks and Verge
- Proposed Retaining Wall
- Proposed Lengthened Subway
- Proposed Profile
- Existing Profile

Notes

1. For locations of Cross sections refer to drawings HE551518-ATK-HGN-ZZ-DR-0001 to 0003
2. Street furniture including street lighting, traffic signals and signs have not been shown.
3. Road restraint systems shown are indicative only.

Rev	Drawn / Des	Checked	Approved	Date
P01	AT	DJG	S.R.H	02/03/16
First Issue				

Description

Drawing Status: FOR COSTING
Suitability: D1

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Client: highways england driving forward

Project Title: REGIONAL INVESTMENT PROGRAMME M25 J25 IMPROVEMENT

Drawing Title: INDICATIVE CROSS-SECTIONS

Scale	Designed / Drawn	Checked	Approved	Authorised
1:100	AT	DJG	S.R.H	KB
Original Size	Date	Date	Date	Date
A1	02/03/16	02/03/16	02/03/16	02/03/16

Drawing Number: HE551518-ATK-HGN-ZZ-DR-D-0005
Revision: P01

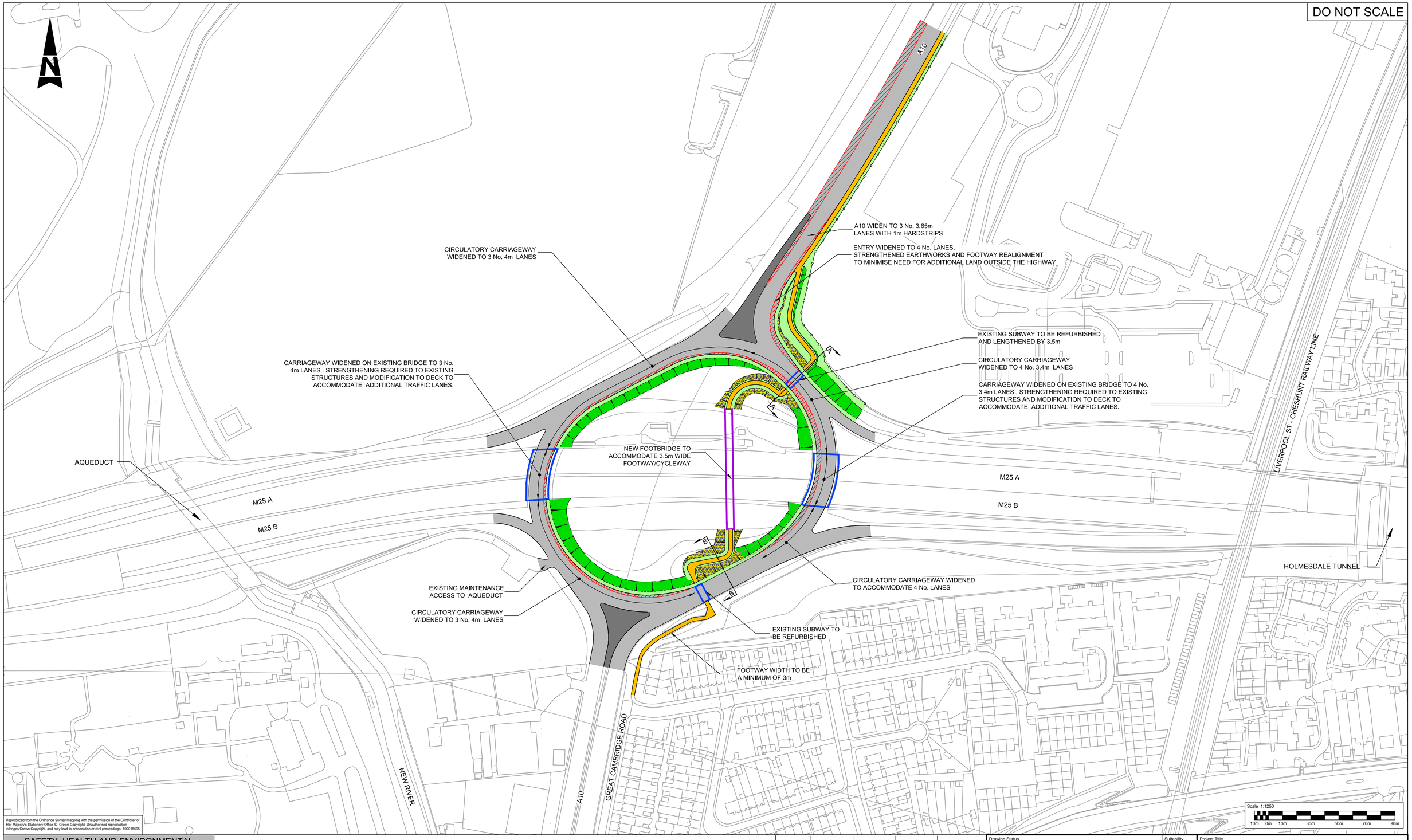
Plotted: Mar 02, 2016 - 3:07pm by: TAMO5256

Appendix E –
Option 1: layout and land take

DO NOT SCALE

Millimetres 0 10 100

DO NOT SCALE



Scale 1:1250

10m 0m 10m 30m 50m 70m 90m

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
HIGH VOLTAGE CABLES PRESENT IN AREA OF WORKS

Maintenance / Cleaning
HIGH VOLTAGE CABLES PRESENT IN AREA OF WORKS

Use
None

Decommissioning / Demolition
HIGH VOLTAGE CABLES PRESENT IN AREA OF WORKS

KEY

- EXISTING CARRIAGEWAY INLAY / OVERLAY
- PROPOSED CARRIAGEWAY WIDENING
- VERGE
- EARTHWORKS
- STRENGTHENED EARTHWORKS
- PAVED ISLAND
- NEW FOOTWAY CONSTRUCTION
- STRUCTURAL WORKS
- PROPOSED FOOTBRIDGE
- CROSS-SECTION LOCATION REFER TO DRAWING HE551518-ATK-HGN-ZZ-DR-D-0005 FOR DETAILS
- PROPOSED FENCE LINE

NOTES

1. MODIFICATIONS WILL BE REQUIRED TO STREET FURNITURE (INC. TRAFFIC SIGNALS, ROAD RESTRAINT SYSTEM AND PARAPETS) IN VICINITY OF WIDENING.

Rev	Drawn / Des	Checked	Approved	Date
P01	AT	DJG	S.R.H	01/03/16

First Issue

Description

Drawing Status: FOR COSTING

Suitability: D1

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Client: highways england driving forward

Project Title: REGIONAL INVESTMENT PROGRAMME M25 J25 IMPROVEMENT

Drawing Title: OPTION 1 GENERAL ARRANGEMENT

Scale	Designed / Drawn	Checked	Approved	Authorised
1:1250	AT	DJG	S.R.H	KB
Original Size	Date	Date	Date	Date
A1	01/03/16	01/03/16	01/03/16	01/03/16

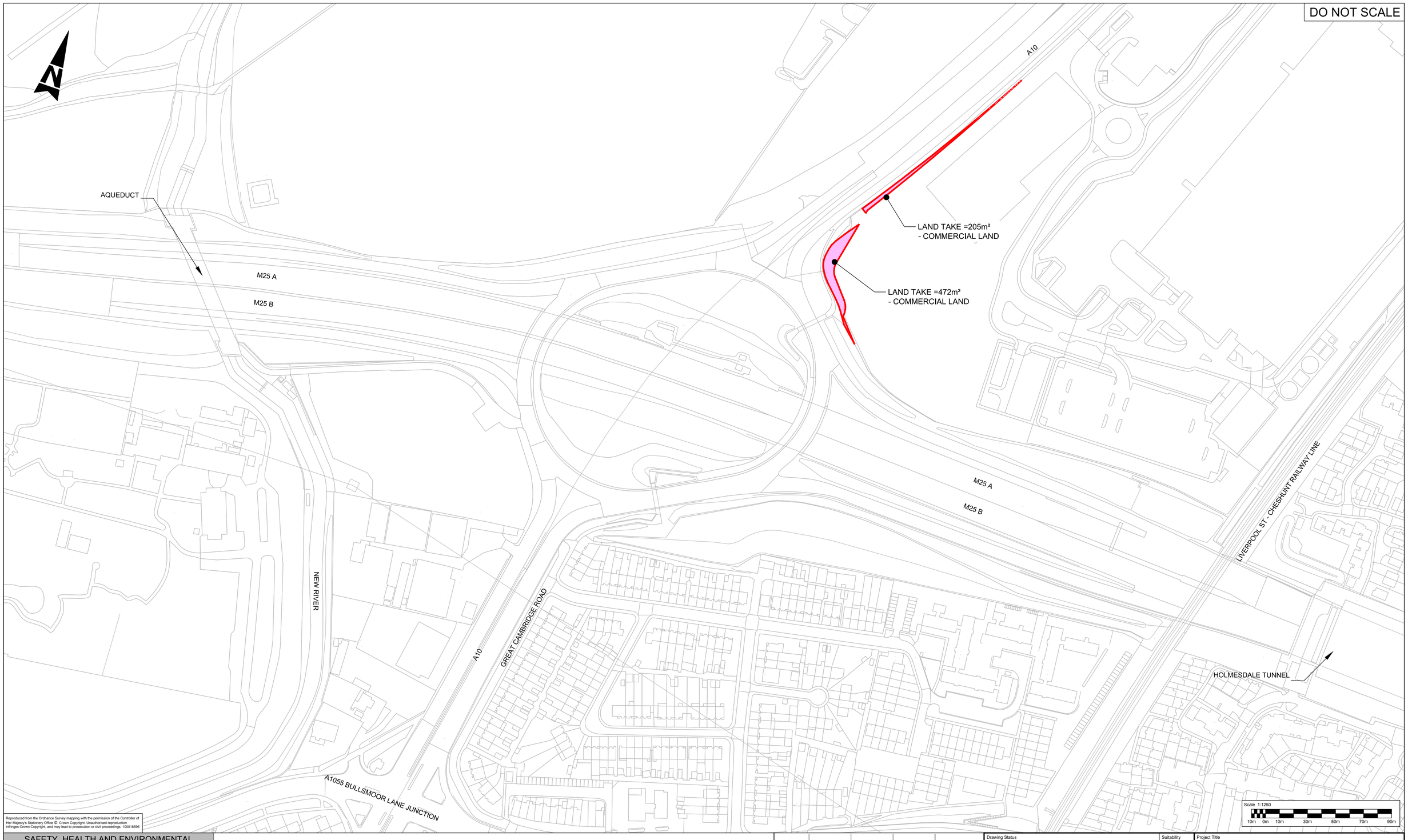
Drawing Number: HE551518-ATK-HGN-ZZ-DR-D-0001

Revision: P01

Plotted: Mar 01, 2016 - 4:36pm by: TAMO5256

DO NOT SCALE

Millimetres 0 10 100



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

KEY

LAND REQUIRED

NOTES

1. AREAS OF LAND RE□UIRED BEYOND HIGHWAY BOUNDARY ARE BASED ON INFORMATION OBTAINED FROM LAND REGISTRY

Rev	Drawn / Des	Checked	Approved	Date
P01	AT	DJG	S.R.H	01/03/16

First Issue

Description

Drawing Status: FOR COSTING

Suitability: D1

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Client: highways england driving forward

Project Title: REGIONAL INVESTMENT PROGRAMME M25 J25 IMPROVEMENT

Drawing Title: LAND EXTENT PLAN OPTION 1

Scale	Designed / Drawn	Checked	Approved	Authorised
1:1250	AT	DJG	S.R.H	KB
Original Size	**Date**	**Date**	**Date**	**Date**
A1	01/03/16	01/03/16	01/03/16	01/03/16

Drawing Number: HE551518-ATK-HGN-ZZ-DR-D-0018

Revision: P01

Plotted: Mar 01, 2016 - 4:24pm by: TAMO5256

Appendix F –
Option 2: layout and land take

DO NOT SCALE

Millimetres 0 10 100

DO NOT SCALE

A10 NORTHBOUND WIDENING TO 3 No. 3.65m LANES WITH 1m HARDSTRIPSTO ACCOMMODATE SEGREGATED LEFT TURN FACILITY WITH STRENGTHENED EARTHWORKS TO MINIMISE THE LAND REQUIRED OUTSIDE THE HIGHWAY BOUNDARY

A10 WIDEN TO 3 No. 3.65m LANES WITH 1m HARDSTRIPS

CIRCULATORY CARRIAGEWAY WIDENED TO 3 No. 4m LANES

ENTRY WIDENED TO 4 No.LANES. STRENGTHENED EARTHWORKS AND FOOTWAY REALIGNMENT TO MINIMISE NEED FOR ADDITIONAL LAND OUTSIDE THE HIGHWAY BOUNDARY.

SEGREGATED LEFT TURN FACILITY 6m WIDE WITH STRENGTHENED EARTHWORKS TO MINIMISE LAND REQUIRED OUTSIDE OF THE HIGHWAY BOUNDARY

EXISTING SUBWAY TO BE REFURBISHED AND LENGTHEND BY 3.5m

CIRCULATORY CARRIAGEWAY WIDENED TO 4 No. 3.4m LANES

CARRIAGEWAY WIDENED ON EXISTING BRIDGE TO 3 No. 4m LANES . STRENGTHENING REQUIRED TO EXISTING STRUCTURES AND MODIFICATION TO DECK TO ACCOMMODATE ADDITIONAL TRAFFIC LANES.

M25 DIVERGE SLIP ROAD WIDENED ON APPROACH TO SEGREGATED LEFT TURN TO ACCOMMODATE AN ADDITIONAL 3.65m LANE WITH STRENGTHENED EARTHWORKS

CARRIAGEWAY WIDENED ON EXISTING BRIDGE TO 4 No. 3.4m LANES . STRENGTHENING REQUIRED TO EXISTING STRUCTURES AND MODIFICATION TO DECK TO ACCOMMODATE ADDITIONAL TRAFFIC LANES.

PROPOSED FOOTBRIDGE TO ACCOMMODATE 3.5m FOOTWAY/CYCLEWAY

AQUEDUCT

M25 A

M25 B

EXISTING MAINTENANCE ACCESS TO AQUEDUCT

CIRCULATORY CARRIAGEWAY WIDENED TO 3 No. 4m LANES

CIRCULATORY CARRIAGEWAY WIDENED TO 4 No. LANES

SLIP ROAD WIDENED TO 3 No. 3.65m LANES ACCOMMODATED BY RETAINING STRUCTURE

EXISTING SUBWAY TO BE REFURBISHED

FOOTWAY WIDTH TO BE A MINIMUM OF 3m

HOLMESDALE TUNNEL

A10

LIVERPOOL ST - CHESHUNT RAILWAY LINE

GREAT CAMBRIDGE ROAD

NEW RIVER

Scale 1:1250

10m 0m 10m 30m 50m 70m 90m

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

Maintenance / Cleaning
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

Use
None

Decommissioning / Demolition
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

KEY

- EXISTING CARRIAGEWAY INLAY / OVERLAY
- PROPOSED CARRIAGEWAY WIDENING
- VERGE
- EARTHWORKS
- STRENGTHENED EARTHWORKS
- PAVED ISLAND
- NEW FOOTWAY CONSTRUCTION
- STRUCTURAL WORKS
- PROPOSED FOOTBRIDGE
- CROSS-SECTION LOCATION REFER TO DRAWING HE551518-ATK-HGN-ZZ-DR-D-0005 FOR DETAILS
- PROPOSED FENCE LINE
- PROPOSED RETAINING STRUCTURE

NOTES

1. MODIFICATIONS WILL BE REQUIRED TO STREET FURNITURE (INC. TRAFFIC SIGNALS, ROAD RESTRAINT SYSTEM AND PARAPETS) IN VICINITY OF WIDENING.

Rev	Drawn / Des	Checked	Approved	Date
P01	AT	DJG	S.R.H	01/03/16

First Issue

Description

Drawing Status: FOR COSTING | Suitability: D1

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Client: highways england driving forward

Project Title: REGIONAL INVESTMENT PROGRAMME M25 J25 IMPROVEMENT

Drawing Title: OPTION 2 GENERAL ARRANGEMENT

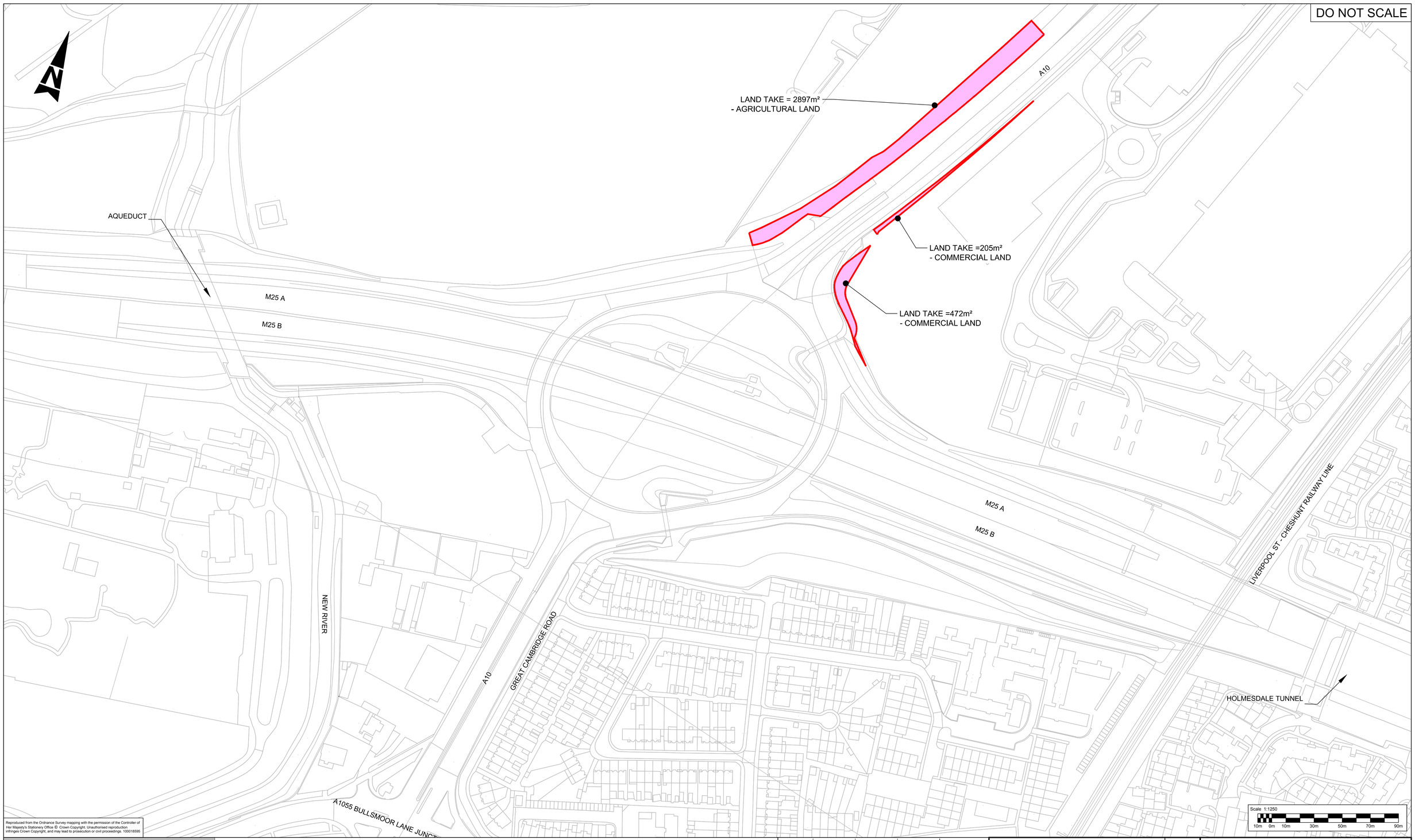
Scale	Designed / Drawn	Checked	Approved	Authorised
1:1250	AT	DJG	S.R.H	KB
Original Size	Date	Date	Date	Date
A1	01/03/16	01/03/16	01/03/16	01/03/16

Drawing Number: HE551518-ATK-HGN-ZZ-DR-D-0002 | Revision: P01

Plotted: Mar 01, 2016 - 4:42pm by: TAMO5256

DO NOT SCALE

Millimetres 0 10 100



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

KEY

LAND REQUIRED

NOTES

1. AREAS OF LAND RE□UIRED BEYOND HIGHWAY BOUNDARY ARE BASED ON INFORMATION OBTAINED FROM LAND REGISTRY

Rev	Drawn / Des	Checked	Approved	Date
P01	AT	DJG	S.R.H	01/03/16
First Issue				

Description

Drawing Status: FOR COSTING
Suitability: D1

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Client: highways england driving forward

Project Title: REGIONAL INVESTMENT PROGRAMME
M25 J25 IMPROVEMENT

Drawing Title: LAND EXTENT PLAN OPTION 2

Scale	Designed / Drawn	Checked	Approved	Authorised
1:1250	AT	DJG	S.R.H	KB
Original Size	**Date**	**Date**	**Date**	**Date**
A1	01/03/16	01/03/16	01/03/16	01/03/16

Drawing Number: HE551518-ATK-HGN-ZZ-DR-D-0019
Revision: P01

Plotted: Mar 01, 2016 - 4:27pm by: TAMO5256

Appendix G –
Option 3: layout and land take

DO NOT SCALE

Millimetres 100 0 10

M25 DIVERGE SLIP ROAD WIDENED ON APPROACH TO SEGREGATED LEFT TURN TO ACCOMMODATE AN ADDITIONAL 3.65m LANE WITH STRENGTHENED EARTHWORKS

SEGREGATED LEFT TURN FACILITY 6m WIDE WITH STRENGTHENED EARTHWORKS TO MINIMISE LAND REQUIRED OUTSIDE OF THE HIGHWAY BOUNDARY

A10 NORTHBOUND WIDENING TO 3 No. 3.65m LANES WITH 1m HARDSTRIPS TO ACCOMMODATE SEGREGATED LEFT TURN FACILITY WITH STRENGTHENED EARTHWORKS TO MINIMISE THE LAND REQUIRED OUTSIDE THE HIGHWAY BOUNDARY

CARRIAGEWAY WIDENED ON EXISTING BRIDGE TO 3 No. 4m LANES . STRENGTHENING REQUIRED TO EXISTING STRUCTURES AND MODIFICATION TO DECK TO ACCOMMODATE ADDITIONAL TRAFFIC LANES.

CIRCULATORY CARRIAGEWAY WIDENED TO 3 No. 4m LANES

AQUEDUCT

A10

A10 WIDENED TO 3.65m LANES WITH 1m HARDSTRIPS

ENTRY WIDENED TO 4 No.LANES. STRENGTHENED EARTHWORKS AND FOOTWAY REALIGNMENT TO MINIMISE NEED FOR ADDITIONAL LAND OUTSIDE THE HIGHWAY

M25 A

M25 B

EXISTING SUBWAY TO BE REFURBISHED AND LENGTHENED BY 3.5m

CIRCULATORY CARRIAGEWAY WIDENED TO 4 No. 3.4m LANES

PROPOSED FOOTBRIDGE TO ACCOMMODATE 3.5m FOOTWAY/CYCLEWAY

CARRIAGEWAY WIDENED ON EXISTING BRIDGE TO 4 No. 3.4m LANES . STRENGTHENING REQUIRED TO EXISTING STRUCTURES AND MODIFICATION TO DECK TO ACCOMMODATE ADDITIONAL TRAFFIC LANES.

EXISTING STRUCTURE TO BE MODIFIED TO ACCEPT ADDITIONAL LANE AND HARD SHOULDER

SLIP ROAD WIDENED TO 2 No. 3.65m LANES WITH 3.3m HARD SHOULDER. STRENGTHENED EARTHWORKS TO MINIMISE LAND REQUIRED OUTSIDE THE HIGHWAY BOUNDARY

SEGREGATED LEFT TURN FACILITY 6.5m WIDE

CIRCULATORY CARRIAGEWAY WIDENED TO 3 No. 4m LANES

A10 NORTHBOUND AND CENTRAL RESERVE REALIGNED TO ALLOW FOR SEGREGATED LEFT TURN LANE

NEW RIVER

EXISTING SUBWAY TO BE REFURBISHED

FOOTWAY WIDTH TO BE A MINIMUM OF 3m

CIRCULATORY CARRIAGEWAY WIDENED TO ACCOMMODATE 4 No. LANES

SLIP ROAD WIDENED TO 3 No. 3.65m LANES ACCOMMODATED BY RETAINING STRUCTURE

LIVERPOOL ST - CHESHUNT RAILWAY LINE

MAINTENANCE ACCESS TRACK TO AQUEDUCT

GREAT CAMBRIDGE ROAD

A10

HOLMESDALE TUNNEL

A10 SOUTHBOUND WIDENED TO PROVIDE EXTENDED LEFT TURN LANE TO BULLSMOOR LANE JUNCTION

A1055 BULLSMOOR LANE JUNCTION

Scale 1:1250
10m 0m 10m 30m 50m 70m 90m

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

Maintenance / Cleaning
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

Use
None

Decommissioning / Demolition
HIGH VOLTAGE CABLE PRESENT IN AREA OF WORKS

KEY

- EXISTING CARRIAGEWAY INLAY / OVERLAY
- PROPOSED CARRIAGEWAY WIDENING
- VERGE
- EARTHWORKS
- STRENGTHENED EARTHWORKS
- PAVED ISLAND
- NEW FOOTWAY CONSTRUCTION
- STRUCTURAL WORKS
- PROPOSED FOOTBRIDGE
- A A — CROSS-SECTION LOCATION REFER TO DRAWING HE551518-ATK-HGN-ZZ-DR-D-0005 FOR DETAILS
- PROPOSED FENCE LINE
- PROPOSED RETAINING STRUCTURE

NOTES

1. MODIFICATIONS WILL BE REQUIRED TO STREET FURNITURE (INC. TRAFFIC SIGNALS, ROAD RESTRAINT SYSTEM AND PARAPETS) IN VICINITY OF WIDENING.

Rev	Drawn / Des	Checked	Approved	Date
P01	AT	DJG	S.R.H	01/03/16
First Issue				
Description				

Drawing Status: FOR COSTING
Suitability: D1

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Client: highways england driving forward

Project Title: REGIONAL INVESTMENT PROGRAMME M25 J25 IMPROVEMENT

Drawing Title: OPTION 3 GENERAL ARRANGEMENT

Scale	Designed / Drawn	Checked	Approved	Authorised
1:1250	AT	DJG	S.R.H	KB
Original Size	Date	Date	Date	Date
A1	01/03/16	01/03/16	01/03/16	01/03/16

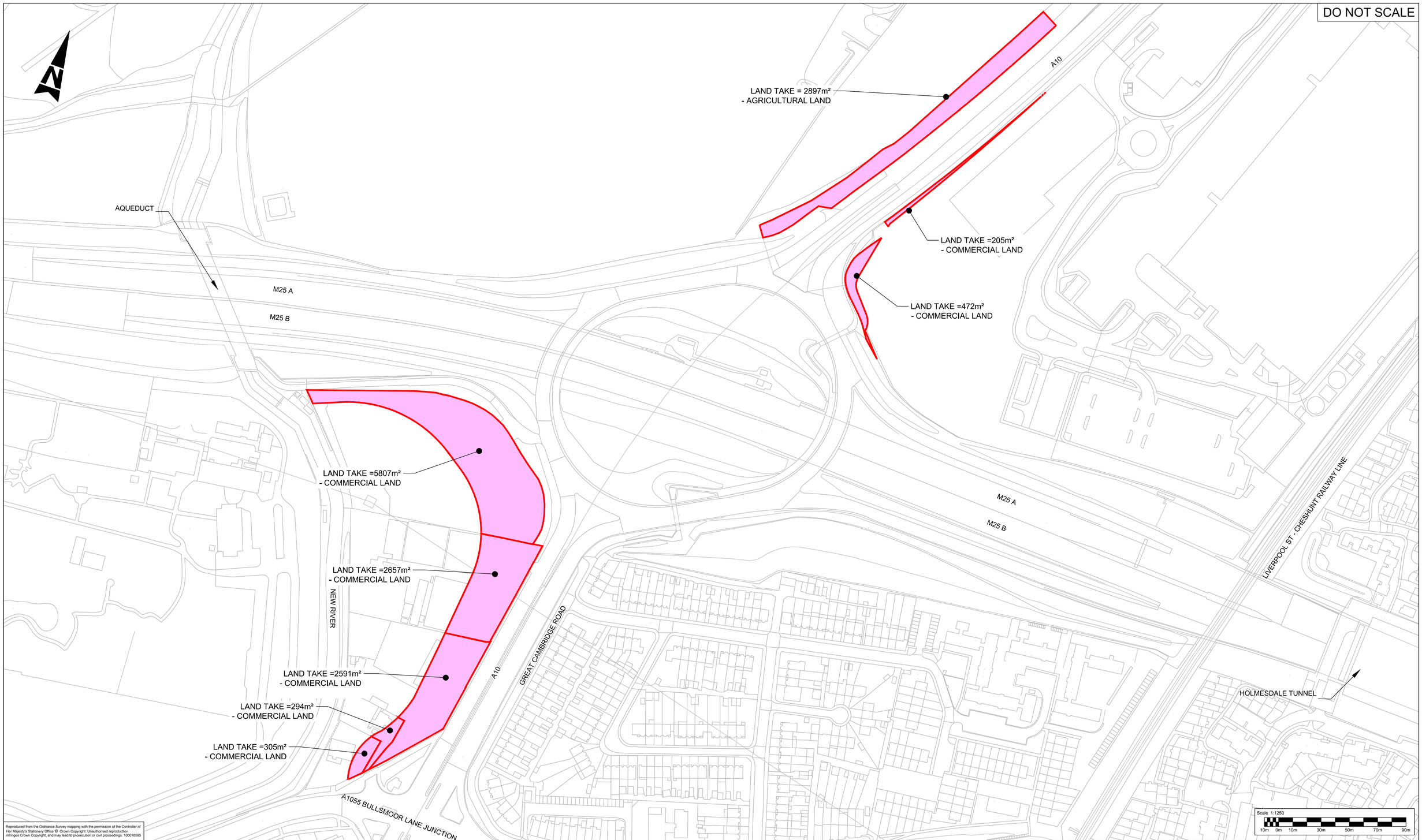
Drawing Number: HE551518-ATK-HGN-ZZ-DR-D-0003
Revision: P01

Plotted: Mar 01, 2016 - 4:46pm by: TAMO5256

DO NOT SCALE

Millimetres 0 10 100

DO NOT SCALE



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

KEY

LAND REQUIRED

NOTES

1. AREAS OF LAND RE□UIRED BEYOND HIGHWAY BOUNDARY ARE BASED ON INFORMATION OBTAINED FROM LAND REGISTRY

Rev	Drawn / Des	Checked	Approved	Date
P01	AT	DJG	S.R.H	01/03/16

First Issue

Description

Drawing Status: FOR COSTING

Suitability: D1

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Client: highways england driving forward

Project Title: REGIONAL INVESTMENT PROGRAMME
M25 J25 IMPROVEMENT

Drawing Title: LAND EXTENT PLAN OPTION 3

Scale	Designed / Drawn	Checked	Approved	Authorised
1:1250	AT	DJG	S.R.H	KB
Original Size	**Date**	**Date**	**Date**	**Date**
A1	01/03/16	01/03/16	01/03/16	01/03/16

Drawing Number: HE551518-ATK-HGN-ZZ-DR-D-0020

Revision: P01

Plotted: Mar 01, 2016 - 4:29pm by: TAMO5256

Appendix H –
Options estimates

PROJECT NAME: M25 Junction 25 Improvements
PCF STAGE: 1

OPTION 1	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Total (Excl Hist)**
PREPARATION EXPENDITURE PROFILE	£520,743	£1,190,265	£1,272,138	£1,758,626	£340,486	£0	£0	£5,082,257
SUPERVISION EXPENDITURE PROFILE	£0	£0	£0	£0	£319,349	£404,010	£9,771	£733,130
WORKS EXPENDITURE PROFILE	£0	£0	£0	£0	£8,253,767	£7,924,556	£172,806	£16,351,129
LANDS EXPENDITURE PROFILE	£0	£0	£0	£0	£924,955	£0	£0	£924,955
TOTAL EXPENDITURE FORECAST (ALL COSTS INCLUDED)	**£520,743**	**£1,190,265**	**£1,272,138**	**£1,758,626**	**£9,838,557**	**£8,328,566**	**£182,577**	**£23,091,471**

The expenditure profiles are based upon cost estimates for each financial year prepared in 2014 Q1 prices and then inflated to outturn costs using HA projected construction related inflation. These costs have then been rebased to 2010 calender year profiles for economic calculations, using the GDP-deflator series as published in the WebTAG Databook.

The costs exclude all recoverable VAT. All historic costs have been removed - previous years and an approximate of this years spend that occurs in the past.

PROJECT NAME: M25 Junction 25 Improvements
PCF STAGE: 1

OPTION 2	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Total (Excl Hist)**
PREPARATION EXPENDITURE PROFILE	£520,742	£1,192,573	£1,276,137	£1,777,728	£345,235	£0	£0	£5,112,415
SUPERVISION EXPENDITURE PROFILE	£0	£0	£0	£0	£318,971	£403,531	£9,759	£732,261
WORKS EXPENDITURE PROFILE	£0	£0	£0	£0	£10,334,397	£9,125,247	£194,844	£19,654,488
LANDS EXPENDITURE PROFILE	£0	£0	£0	£0	£1,417,110	£0	£0	£1,417,110
TOTAL EXPENDITURE FORECAST (ALL COSTS INCLUDED)	**£520,742**	**£1,192,573**	**£1,276,137**	**£1,777,728**	**£12,415,713**	**£9,528,778**	**£204,604**	**£26,916,274**

The expenditure profiles are based upon cost estimates for each financial year prepared in 2014 Q1 prices and then inflated to outturn costs using HA projected construction related inflation. These costs have then been rebased to 2010 calender year profiles for economic calculations, using the GDP-deflator series as published in the WebTAG Databook.

The costs exclude all recoverable VAT. All historic costs have been removed - previous years and an approximate of this years spend that occurs in the past.

PROJECT NAME: M25 Junction 25 Improvements
PCF STAGE: 1

OPTION 3	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Total (Excl Hist)**
PREPARATION EXPENDITURE PROFILE	£520,172	£1,192,483	£1,276,846	£1,931,133	£388,557	£0	£0	£5,309,191
SUPERVISION EXPENDITURE PROFILE	£0	£0	£0	£0	£318,422	£402,837	£9,742	£731,001
WORKS EXPENDITURE PROFILE	£0	£0	£0	£0	£12,651,569	£11,690,294	£237,616	£24,579,478
LANDS EXPENDITURE PROFILE	£0	£0	£0	£0	£7,437,109	£0	£0	£7,437,109
TOTAL EXPENDITURE FORECAST (ALL COSTS INCLUDED)	**£520,172**	**£1,192,483**	**£1,276,846**	**£1,931,133**	**£20,795,656**	**£12,093,131**	**£247,358**	**£38,056,779**

The expenditure profiles are based upon cost estimates for each financial year prepared in 2014 Q1 prices and then inflated to outturn costs using HA projected construction related inflation. These costs have then been rebased to 2010 calender year profiles for economic calculations, using the GDP-deflator series as published in the WebTAG Databook.

The costs exclude all recoverable VAT. All historic costs have been removed - previous years and an approximate of this years spend that occurs in the past.

Appendix I –
Appraisal Summary Tables

Appraisal Summary Table

Date produced:	01/11/2016

Contact:	
Name	Piotr Grabowiecki
Organisation	Highways England
Role	Project Manager

Name of scheme:	M25 Junction 25 Improvements PCF Stage 1: Option 1
Description of scheme:	- Widen the M25 J25 circulatory carriageway to three / four lanes throughout - Widen the A10(N) Southbound entry to the roundabout - Re-provide and improve the pedestrian/cycle facility that would be lost

Impacts		Summary of key impacts **Each scenario or sensitivity test (as a minimum, the core scenario and two alternative scenarios or sensitivity tests) should form the basis for a full appraisal, including environmental and other impacts where appropriate. It is expected that the core scenario will be reported in the AST, with any exceptional outcomes of the uncertainty analysis also included. EG if there are significantly different results in an alternative scenario that would affect the AST score in a particular category, then that information will be included as qualitative comments (but quantifying the difference) in the AST**	Assessment Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme generates net overall benefits for business users from travel time and vehicle operating cost savings resulting from delay relief at the junction. · The percentage of total TEE benefit during normal operation attributable to changes in consumers journey times and vehicle operating costs is 67% (see EAR for further detail). · The total vehicle hours saved by consumer users in opening year during normal operation is 75,000. For all vehicles and trip purposes combined: · The overall change in average journey time per vehicle in the study area reduces by between 0.1 and 0.5 minutes depending on the time period. See Tables 6.2, 6.4 and 6.6 in the Traffic Forecasting Report for a summary of the opening year peak and inter-peak journey time changes in seconds by route. · Peak hour journey time changes during construction in minutes are not available at PCF Stage 1.	**Value of journey time changes(£)** £49.8m **Net journey time changes (£)** **0 to 2min**: £28.5m; **2 to 5min**: £21.4m; **> 5min**: £0m	N/A	£53.4m (including vehicle operating cost and delays in construction)	N/A at PCF Stage 1
	Reliability impact on Business users	Scheme will improve reliability for business users through the increased capacity provided which will improve the junction's resilience to incidents and reduce the scale of delay associated with incidents and lane closures.	Not assessed	Not assessed	Not assessed	
	Regeneration	Not assessed	Not assessed	N/A	N/A	
	Wider Impacts	Not assessed	N/A	N/A	N/A	
Environmental	Noise	A minor decrease (1-3dB LA10,18h) in noise is predicted at the eastbound M25 off-slip at Junction 25, relative to the Do Minimum scenario in the opening year (derived from the Environment Study Report assessment). Negligible impacts are predicted elsewhere in the opening year. Negligible changes are predicted throughout the study area in the design year.	12,982 households potentially affected	Preliminary Basic Noise Level calculations indicate that a total of 12,982 households are located within 600m of road links that could experience a change in noise (for both the opening year and forecast years). It should be noted that this calculation does not account for the cumulative impact from all road links however, and similarly does not account for the potential masking of those increases by nearby links with greater flows and noise levels, consequently this information is provided for indicative purposes only.	Not monetised at this stage.	Not assessed at this stage.
	Air Quality	The scheme is located within the Enfield AQMA, designated for exceeding the NO2 annual mean and PM10 24-hour mean AQS objectives. The scheme is expected to lead to an increase in traffic on a number of roads in the vicinity of Junction 25, which could potentially lead to an increase in pollutant concentrations at receptors near the affected road network, including those within the Enfield AQMA and within Broxbourne AQMA No. 3.	It is estimated that 1241 properties could potentially experience an increase in pollutant concentrations	At this stage the option is considered to pose a risk of a potentially signficant adverse effect at nearby receptors particularly those within the Enfield and Broxbourne AQMAs.	Not monetised at this stage.	Not assessed at this stage.
	Greenhouse gases	The scheme is likely to lead to an increase in emissions based on the expected increases in traffic.	Not assessed at this stage. **Change in non-traded carbon over 60y (CO2e)**: Not assessed **Change in traded carbon over 60y (CO2e)**: Not assessed			
	Landscape	Would result in removal of vegetation along the inner perimeter of the junction and to the north east of the junction. Vegetation that will be removed is a common place landscape element comprising of trees, native shrubs and scrub within the highways estate. Small scale earthworks will also be introduced, however these would be barely perceptible in the context of the earthworks associated with the existing junction. The introduction of the footway bridge would also provide a slight alteration to the configuration of the existing junction. Overall the scale of proposed alterations is too small to result in significant townscape effects both within the local landscape but also at the scale of broader landscape character areas identified within published landscape character assessments. There are also good opportunities to accommodate environmental design or mitigation measures. As a result the existing townscape character will be maintained and scheme elements will be integrated within the existing townscape.	N/A	Neutral	N/A	
	Townscape	Covered under landscape above.	N/A	Neutral	N/A	
	Historic Environment	Impacts on the historic environment are likely to be in the form of setting impacts on listed buildings resulting from the scheme. A slight adverse effect is recorded on a number of Grade II listed buildings as a result.	N/A	Slight adverse	N/A	
	Biodiversity	There will be no effects on designated sites close to the scheme. Notable species are highly unlikely to be affected significantly so long as mitigation is implemented. Small losses of plantation woodland and grassland from within the junction would result in an overall slight adverse effect as these habitats cannot be replaced within the scheme.	N/A	Slight adverse	N/A	Slight adverse
	Water Environment	Potential increased discharge and associated polluant runoff to the New River, Turkey Brook and Theobalds Brook due to increase in impermeable areas. Cuttings and earthworks present potential mechanism for impacts on groundwater level and quality. Option will cross a Source Protection Zone (SPZ) and areas defined as Secondary Aquifer, potential effects may be associated with cuttings and will most likely require piling. Earthworks, cutting and piling may affect the flow of groundwater in the Secondary Aquifer, indirectly affecting surface water features and abstractions which are dependent upon groundwater inputs. Works may introduce new pollutant pathways to the underlying Aquifer. The SPZ suggests that no discharge to ground would be possible or be very limited. There is also currently a very high risk priority outfall to draining to surface water nearby which could be an opportunity for improvement.	N/A	Moderate adverse	N/A	
Social	Commuting and Other users	The scheme generates net benefits for commuting and other users from travel time and vehicle operating cost savings. · The percentage of total TEE benefit during normal operation attributable to changes in consumers journey times and vehicle operating costs is 33% (see EAR for further detail). · The total vehicle hours saved by consumer users in opening year during normal operation is 142.000 For all vehicles and trip purposes combined: · The overall change in average journey time per vehicle in the study area reduces by between 0.1 and 0.5 minutes depending on the time period. See Tables 6.2, 6.4 and 6.6 in the Traffic Forecasting Report for a summary of the opening year peak and inter-peak journey time changes in seconds by route. · Peak hour journey time changes during construction in minutes are not available at PCF Stage 1.	**Value of journey time changes(£)** £27.3m **Net journey time changes (£)** **0 to 2min**: £12.6m; **2 to 5min**: £14.7m; **> 5min**: £0m	N/A	£24.4m (including vehicle operating cost and delays in construction)	N/A at PCF Stage 1
	Reliability impact on Commuting and Other users	Scheme will improve reliability for commuting and other users through the increased capacity provided which will improve the junction's resilience to incidents and reduce the scale of delay associated with incidents and lane closures.	Not assessed	Not assessed	Not assessed	
	Physical activity	NMUs are only likely to experience negligible adverse effects in operation while the shared footpath and cycleway is likely to be a major benefit.	Slight Beneficial Impact - Likely increase in numbers of walkers and cyclists along the shared footpath and cycleway due to improvements in amenity of that NMU route. Average journey times for pedestrians and cyclists are likely to remain	Beneficial	Not assessed at this stage.	
	Journey quality	The impact on motorised traveller's views from the road will depend on the design and landscaping mitigation of the option but it is assumed a loss of current vegetation screening will be required under this option for the proposed improvements. NMUs of the shared footpath and cycleway are likely to be a major benefit due to the improvements at J25 crossing. Driver stress is expected to be temporarily adversely impacted by the construction works, however is expected to reduce during operation through increased traffic flows and a more efficient road network reducing driver stress and frustration.	N/A	Neutral	N/A	
	Accidents	Scheme forecast to slightly decrease accidents at the junction as a result of increased capacity and decreased conflicts	Negligible	N/A	PVB £0.09m	N/A at PCF Stage 1
	Security	No public transport elements to scheme but existing pedestrian / cycling facilities are poorly lit, and scheme is aiming to improve this.	Unknown as this stage - NMU surveys to be undertaken in Sept 2016	Slight beneficial	N/A	N/A at PCF Stage 1
	Access to services	No public transport element to scheme	N/A	Neutral	N/A	N/A at PCF Stage 1
	Affordability	Negligible impact on monetary cost of travel (fuel costs only)	N/A	Neutral	N/A	N/A at PCF Stage 1
	Severance	Several of the existing footpaths which traverse the area of land near Junction 25 include a pedestrian link between Bullsmoor and Waltham Cross. In addition to recreational use of the footpaths, they may be used by residents utilising the services provided by these community facilities.	N/A	Neutral	N/A	N/A at PCF Stage 1
	Option values	As no new transport options will be created by this scheme, option values have not been considered.	Not assessed	Not assessed (Unmonetised)	N/A (Unmonetised)	
Public Accounts	Cost to Broad Transport Budget	Highways England capital investment costs of £19.5 million (2010 prices, PV)	The costs of capital investment, operating and maintenance are funded by Central Government.	N/A	PVC £19.5m	
	Indirect Tax Revenues	Scheme leads to decreased vehicle operating costs. This feeds through to overall decreased indirect tax revenues.	Not assessed	N/A	PVB £7.6m	

Appraisal Summary Table

Date produced:	01/11/2016

Contact:	
Name	Piotr Grabowiecki
Organisation	Highways England
Role	Project Manager

Name of scheme:	M25 Junction 25 Improvements PCF Stage 1: Option 2
Description of scheme:	Option 1 PLUS: - Widen M25 westbound off-slip to 3 lanes - Widen M25 eastbound off-slip to 3 lanes - Segregated left turn lane from M25 West and A10 North

Impacts		Summary of key impacts **Each scenario or sensitivity test (as a minimum, the core scenario and two alternative scenarios or sensitivity tests) should form the basis for a full appraisal, including environmental and other impacts where appropriate. It is expected that the core scenario will be reported in the AST, with any exceptional outcomes of the uncertainty analysis also included. EG if there are significantly different results in an alternative scenario that would affect the AST score in a particular category, then that information will be included as qualitative comments (but quantifying the difference) in the AST**	Assessment Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme generates large overall benefits for business users from travel time and vehicle operating cost savings resulting from capacity increase and reduced congestion at the junction. · The percentage of total TEE benefit during normal operation attributable to changes in consumers journey times and vehicle operating costs is 67% (see EAR for further detail). · The total vehicle hours saved by consumer users in opening year during normal operation is 244,000. For all vehicles and trip purposes combined: · The overall change in average journey time per vehicle in the study area reduces by between 0.8 to 2.2 minutes depending on the time period. See Tables 6.2, 6.4 and 6.6 in the Traffic Forecasting Report for a summary of the opening year peak and inter-peak journey time changes in seconds by route. · Peak hour journey time changes during construction in minutes are not available at PCF Stage 1.	**Value of journey time changes(£)** £207.7m **Net journey time changes (£)** **0 to 2min**: £77.8m; **2 to 5min**: £129.8m; **> 5min**: £0m	N/A	£229.7m (including vehicle operating cost and delays in construction)	N/A at PCF Stage 1
	Reliability impact on Business users	Scheme will improve reliability for business users through the increased capacity provided which will improve the junction's resilience to incidents and reduce the scale of delay associated with incidents and lane closures.	Not assessed	Not assessed	Not assessed	
	Regeneration	Not assessed	Not assessed	N/A	N/A	
	Wider Impacts	Not assessed	N/A	N/A	N/A	
Environmental	Noise	A minor noise increase (1-3dB LA10,18h) is predicted at the eastbound carriageway of the M25 prior to Junction 25 in the opening year (derived from the Environment Study Report assessment). This is due to traffic speeds improving as congestion is relieved at Junction 25. This section of road passes through Important Area 5716 at Bulls Cross Ride. In the design year, negligible changes to noise are predicted, relative to the Do Minimum scenario. A minor noise increase is predicted in the opening year at road links associated with the proposed additional lane on the westbound diverge, which aligns the road closer to approximately 150 residential properties south east of the J25 roundabout and Important Area 1186. A negligible change in noise levels in this area is predicted in the long-term. The noise increases in this area (Bullsmoor Way, Bullsmoor Ride and Bullsmoor Gardens) may be affected by the height reduction of the retaining wall adjacent to the M25 westbound carriageway, stretching over the 150m length up to the roundabout. This would provide less screening from road traffic noise, causing further noise increases. The segregated left turn lane from the eastbound M25 to northbound A10 will align the footprint of Junction 25 closer to noise sensitive receptors to the northwest of the roundabout. Major noise increases are predicted in the opening year (increase of 5dB LA10,18h or more) and the design year (increase of 10dB LA10,18h or more). A minor noise increase is predicted at Bullsmoor Lane in the opening year due to changes in traffic. In the design year, negligible impacts were predicted.	12,982 households potentially affected	Preliminary Basic Noise Level calculations indicate that a total of 12,982 households are located within 600m of road links that could experience a change in noise (for both the opening year and forecast years). It should be noted that this calculation does not account for the cumulative impact from all road links however, and similarly does not account for the potential masking of those increases by nearby links with greater flows and noise levels, consequently this information is provided for indicative purposes only.	Not monetised at this stage.	Not assessed at this stage.
	Air Quality	The scheme is located within the Enfield AQMA, designated for exceeding the NO2 annual mean and PM10 24-hour mean AQS objectives. The scheme is expected to lead to an increase in traffic on a number of roads in the vicinity of Junction 25, which could potentially lead to an increase in pollutant concentrations at receptors near the affected road network, including those within the Enfield AQMA and within Broxbourne AQMA Nos. 1, 2 and 3.	It is estimated that 4103 properties could potentially experience an increase in pollutant concentrations	At this stage the option is considered to pose a risk of a potentially signficant adverse effect at nearby receptors particularly those within the Enfield and Broxbourne AQMAs.	Not monetised at this stage.	Not assessed at this stage.
	Greenhouse gases	The scheme is likely to lead to an increase in emissions based on the expected increases in traffic.	Not assessed at this stage. **Change in non-traded carbon over 60y (CO2e)**: Not assessed **Change in traded carbon over 60y (CO2e)**: Not assessed	N/A	Not monetised at this stage.	
	Landscape	Would result in the removal of vegetation along the inner perimeter of the roundabout associated with the M25 and along large stretches of approaches to the junction. Vegetation that may be removed is a common place element within the local landscape as it comprises of man-made planting along the road corridor that can be substituted as part of the introduced environmental design or mitigation measures. The introduction of small scale earthworks and elements of the scheme like proposed carriageway widening and pedestrian bridge would cause a small scale change within the local landscape and barely perceptible at the scale of the published landscape character areas. Overall the scale of the proposed alterations is too small to result in significant landscape effects. There are also good opportunities to accommodate environmental design or mitigation measures with the effect that the character of the townscape will be maintained and scheme elements could be integrated within the existing townscape.	N/A	Neutral	N/A	
	Townscape	Covered under landscape above.	N/A	Neutral	N/A	
	Heritage of Historic resources	Impacts on the historic environment are likely to be in the form of setting impacts on listed buildings resulting from the scheme. A slight adverse effect is predicted on a number of Grade II listed buildings as a result.	N/A	Slight adverse	N/A	
	Biodiversity	There will be no effects on designated sites close to the scheme. Notable species are highly unlikely to be affected significantly so long as mitigation is implemented. Small losses of habitats including plantation woodland from within the junction and the verges of the sliproads, plus losses of semi-improve neutral grassland from the verges would result in an overall slight adverse effect as these habitats cannot be replaced within the scheme.	N/A	Slight adverse	N/A	N/A at PCF Stage 1
	Water Environment	Increased discharge and associated polluant runoff to the New River, Turkey Brook and Theobalds Brook due to increase in impermeable areas . Cuttings and earthworks present potential mechanism for impacts on groundwater level and quality. Option will cross a Source Protection Zone (SPZ) and areas defined as Secondary Aquifer, potential effects may be associated with cuttings and will most likely require piling. Earthworks, cutting and piling may affect the flow of groundwater in the Secondary Aquifer, indirectly affecting surface water features and abstractions which are dependent upon groundwater inputs. Works may introduce new pollutant pathways to the underlying Aquifer. The SPZ suggests that no discharge to ground would be possible or be very limited. There is also currently a very high risk priority outfall to draining to surface water nearby which could be an opportunity for improvement.	N/A	Moderate adverse	N/A	
Social	Commuting and Other users	The scheme generates net benefits for commuting and other users from travel time and vehicle operating cost savings. · The percentage of total TEE benefit during normal operation attributable to changes in consumers journey times and vehicle operating costs is 33% (see EAR for further detail). · The total vehicle hours saved by consumer users in opening year during normal operation is 449,000 For all vehicles and trip purposes combined: · The overall change in average journey time per vehicle in the study area reduces by between 0.8 to 2.2 minutes depending on the time period. See Tables 6.2, 6.4 and 6.6 in the Traffic Forecasting Report for a summary of the opening year peak and inter-peak journey time changes in seconds by route. · Peak hour journey time changes during construction in minutes are not available at PCF Stage 1.	**Value of journey time changes(£)** £111.8m **Net journey time changes (£)** **0 to 2min**: £37.9m; **2 to 5min**: £73.9m; **> 5min**: £0m	N/A	£109.8m (including vehicle operating cost and delays in construction)	N/A at PCF Stage 1
	Reliability impact on Commuting and Other users	Scheme will improve reliability for commuting and other users through the increased capacity provided which will improve the junction's resilience to incidents and reduce the scale of delay associated with incidents and lane closures	Not assessed	Not assessed	Not monetised at this stage.	
	Physical activity	NMUs are only likely to experience negligible adverse effect during operation while the shared footpath and cycleway is likely to be a major benefit.	Slight Benefical Impact - Likely increase in numbers of walkers and cyclists along the shared footpath and cycleway due to improvements in amenity of that NMU route. Average journey times for pedestrians and cyclists are likely to remain	Beneficial	N/A	
	Journey quality	The impact on motorised traveller's views from the road will depend on the design and landscaping mitigation but it is assumed some loss of current vegetation screening, and the loss of agricultural land at Theobalds Park Farm, will be required but this will not change views significantly. NMU users of the shared footpath and cycleway is likely to be a major benefit due to the improvements at J25 crossing. Driver stress is expected to be temporarily adversely impacted by the construction works, however is expected to reduce during operation through increased traffic flows and a more efficient road network reducing driver stress and frustration.	N/A	Slight beneficial	N/A	
	Accidents	Scheme forecast to slightly decrease accidents at the junction as a result of increased capacity and decreased conflicts	Negligible	N/A	PVB £0.1m	N/A at PCF Stage 1
	Security	No public transport elements to scheme but existing pedestrian / cycling facilities are poorly lit, and scheme is aiming to improve this.	Unknown as this stage - NMU surveys to be undertaken in Sept 2016	Slight beneficial	N/A	N/A at PCF Stage 1
	Access to services	No public transport element to scheme	N/A	Neutral	N/A	N/A at PCF Stage 1
	Affordability	Negligible impacton monetary cost of travel (fuel costs only)	N/A	Neutral	N/A	N/A at PCF Stage 1
	Severance	Several of the existing footpaths which traverse the area of land near Junction 25 include a pedestrian link between Bullsmoor and Waltham Cross. In addition to recreational use of the footpaths, they may be used by residents utilising the services provided by these community facilities.	N/A	Neutral	N/A	N/A at PCF Stage 1
	Option values	As no new transport options will be created by this scheme, option values have not been considered.	Not assessed	Not assessed (Unmonetised)	N/A (Unmonetised)	
Public Accounts	Cost to Broad Transport Budget	Highways England capital investment costs of £22.7 million (2010 prices, PV)	The costs of capital investment, operating and maintenance are funded by Central Government.	N/A	PVC £22.7m	
	Indirect Tax Revenues	Scheme leads to increased vehicle operating costs. This feeds through to overall increased indirect tax revenues.	Not assessed	N/A	PVB £-1.3m	

Appraisal Summary Table

Date produced:	01/11/2016

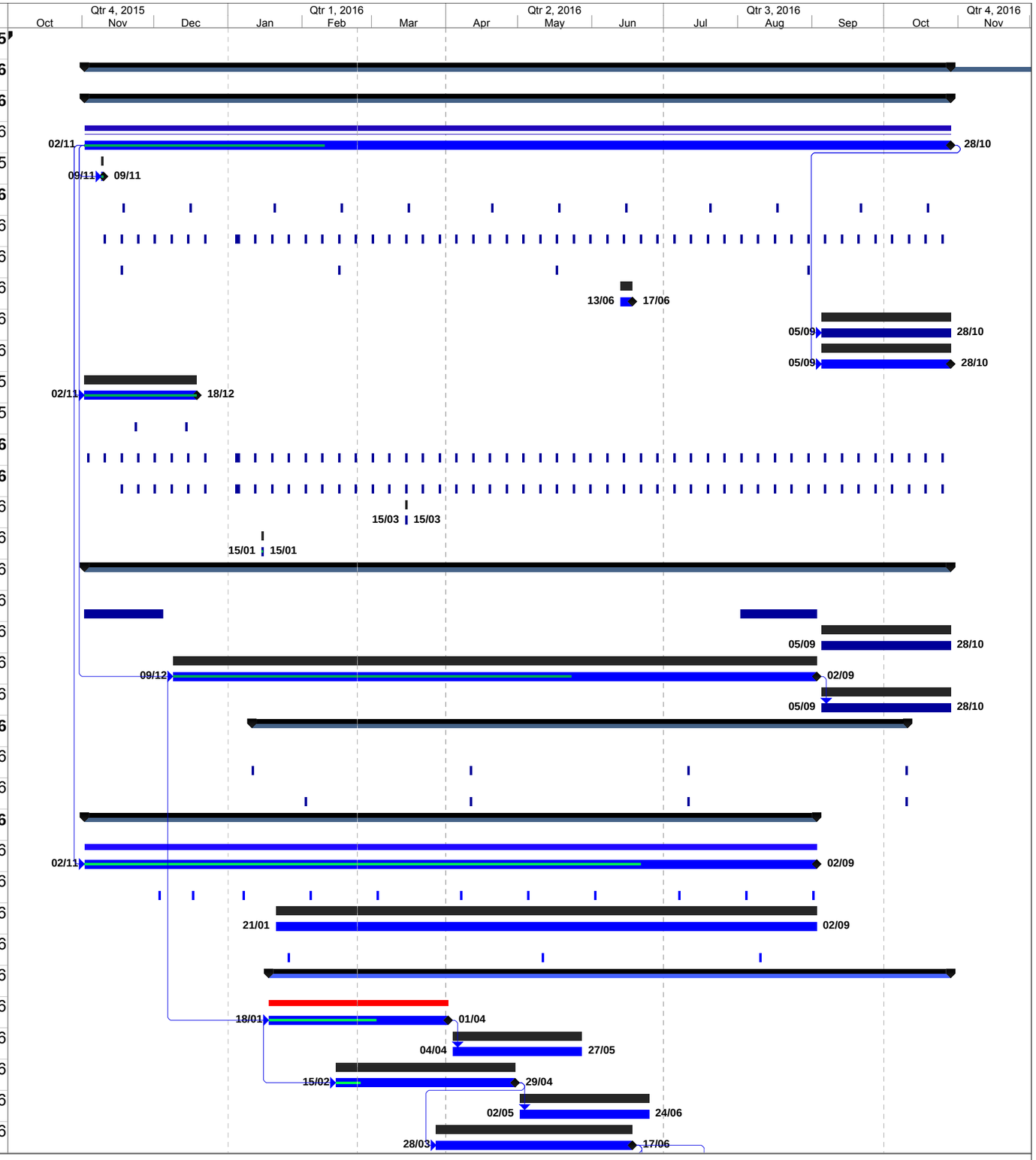
Contact:	
Name	Piotr Grabowiecki
Organisation	Highways England
Role	Project Manager

Name of scheme:	M25 Junction 25 Improvements PCF Stage 1: Option 3
Description of scheme:	Option 1 and 2 PLUS: - Segregated left turn lane from A10 South to M25 West - Widen A10(S) southbound on approach to Bullsmoor Lane junction to provide dedicated left turn lane between M25 and Bullsmoor Lane

Impacts		Summary of key impacts **Each scenario or sensitivity test (as a minimum, the core scenario and two alternative scenarios or sensitivity tests) should form the basis for a full appraisal, including environmental and other impacts where appropriate. It is expected that the core scenario will be reported in the AST, with any exceptional outcomes of the uncertainty analysis also included. EG if there are significantly different results in an alternative scenario that would affect the AST score in a particular category, then that information will be included as qualitative comments (but quantifying the difference) in the AST**	Assessment Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme generates large overall benefits for business users from travel time and vehicle operating cost savings resulting from capacity increase and reduced congestion at the junction. · The percentage of total TEE benefit during normal operation attributable to changes in consumers journey times and vehicle operating costs is 66% (see EAR for further detail). · The total vehicle hours saved by consumer users in opening year during normal operation is 337,000. For all vehicles and trip purposes combined: · The overall change in average journey time per vehicle in the study area reduces by between 0.9 to 2.5 minutes depending on the time period. See Tables 6.2, 6.4 and 6.6 in the Traffic Forecasting Report for a summary of the opening year peak and inter-peak journey time changes in seconds by route. · Peak hour journey time changes during construction in minutes are not available at PCF Stage 1.	**Value of journey time changes(£)** £251.8m **Net journey time changes (£)** **0 to 2min** £76.9m; **2 to 5min** £174.9m; **> 5min** £0m	N/A	£279.1m (including vehicle operating cost and delays in construction)	N/A at PCF Stage 1
	Reliability impact on Business users	Scheme will improve reliability for business users through the increased capacity provided which will improve the junction's resilience to incidents and reduce the scale of delay associated with incidents and lane closures.	Not assessed	Not assessed	Not assessed	
	Regeneration	Not assessed	Not assessed	N/A	N/A	
	Wider Impacts	Not assessed	N/A	N/A	N/A	
Environmental	Noise	A minor noise increase (1-3dB LA10,18h) is predicted at the eastbound carriageway of the M25 prior to Junction 25 in the opening year (derived from the Environment Study Report assessment). This is due to traffic speeds improving as congestion is relieved at Junction 25. This section of road passes through Important Area 5716 at Bulls Cross Ride. In the design year, negligible changes to noise were predicted, relative to the Do Minimum scenario. A minor noise increase is predicted in the opening year at road links associated with the proposed additional lane on the westbound diverge, which aligns the road closer to approximately 150 residential properties south east of the J25 roundabout and Important Area 1186. A negligible change in noise levels in this area is predicted in the long-term. The noise increases in this area (Bullsmoor Way, Bullsmoor Ride and Bullsmoor Gardens) may be affected by the height reduction of the retaining wall adjacent to the M25 westbound carriageway, stretching over the 150m length up to the roundabout. This would provide less screening from road traffic noise, causing further noise increases. The segregated left turn lane from the eastbound M25 to northbound A10 will align the footprint of Junction 25 closer to noise sensitive receptors to the northwest of the roundabout. Major noise increases are predicted in the opening year (increase of 5dB LA10,18h or more) and the design year (increase of 10dB LA10,18h or more). A minor noise increase is predicted at Bullsmoor Lane in the opening year due to changes in traffic. In the design year, negligible impacts were predicted. The northbound A10 located north of Junction 25 is predicted a minor noise increase in the opening year and negligible changes in the design year. Minor noise increases are predicted at Bullsmoor Lane due to changes in traffic in the opening year compared with the Do Minimum scenario. Negligible changes to the noise levels at Bullsmoor Lane are predicted in the design year. The segregated left turn lane from A10 northbound to M25 westbound merge is predicted major noise increases in the opening year and the design year, affecting noise sensitive receptors located to the south west of the J25 roundabout. Widening the southbound A10 to accommodate an extra lane is predicted to result in a minor noise increase in the opening year, concentrated at the merge onto the A10 from the M25. Negligible changes to noise levels are predicted at the same road link in the design year.	12,982 households potentially affected	Preliminary Basic Noise Level calculations indicate that a total of 12,982 households are located within 600m of road links that could experience a change in noise (for both the opening year and forecast years). It should be noted that this calculation does not account for the cumulative impact from all road links however, and similarly does not account for the potential masking of those increases by nearby links with greater flows and noise levels, consequently this information is provided for indicative purposes only.	Not monetised at this stage.	Not assessed at this stage
	Air Quality	The scheme is located within the Enfield AQMA, designated for exceeding the NO2 annual mean and PM10 24-hour mean AQS objectives. The scheme is expected to lead to an increase in traffic on a number of roads in the vicinity of Junction 25, which could potentially lead to an increase in pollutant concentrations at receptors near the affected road network, including those within the Enfield AQMA and within Broxbourne AQMA Nos. 1, 2 and 3.	It is estimated that 4103 properties could potentially experience an increase in pollutant concentrations	At this stage the option is considered to pose a risk of a potentially signficant adverse effect at nearby receptors particularly those within the Enfield and Broxbourne AQMAs.	Not monetised at this stage.	Not assessed at this stage
	Greenhouse gases	The scheme is likely to lead to an increase in emissions based on the expected increases in traffic.	Not assessed at this stage. **Change in non-traded carbon over 60y (CO2e)** Not assessed **Change in traded carbon over 60y (CO2e)** Not assessed	N/A	Not monetised at this stage.	
	Landscape	Would result in the removal of vegetation along the inner perimeter of the roundabout associated with the M25 and along large stretches of approaches to the junction. The introduced elements would be of small scale including earthworks, strengthened earthworks and footway bridges. The proposed alterations would take place along the perimeter of the roundabout and along approaches resulting in a series of small scale alterations that are likely to be accommodated into the local landscape through the potential implementation of environmental design and mitigation measures. Combined the proposed changes would result in a slight alteration to the local townscape character and would not affect key qualities and attributes of landscape character areas identified within published landscape character assessments. There are also good opportunities to accommodate environmental design or mitigation measures with the effect that the character of the townscape will be maintained and scheme elements could be integrated within the existing townscape.	N/A	Neutral	N/A	
	Townscape	Covered under landscape above.	N/A	Neutral	N/A	
	Heritage of Historic resources	Impacts on the historic environment are likely to be in the form of setting impacts on listed buildings resulting from the scheme. A moderate adverse effect is recorded on the Grade II* listed Capel House as a result. There may also be the potential for the removal or truncation of unknown archaeological deposits within a GLAAS Archaeological Priority Area.	N/A	Moderate adverse	N/A	
	Biodiversity	There will be no effects on designated sites close to the scheme. Notable species are highly unlikely to be affected significantly so long as mitigation is implemented. Small losses of habitats including plantation woodland from within the junction and the verges of the sliproads, plus losses of semi-improve neutral grassland from the verges would be compensated under Option 3 by the creation of new habitat on a widened verge in the SW quadrant. This habitat would replace hardstanding and habitat of negligible value in that area. The resultant overall assessment score for Option 3 is slight beneficial.	N/A	Slight beneficial	N/A	Slight beneficial
	Water Environment	Increased discharge and/or associated polluant runoff to the New River, Turkey Brook and Theobalds Brook due to increase in impermeable areas. Cuttings and earthworks present potential mechanism for impacts on groundwater level and quality. Modifying the aqueduct – a strategic water resources asset. Option will cross a Source Protection Zone (SPZ) and areas defined as Secondary Aquifer, potential effects may be associated with cuttings and will most likely require piling. Earthworks, cutting and piling may affect the flow of groundwater in the Secondary Aquifer, indirectly affecting surface water features and abstractions which are dependent upon groundwater inputs. Works may introduce new pollutant pathways to the underlying Aquifer. The SPZ suggests that no discharge to ground would be possible or be very limited. There is also currently a very high risk priority outfall to draining to surface water nearby which could be an opportunity for improvement.	N/A	Moderate adverse	N/A	
Social	Commuting and Other users	The scheme generates net benefits for commuting and other users from travel time and vehicle operating cost savings. · The percentage of total TEE benefit during normal operation attributable to changes in consumers journey times and vehicle operating costs is 34% (see EAR for further detail). · The total vehicle hours saved by consumer users in opening year during normal operation is 639,000 For all vehicles and trip purposes combined: · The overall change in average journey time per vehicle in the study area reduces by between 0.9 to 2.5 minutes depending on the time period. See Tables 6.2, 6.4 and 6.6 in the Traffic Forecasting Report for a summary of the opening year peak and inter-peak journey time changes in seconds by route. · Peak hour journey time changes during construction in minutes are not available at PCF Stage 1.	**Value of journey time changes(£)** £145.3m **Net journey time changes (£)** **0 to 2min** £35.2m; **2 to 5min** £110.0m; **> 5min** £0m	N/A	£143.9m (including vehicle operating cost and delays in construction)	N/A at PCF Stage 1
	Reliability impact on Commuting and Other users	Scheme will improve reliability for commuting and other users through the increased capacity provided which will improve the junction's resilience to incidents and reduce the scale of delay associated with incidents and lane closures.	Not assessed	Not assessed	Not assessed	
	Physical activity	NMUs are only likely to experience negligible adverse effects in operation while the shared footpath and cycleway is likely to be a major benefit.	Slight Benefical Impact - Likely increase in numbers of walkers and cyclists along the shared footpath and cycleway due to improvements in amenity of that NMU route. Average journey times for pedestrians and cyclists are likely to remain	Beneficial	Not assessed	
	Journey quality	The impact on motorised traveller's and NMUs views from the road will depend on the design and landscaping mitigation of the option but it is assumed a loss of current vegetation screening will be required under this option for the proposed improvements and it is likely views will change significantly under this option, especially along Great Cambridge Road south of Junction 25. NMU users of the shared footpath and cycleway is likely to be a major benefit due to the improvements at J25 crossing. Driver stress is expected to be temporarily adversely impacted by the construction works, however is expected to reduce during operation through increased traffic flows and a more efficient road network reducing driver stress and frustration.	N/A	Slight beneficial	N/A	
	Accidents	Negligible impact on accidents	Negligible	N/A	PVB £0.015m	N/A at PCF Stage 1
	Security	No public transport elements to scheme but existing pedestrian / cycling facilities are poorly lit, and scheme is aiming to improve this.	Unknown as this stage - NMU surveys to be undertaken in Sept	Slight beneficial	N/A	N/A at PCF Stage 1
	Access to services	No public transport element to scheme	N/A	Neutral	N/A	N/A at PCF Stage 1
	Affordability	Negligible impacton monetary cost of travel (fuel costs only)	N/A	Neutral	N/A	N/A at PCF Stage 1
	Severance	Several of the existing footpaths which traverse the area of land near Junction 25 include a pedestrian link between Bullsmoor and Waltham Cross. In addition to recreational use of the footpaths, they may be used by residents utilising the services provided by these community facilities.	N/A	Neutral	N/A	N/A at PCF Stage 1
	Option values	As no new transport options will be created by this scheme, option values have not been considered.	Not assessed	Not assessed (Unmonetised)	N/A (Unmonetised)	
Public Accounts	Cost to Broad Transport Budget	Highways England capital investment costs of £32.1 million (2010 prices, PV)	The costs of capital investment, operating and maintenance are funded by Central Government.	N/A	PVC £32.1m	
	Indirect Tax Revenues	Scheme leads to increased vehicle operating costs. This feeds through to overall increased indirect tax revenues.	Not assessed	N/A	PVB £-0.9m	

Appendix J – Programme

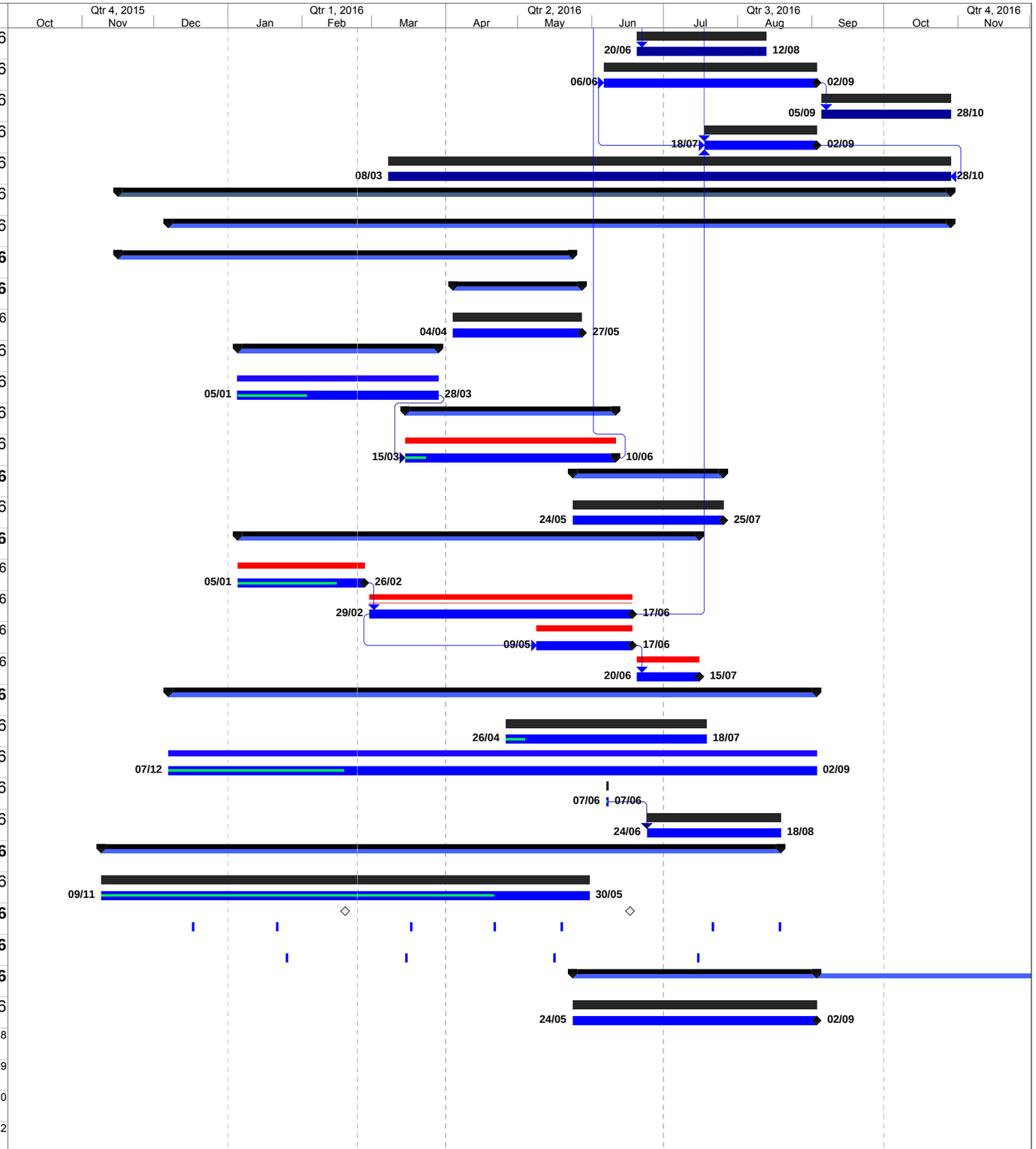
ID	Task Name	% Complete	Duration	Start	Finish
1	**PCF Stage 0 Options Strategy Shaping and Prioritisation Phase**	**100%**	**123 days**	**Mon 13/04/15**	**Wed 30/09/15**
42	**PCF Stage 1 Option Identification Phase**	**17%**	**254 days**	**Mon 02/11/15**	**Fri 28/10/16**
43	**Project Management**	**29%**	**254 days**	**Mon 02/11/15**	**Fri 28/10/16**
44	Product Checklist	26%	254 days	Mon 02/11/15	Fri 28/10/16
45	Project Management Plan	100%	1 day	Mon 09/11/15	Mon 09/11/15
46	**Project Schedule**	**33%**	**235 days**	**Wed 18/11/15**	**Wed 19/10/16**
59	Regular Reporting	**31%**	245 days	Tue 10/11/15	Tue 25/10/16
111	Lessons Learnt Log	**13%**	200 days	Tue 17/11/15	Tue 30/08/16
116	Equality impact assessment (EQIA) screening, analysis and monitoring	0%	5 days	Mon 13/06/16	Fri 17/06/16
117	Stage Gate Assessment Review Certificate	0%	40 days	Mon 05/09/16	Fri 28/10/16
118	End of Stage Report	0%	40 days	Mon 05/09/16	Fri 28/10/16
119	BIM Execution Plan	100%	35 days	Mon 02/11/15	Fri 18/12/15
120	Project Start up Workshop	**100%**	16 days	Mon 23/11/15	Mon 14/12/15
123	**Project Progress Meetings**	**33%**	**250 days**	**Tue 03/11/15**	**Tue 25/10/16**
176	**Client Progress Meetings**	**30%**	**240 days**	**Tue 17/11/15**	**Tue 25/10/16**
227	Health & Safety Workshop	0%	1 day	Tue 15/03/16	Tue 15/03/16
228	Projectwise Training	60%	1 day	Fri 15/01/16	Fri 15/01/16
229	Scoping	48%	254 days	Mon 02/11/15	Fri 28/10/16
230	Client Scheme Requirements	80%	214 days	Mon 02/11/15	Fri 02/09/16
233	Highways England Review Period	0%	40 days	Mon 05/09/16	Fri 28/10/16
234	Appraisal Summary Report	60%	187 days	Wed 09/12/15	Fri 02/09/16
235	Highways England Review Period	0%	40 days	Mon 05/09/16	Fri 28/10/16
236	**Change Management**	**13%**	**196 days**	**Mon 11/01/16**	**Mon 10/10/16**
237	Change request log and form	**25%**	196 days	Mon 11/01/16	Mon 10/10/16
242	Exception Report	**0%**	180 days	Tue 02/02/16	Mon 10/10/16
247	**Risk**	**42%**	**214 days**	**Mon 02/11/15**	**Fri 02/09/16**
248	Risk Management Plan	75%	214 days	Mon 02/11/15	Fri 02/09/16
249	Risk Register	**36%**	190 days	Thu 03/12/15	Thu 01/09/16
261	Qualitative Risk Assessment	0%	162 days	Thu 21/01/16	Fri 02/09/16
262	Risk Workshops	33%	142 days	Tue 26/01/16	Wed 10/08/16
266	Business Case and Funding	7%	205 days	Mon 18/01/16	Fri 28/10/16
267	Traffic Data Collection Report	60%	55 days	Mon 18/01/16	Fri 01/04/16
268	Highways England Review Period	0%	40 days	Mon 04/04/16	Fri 27/05/16
269	Local Model Validation Report	15%	55 days	Mon 15/02/16	Fri 29/04/16
270	Highways England Review Period	0%	40 days	Mon 02/05/16	Fri 24/06/16
271	Traffic Forecasting Report	0%	60 days	Mon 28/03/16	Fri 17/06/16



Project: MSP PCF S0-7 M25 J25 v11
Date: Wed 24/02/16

Task	Rolled Up Milestone	Project Summary	Manual Task	Start-only	Critical
Milestone	Rolled Up Progress	Group By Summary	Duration-only	Finish-only	Critical Split
Summary	Split	Inactive Milestone	Manual Summary Rollup	External Tasks	Progress
Rolled Up Task	External Tasks	Inactive Summary	Manual Summary	External Milestone	Baseline

ID	Task Name	% Complete	Duration	Start	Finish
272	Highways England Review Period	0%	40 days	Mon 20/06/16	Fri 12/08/16
273	Economic Assessment Report	0%	65 days	Mon 06/06/16	Fri 02/09/16
274	Highways England Review Period	0%	40 days	Mon 05/09/16	Fri 28/10/16
275	Appraisal Summary Table	0%	35 days	Mon 18/07/16	Fri 02/09/16
276	Business Case	0%	169 days	Tue 08/03/16	Fri 28/10/16
277	Specifications, requirements and design	16%	244 days	Mon 16/11/15	Fri 28/10/16
278	Technical Appraisal Report	8%	229 days	Mon 07/12/15	Fri 28/10/16
286	**Engineering**	**33%**	**130 days**	**Mon 16/11/15**	**Mon 23/05/16**
290	**Standards and Specifications**	**0%**	**40 days**	**Mon 04/04/16**	**Fri 27/05/16**
291	Departures from Standards Checklist	0%	40 days	Mon 04/04/16	Fri 27/05/16
292	Works Procurement	35%	60 days	Tue 05/01/16	Mon 28/03/16
293	Statutory Undertakers	35%	60 days	Tue 05/01/16	Mon 28/03/16
294	Estimating	10%	64 days	Tue 15/03/16	Fri 10/06/16
295	Options Estimate	10%	64 days	Tue 15/03/16	Fri 10/06/16
296	**NetServ Approvals / Professional & Technical Solutions Approvals**	**0%**	**45 days**	**Tue 24/05/16**	**Mon 25/07/16**
297	Statement of Intent	0%	45 days	Tue 24/05/16	Mon 25/07/16
298	**Environment**	**17%**	**139 days**	**Tue 05/01/16**	**Fri 15/07/16**
299	Baseline Environmental Scoping and Surveys (Ecology, Contamination, Landscape, Noise	75%	39 days	Tue 05/01/16	Fri 26/02/16
300	Environmental Assessment and Appraisal (EAR & WebTAG)	0%	80 days	Mon 29/02/16	Fri 17/06/16
301	Assessment of Implications on European Sites	0%	30 days	Mon 09/05/16	Fri 17/06/16
302	Environmental Risk Assessment	0%	20 days	Mon 20/06/16	Fri 15/07/16
303	**Value Management**	**18%**	**189 days**	**Mon 07/12/15**	**Fri 02/09/16**
304	Value Management Plan	10%	60 days	Tue 26/04/16	Mon 18/07/16
305	Efficiency Register	25%	189 days	Mon 07/12/15	Fri 02/09/16
306	Value Management Workshop	20%	1 day	Tue 07/06/16	Tue 07/06/16
307	Value Management Workshop Report	0%	40 days	Fri 24/06/16	Thu 18/08/16
308	**Communications**	**75%**	**198 days**	**Mon 09/11/15**	**Thu 18/08/16**
309	Communications Plan	80%	140 days	Mon 09/11/15	Mon 30/05/16
310	**Stakeholder Meetings**	**11%**	**170 days**	**Thu 17/12/15**	**Thu 18/08/16**
320	**Stakeholder Workshops**	**25%**	**125 days**	**Mon 25/01/16**	**Fri 15/07/16**
325	**Public Consultation**	**0%**	**74 days**	**Tue 24/05/16**	**Fri 02/09/16**
326	Public Consultation Strategy Report	0%	74 days	Tue 24/05/16	Fri 02/09/16
327	Combined PCF Stage 2 Option Selection Phase & Stage 3 Preliminary Design	0%	375 days	Mon 09/01/17	Fri 15/06/18
328	PCF Stage 4 Statutory procedures and powers	0%	250 days	Mon 25/06/18	Fri 07/06/19
329	PCF Stage 5 Construction Preparation	0%	150 days	Mon 10/06/19	Fri 03/01/20
330	PCF Stage 6 Construction, Commissioning and Handover	0%	520 days	Mon 16/03/20	Fri 11/03/22



Project: MSP PCF S0-7 M25 J25 v11
Date: Wed 24/02/16

Task	Rolled Up Milestone	Project Summary	Manual Task	Start-only	Critical
Milestone	Rolled Up Progress	Group By Summary	Duration-only	Finish-only	Critical Split
Summary	Split	Inactive Milestone	Manual Summary Rollup	External Tasks	Progress
Rolled Up Task	External Tasks	Inactive Summary	Manual Summary	External Milestone	Baseline

Appendix K –
Accident analysis

M25 – J25 - 01.09.2010 to 31.08.2015

Accident Date BETWEEN '01-Sep-2010' AND '31-Aug-2015'

ACCIDENT SEVERITY UPTO 2015

	2010	2011	2012	2013	2014	2015	Total
Fatal	0	0	0	0	0	0	0
Serious	0	0	0	0	0	1	1
Slight	1	11	4	6	1	4	27
Damage	0	0	0	0	0	0	0
Total	1	11	4	6	1	5	28

ACCIDENTS BY MONTH AND YEAR UPTO 2015

	2010	2011	2012	2013	2014	2015	Total
January	0	2	1	0	0	1	4
February	0	1	0	1	0	0	2
March	0	1	1	1	0	1	4
April	0	2	0	0	0	1	3
May	0	0	0	1	0	1	2
June	0	1	0	0	0	0	1
July	0	1	0	0	0	0	1
August	0	0	1	1	0	1	3
September	0	0	0	1	0	0	1
October	1	1	0	1	0	0	3
November	0	1	0	0	0	0	1
December	0	1	1	0	1	0	3
Total	1	11	4	6	1	5	28
%	4%	39%	14%	21%	4%	18%	100%

ACCIDENTS BY DAY AND TIME

	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
Midnight - 00:59	0	0	0	0	0	1	0	1
01:00 - 01:59	0	0	0	0	0	0	0	0
02:00 - 02:59	0	0	0	0	0	0	0	0
03:00 - 03:59	0	0	0	0	0	0	0	0
04:00 - 04:59	0	0	0	0	0	0	0	0
05:00 - 05:59	0	0	0	0	0	0	0	0
06:00 - 06:59	0	0	1	0	0	0	0	1
07:00 - 07:59	0	0	0	0	0	0	1	1
08:00 - 08:59	0	0	0	0	0	0	0	0
09:00 - 09:59	0	0	1	1	2	0	0	4
10:00 - 10:59	0	0	0	0	3	0	1	4
11:00 - 11:59	1	0	0	0	1	0	0	2
12:00 - 12:59	0	0	0	1	0	0	0	1
13:00 - 13:59	0	0	1	0	0	0	1	2
14:00 - 14:59	0	0	1	1	0	0	0	2
15:00 - 15:59	0	0	0	0	0	2	0	2
16:00 - 16:59	0	0	0	1	1	1	0	3
17:00 - 17:59	0	0	0	1	1	0	0	2
18:00 - 18:59	2	0	0	0	0	0	0	2
19:00 - 19:59	0	0	0	0	0	0	0	0
20:00 - 20:59	0	0	0	0	0	0	0	0
21:00 - 21:59	0	0	0	0	0	1	0	1
22:00 - 22:59	0	0	0	0	0	0	0	0
23:00 - 23:59	0	0	0	0	0	0	0	0
Total	3	0	4	5	8	5	3	28
%	11%	0%	14%	18%	29%	18%	11%	100%

M25 – J25 - 01.09.2010 to 31.08.2015

Accident Date BETWEEN '01-Sep-2010' AND '31-Aug-2015'

JUNCTION DETAIL

	Number	%
SLIP ROAD	1	4
NOT AT JUNCTION	3	11
ROUNDABOUT AND MINI	24	86
TOTAL	**28**	

JUNCTION CONTROLS

	Number	%
AUTOMATIC TRAFFIC SIG	14	50
GIVE WAY SIGN	11	39
NOT AT JUNCTION	3	11
TOTAL	**28**	

SPEED LIMIT

	Number	%
30 MPH	12	43
40 MPH	5	18
50 MPH	7	25
60 MPH	1	4
70 MPH	3	11
TOTAL	**28**	

ROAD CLASS

	Number	%
Motorway	8	29
A	20	71
TOTAL	**28**	

NUMBER OF ACCIDENTS INVOLVING PEDESTRIANS

Number	%
0	0

NUMBER OF ACCIDENTS INVOLVING SKIDDING

Number	%
0	0

WEATHER

	Number	%
FINE	24	86
RAIN	3	11
UNKNOWN	1	4
TOTAL	**28**	

ROAD SURFACE

	Number	%
DRY	23	82
WET	5	18
TOTAL	**28**	

LIGHT CONDITIONS

	Number	%
Light	23	82
Dark	5	18
TOTAL	**28**	

M25 – J25 - 01.09.2010 to 31.08.2015

Accident Date BETWEEN '01-Sep-2010' AND '31-Aug-2015'

CASUALTY SEVERITY UPTO 2015

	2010	2011	2012	2013	2014	2015	Total
Fatal	0	0	0	0	0	0	0
Serious	0	0	0	0	0	1	1
Slight	1	13	4	7	3	5	33
Total	1	13	4	7	3	6	34
%	3%	38%	12%	21%	9%	18%	100%

CASUALTIES BY MONTH AND YEAR UPTO 2015

	2010	2011	2012	2013	2014	2015	Total
January	0	2	1	0	0	2	5
February	0	2	0	1	0	0	3
March	0	1	1	1	0	1	4
April	0	2	0	0	0	1	3
May	0	0	0	1	0	1	2
June	0	2	0	0	0	0	2
July	0	1	0	0	0	0	1
August	0	0	1	1	0	1	3
September	0	0	0	1	0	0	1
October	1	1	0	2	0	0	4
November	0	1	0	0	0	0	1
December	0	1	1	0	3	0	5
Total	1	13	4	7	3	6	34
%	3%	38%	12%	21%	9%	18%	100%

CASUALTIES BY DAY AND TIME

	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
Midnight - 00:59	0	0	0	0	0	1	0	1
01:00 - 01:59	0	0	0	0	0	0	0	0
02:00 - 02:59	0	0	0	0	0	0	0	0
03:00 - 03:59	0	0	0	0	0	0	0	0
04:00 - 04:59	0	0	0	0	0	0	0	0
05:00 - 05:59	0	0	0	0	0	0	0	0
06:00 - 06:59	0	0	1	0	0	0	0	1
07:00 - 07:59	0	0	0	0	0	0	1	1
08:00 - 08:59	0	0	0	0	0	0	0	0
09:00 - 09:59	0	0	1	1	2	0	0	4
10:00 - 10:59	0	0	0	0	5	0	2	7
11:00 - 11:59	1	0	0	0	1	0	0	2
12:00 - 12:59	0	0	0	1	0	0	0	1
13:00 - 13:59	0	0	2	0	0	0	1	3
14:00 - 14:59	0	0	1	1	0	0	0	2
15:00 - 15:59	0	0	0	0	0	2	0	2
16:00 - 16:59	0	0	0	2	2	1	0	5
17:00 - 17:59	0	0	0	1	1	0	0	2
18:00 - 18:59	2	0	0	0	0	0	0	2
19:00 - 19:59	0	0	0	0	0	0	0	0
20:00 - 20:59	0	0	0	0	0	0	0	0
21:00 - 21:59	0	0	0	0	0	1	0	1
22:00 - 22:59	0	0	0	0	0	0	0	0
23:00 - 23:59	0	0	0	0	0	0	0	0
Total	3	0	5	6	11	5	4	34
%	9%	0%	15%	18%	32%	15%	12%	100%

M25 – J25 - 01.09.2010 to 31.08.2015

Accident Date BETWEEN '01-Sep-2010' AND '31-Aug-2015'

CASUALTIES BY TYPE AND AGE GROUPING

	Unknown Age	0 to 4	5 to 15	16 to 19	20 to 29	30 to 59	60 Plus	Total	%
PTW Rider	1	0	0	0	0	0	1	**1**	3
Car Driver	3	0	0	0	4	11	3	**18**	60
Car Passenger	0	0	0	1	1	2	3	**7**	23
Goods Driver	0	0	0	0	0	4	0	**4**	13
TOTAL	**4**	**0**	**0**	**1**	**5**	**17**	**7**	**30**	
%	13	0	0	3	17	57	23		

Number of Casualties with unknown age: 4

VEHICLES INVOLVED BY TYPE AND AGE OF DRIVER

	0 to 15	16 to 19	20 to 29	30 to 59	60 Plus	Unknown	Total	%
PTW	0	0	0	0	1	1	**2**	3
Car	0	0	9	15	7	9	**40**	61
Goods < 3.5T	0	0	0	5	0	5	**10**	15
Goods > 3.5T	0	0	0	7	1	5	**13**	20
Hackney/Private	0	0	0	0	0	1	**1**	2
TOTAL	**0**	**0**	**9**	**27**	**9**	**21**	**66**	
%	0	0	14	41	14	32		

VEHICLE MANOEUVRES

	Number	%
CHANGING LANE TO LEFT	2	3
CHANGING LANE TO RIGHT	2	3
GOING AHEAD LEFT HAND BEND	6	9
GOING AHEAD OTHER	22	33
GOING AHEAD RIGHT HAND BEND	5	8
STARTING	1	2
OVERTAKING MOVING VEHICLE ON ITS NEARSIDE	1	2
STOPPING	20	30
TURNING LEFT	1	2
WAITING TO GO AHEAD BUT HELD UP	5	8
WAITING TO TURN LEFT	1	2
TOTAL	**66**	

BREATH TEST

	Number	%
NEGATIVE	25	38
NOT REQUESTED	7	11
DRIVER NOT CONTACTED	32	48
MEDICAL REASONS	2	3
TOTAL	**66**	

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

S170059