A355 Improvements (Gore Hill / Wilton Park)

Buckinghamshire County Council

Stage 2 Option Assessment Report

A355GHWP/S2OAR | 1

March 2016

BCC

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1. Introduction

1.1 Purpose of Report

Jacobs is framework consultants to the Transport for Buckinghamshire Alliance (TfB) between Ringway Jacobs and Buckinghamshire County Council (BCC). Under the terms of this contract, Jacobs is commissioned to undertake transport planning, modelling and appraisal projects on behalf of BCC.

Jacobs has been commissioned by BCC to deliver a Business Case for the A355 Improvements (Gore Hill / Wilton Park) in support of the Buckinghamshire Thames Valley Local Enterprise Partnership (BTVLEP) Strategic Economic Plan (SEP)[1]. The SEP sets out infrastructure priorities and ambitions through to 2031 with the aim of improving strategic access and connectivity within Buckinghamshire. Stage 1 of the A355 Improvements Business Case provisionally secured a £6.05m funding package to continue work and deliver the scheme. For the purposes of this report, the proposal will be referred to collectively as 'the Scheme'.

This Stage 2 Option Assessment Report follows the documents that were initially produced in Stage 1 of the scheme development process. The Stage 1 documents comprised:

- Strategic Outline Business Case (SOC)
- Stage 1 Option Assessment Report (OAR)
- Appraisal Specification Report (ASR)

This Stage 2 OAR documents the Stage 2 scheme appraisal process which includes the reconfirmation of the strategic conclusions drawn in Stage 1, whilst focussing on a detailed assessment of a small number of better performing options, previously identified in the Stage 1 OAR. This document provides the following, in order to meet the requirements set out within the Department for Transport's (DfT) Transport Appraisal Process[2]:

- Reconfirms the strategic conclusions drawn in Stage 1;
- Details of the stakeholder engagement
- Further detailed appraisal of the better performing options identified in Stage 1. (Decisions made on discarded options will be recorded, along with supporting evidence);
- Documented results of the subsequent assessment of the preferred option against the Appraisal Framework. Evidence will be presented in relation to the '5 case model' (Strategic Case, the Value for Money Case, the Delivery Case, the Financial Case and the Commercial Case), the Appraisal Summary Table and against local objectives
- Summary of the results for all appraised options and conclusions on the comparative performance of options;
- Confirmation of the preferred option(s)

1.2 Current Stage of Project

Stage 1 of this project has already been completed. In Stage 1, the need for intervention was established and a range of options developed and considered. The result of the overall appraisal identified that an A355 relief road option should be taken forward as the Preferred Option for further, more detailed appraisal in Stage 2.

The Stage 1 OAR identified that the relief road options achieved the highest Benefit Cost Ratio (BCR), which ranged between 11.0 and 12.2, representing 'very high' value for money. They provided a good strategic fit, and demonstrated positive contributions against the identified intervention-specific objectives. The Stage 1 appraisal

[1] *BTVLEP, n.d. Strategic Economic Plan (2012–2031) & Local Growth Deal (2015–2016).*
[2] *DfT, 2014. Transport Analysis Guidance: The Transport Appraisal Process.* *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/275728/webtag-tag-transport-appraisal-process.pdf*

also concluded that the provision of a relief road option would deliver the best network performance in both the AM and PM peak hours, and it is expected that any environmental implications could be satisfactorily mitigated.

A dedicated left turn lane at the London End roundabout and A40 widening appeared as the 'next best' alternative to the Relief Road, worthy of further consideration.

In order to achieve the A355 improvement objectives (see section 6), initial assessment identified that, in addition to the above there would be a need for intervention at the Gore Hill roundabout junction and Ledborough Lane / Longbottom Lane priority junctions along the corridor. This stage of the Business Case will finalise the scope of these elements of the scheme in line with the development of the selected Preferred Option.

1.3 Background

1.3.1 Local Transport Body and Scheme Prioritisation

In October 2010, the previous Coalition Government published the Local Growth White Paper[3] which set out a new approach for driving sustainable economic growth based on local, rather than top-down, decision making. This was to be realised through the now well established Local Transport Bodies (LTB's). The Buckinghamshire LTB was formed as a voluntary partnership between BCC, District Councils, BTVLEP, and other organisations (see Figure 1-1)

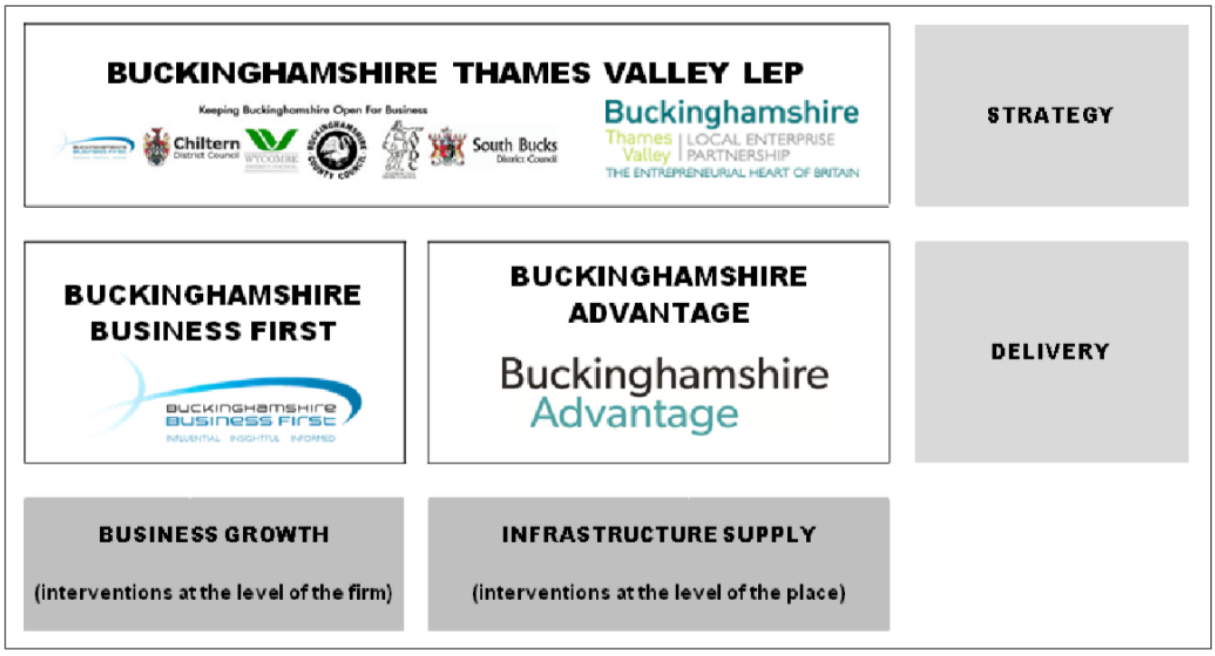

Figure 1-1 : Local Transport Body Structure

In September 2012, following a period of consultation, the DfT set out its firm proposals to devolve funding for local major transport schemes to LTB's from 2015 from a national pot of £2bn. The then Government's response to the Heseltine review further confirmed the commitment to delegate funding decisions and negotiate a Growth Deal with every LTB to deliver local growth and infrastructure priorities.

The overall funding envelope to be managed by the LTB's also incorporates the Regional Growth Fund, Growing Places Fund etc, Integrated Transport Block, and Local Sustainable Transport Fund pots alongside the local major transport scheme funds. In addition to the Local Growth Deal, the Government has also given LTB's the opportunity to develop investment plans for European Structural and Investment Funds for 2014 to 2020.

[3] *HM Government, 2010. Local growth: realising every place's potential.* http://www.bis.gov.uk/assets/biscore/economic-development/docs/l/cm7961-local-growth-white-paper.pdf

Infrastructure priorities have been set out in a draft BTVLEP Strategic Economic Plan[1] based on appraisal work undertaken by BCC for a range of Countywide Schemes. The A355 Improvement Scheme was prioritised from a list of over 70 as one of the top 4 priority transport infrastructure schemes within the County.

1.3.2 Scheme Background

The A355 runs north-south through the South Bucks and Chiltern Districts within Buckinghamshire, connecting Slough in the south to Amersham in the north via Beaconsfield and Farnham Common with connections to the M40 at junction 2. The corridor is widely cited as suffering from congestion at peak times, with a number of junctions seen as forming significant bottlenecks. In recognition of this, Buckinghamshire's Local Transport Plan 2011-2016[4] (LTP3) classifies the A355 Amersham to Beaconsfield as an Interurban 'Priority Congestion Management Corridor'.

> *"**Manage and mitigate the impact of growth**. Ensuring the Wilton Park development and any other developments that come forward are safely accessible from the public highway. The impacts of such developments will be properly mitigated so that they are not to the detriment of the local highway network operation. In particular this refers to the A355 in Beaconsfield"*
>
> *BCC, LTP3 Local Area Strategies*

Improvements to the A355 corridor (most notably at the Gore Hill roundabout junction in Amersham, Ledborough / Longbottom Lane priority junctions with the A355 and London End roundabout junction in Beaconsfield) are seen as key elements of the transport solution required to deliver growth and improve connectivity within Buckinghamshire. The improvements are included in BTVLEP's SEP as a major scheme for preparation and commencement before 2021.

The main element of the Scheme is closely associated with the delivery of the proposed strategic housing and employment site at Wilton Park, to the east of Beaconsfield. In line with the South Bucks District Council (SBDC) Core Strategy[5], a range of measures, including a new access off the Pyebush roundabout (which could be extended to provide an A355 Relief Road later in the Plan period), are proposed in order to address traffic congestion concerns, reduce pressure on the London End roundabout and ensure that the proposed development can be delivered without an unacceptable impact on the local road network. The scheme intends to improve the resilience and performance of Buckinghamshire's local highway network, and improve strategic north/south connectivity for the county. A diagram of the scheme is illustrated in Figure 1-2.

[4] *TfB, 2011. Buckinghamshire's Local Transport Plan 2011-2016.* http://www.tfbucks.co.uk/documents/ltp/LTP3.pdf
[5] *SBDC, 2011. Core Strategy for South Bucks.* http://www.southbucks.gov.uk/includes/documents/cm_docs/2011/s/sbdccorestrategy.pdf

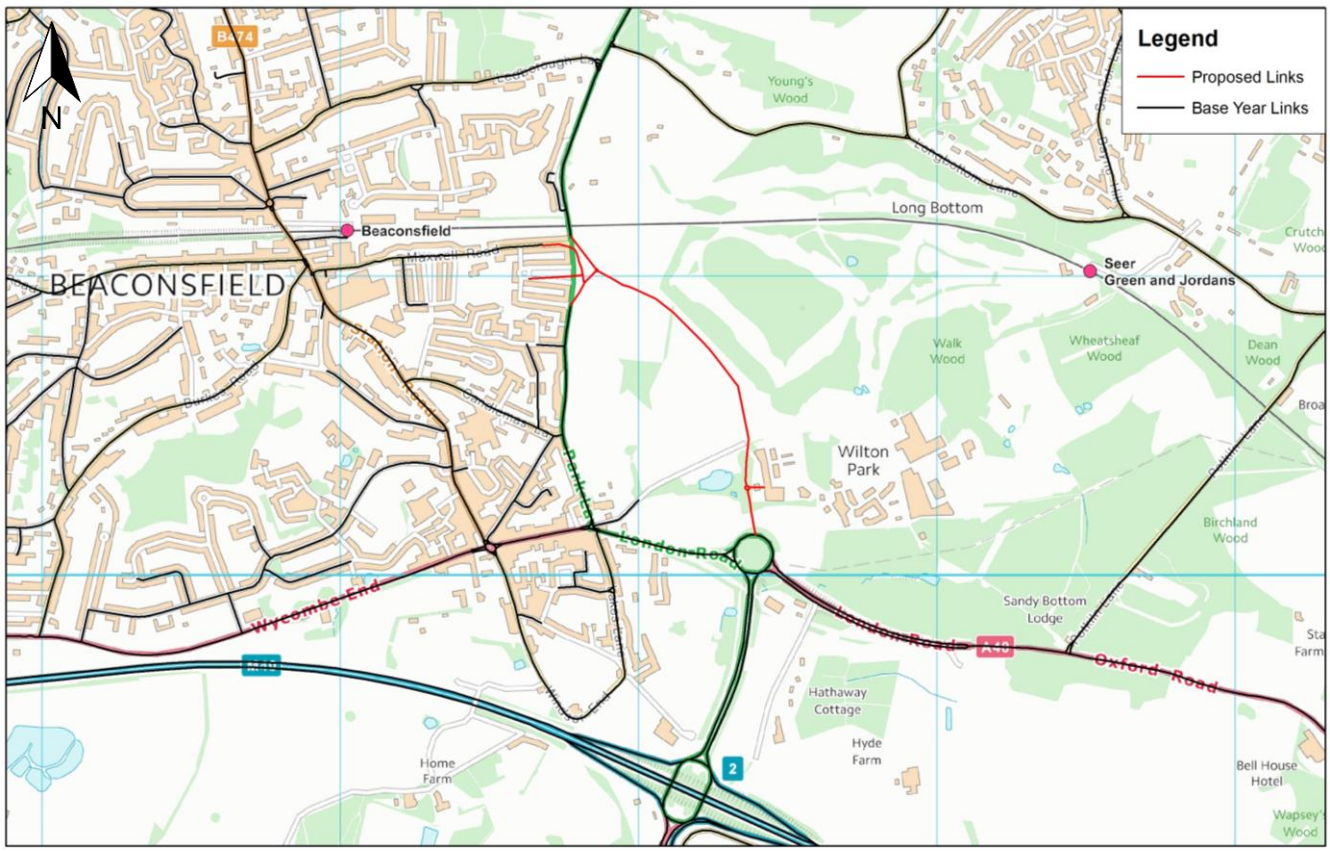

Figure 1-2 : Proposed route of A355 Relief Road

The second element of the scheme aims to improve the A413/A355 intersection on the southern edge of Amersham, known as the 'Gore Hill roundabout'. The junction has been identified as a bottleneck in the Chesham and Amersham Transport Study[6]. The scheme would provide a modified junction layout in order to address queuing and congestion, and would better manage the balance of traffic demands at this junction. Junction improvements at this location are considered necessary to support the effective delivery of improvements further south on the route.

1.4 Overview of Assessment

The DfT's Transport Appraisal Process[7] describes the steps to be undertaken in the Stage 2 (Further Appraisal) Process. These are outlined in Figure 1-3 below and described in more detail in the following sections of this OAR.

[6] *Jacobs, 2007. Chesham and Amersham Transport Study.* http://www.transportforbucks.net/Strategy/Chesham-and-Amersham-Transport-Study.aspx

[7] *DfT, 2014. Transport Analysis Guidance: The Transport Appraisal Process.* https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/275728/webtag-tag-transport-appraisal-process.pdf#nameddest=chptr02

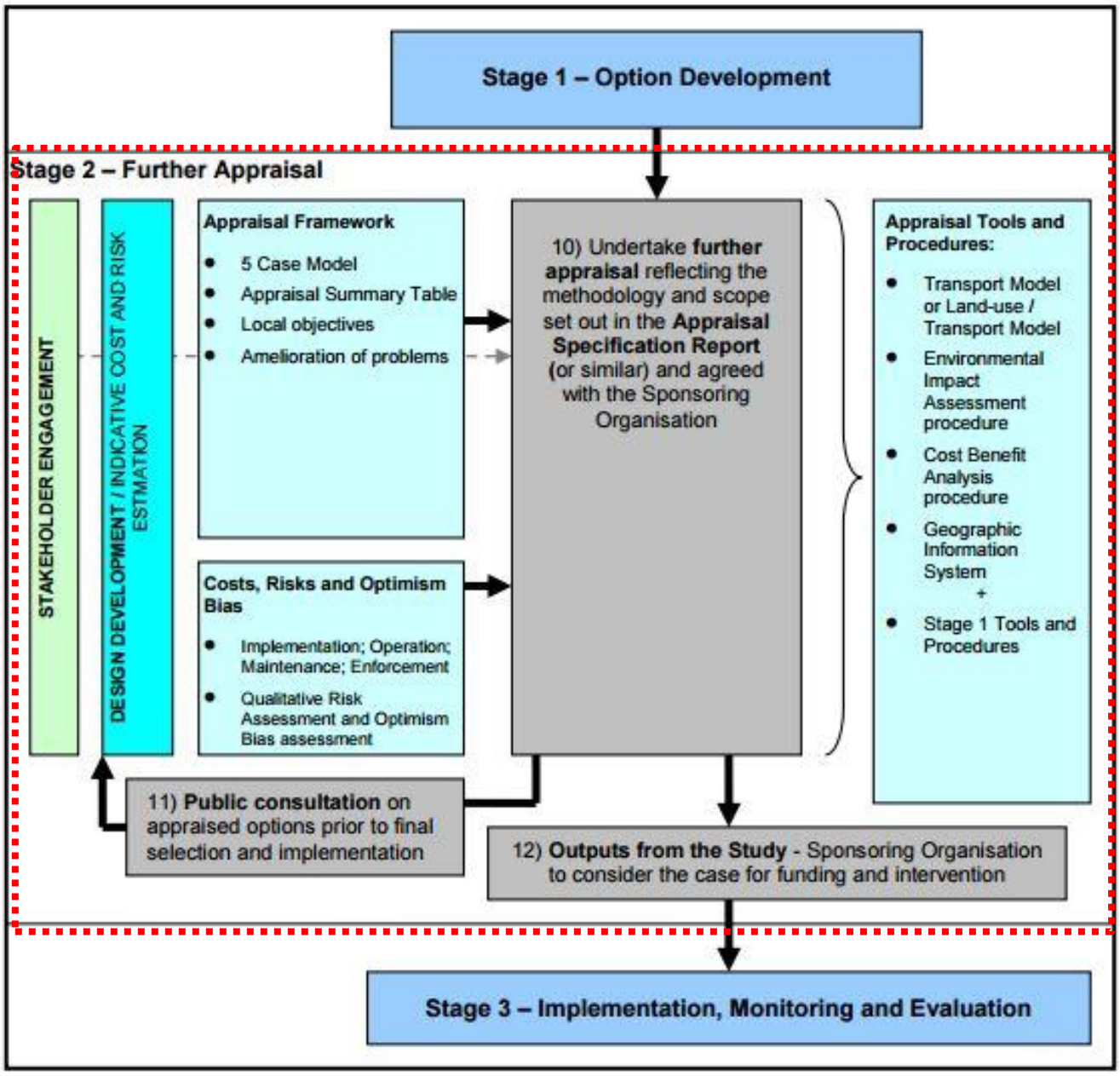

Figure 1-3 : Stage 2 (Further Appraisal) Process (Source: WebTAG Transport Appraisal Process)

As highlighted in Figure 1-3 and in the Transport Appraisal Process, traffic modelling forms a key appraisal tool and adds the required level of evidence to more basic methods of analysis. For the purpose of this report, therefore, traffic models have been developed for specific areas of the A355 corridor that have been identified for intervention and also to appraise the overall Preferred Scheme package. Figure 1-4 details the transport modelling process that has been used to assess the proposed options that consist of the A355 Improvements Scheme.

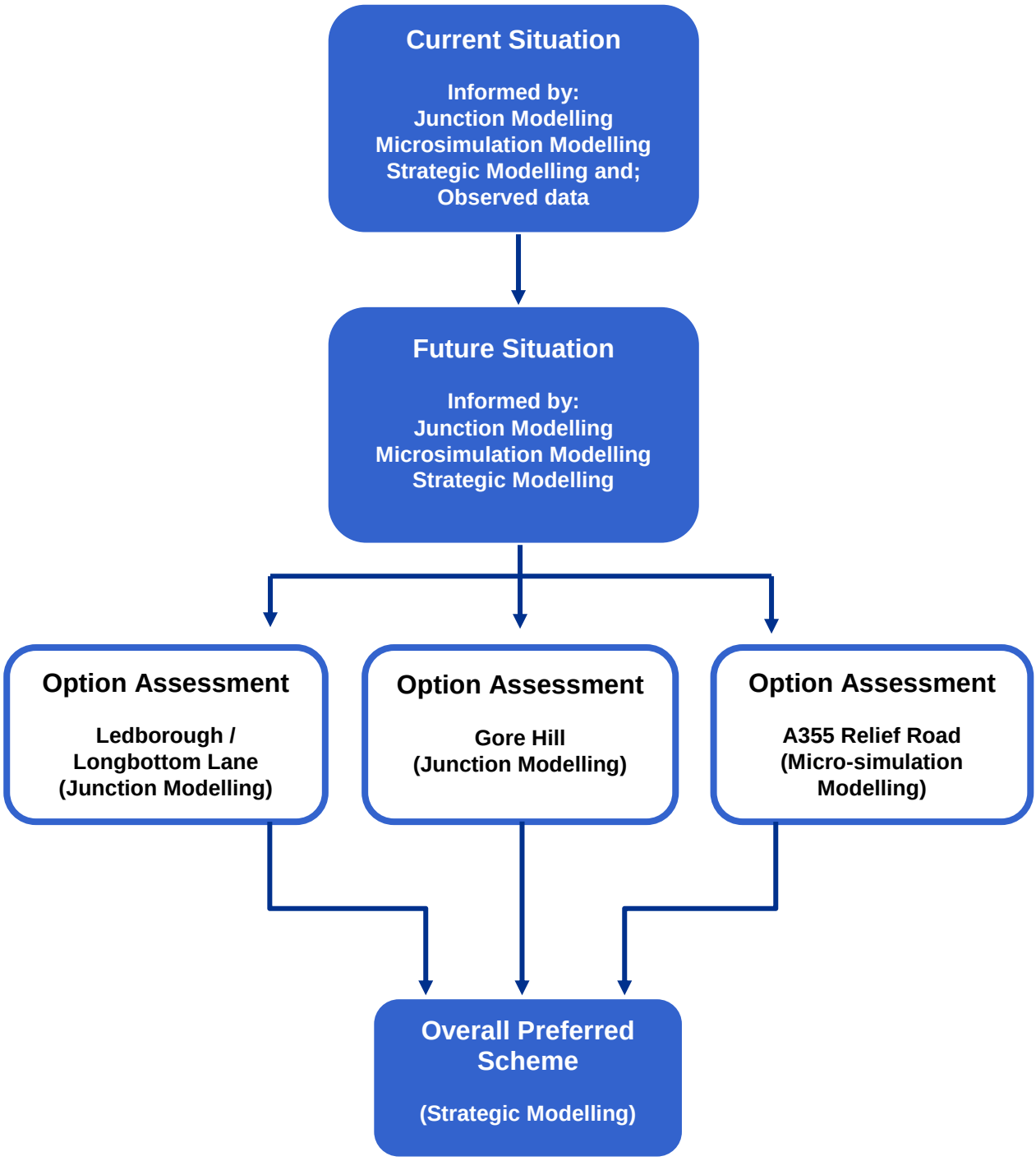

Figure 1-4 : Overview of Modelling Process

Overall Preferred Scheme Modelling

The transport modelling undertaken for the overall Preferred Scheme will assess the wider strategic distribution of traffic volumes and the potential for induced or suppressed traffic demand impacts. The outputs from the 'Preferred Scheme' transport modelling assessment will assess the Preferred Scheme against the '5 case model' (Strategic Case, the Value for Money (VfM) Case, the Delivery Case, the Financial Case and the Commercial Case).

In November 2013, Jacobs was commissioned through the TfB framework, to build a strategic transport model covering the whole of Buckinghamshire. The model was commissioned with a number of purposes in mind, one of which was to support major scheme business cases. The Buckinghamshire Countywide model covers the whole of the County.

Given the proposed uses of the model and the key design, consideration was given to the best modelling approach for assessing the schemes. Upgrade of the existing Countywide model to WebTAG standards, across the whole of the modelled area of Buckinghamshire was considered but due to timescale and cost constraints was discarded. Recognising that the impacts of the Proposed Scheme will have a limited geographic scope, it was decided that a cordon of the Countywide model would provide an appropriate modelling platform.

Within Beaconsfield, the Countywide network structure was detailed enough to include all key movements likely to be affected by the proposed scheme. The majority of residential roads were included; these are necessary to ensure that trips generated from within residential areas load on to the wider network appropriately.

Technical evidence from the junction and micro-simulation modelling at Gore Hill, Ledborough / Longbottom Lane and A355 (Beaconsfield), along with the outcomes from the stakeholders workshops, will help inform the decision as to which individual elements should be taken forward as the overall Preferred Scheme.

A355 Beaconsfield Microsimulation Model

The A355 Beaconsfield micro-simulation traffic model is a tool with the capability to model both existing and future traffic scenarios, land use scenarios and road network infrastructure interventions within Beaconsfield. The model is validated to a 2013 base year and reflects typical weekday morning and evening peak traffic conditions.

A forecast 2031 Do Minimum scenario has been developed, against which the impact of the Scheme can be assessed. This forecast scenario includes developments allocated in the adopted Local Development Framework, and background growth based on the National Trip End Model (NTEM) via TEMPRO.

The results from the micro-simulation and junction modelling will help inform the decision as to which elements will be taken forward to be assessed as part of the overall Preferred Scheme.

Gore Hill and Ledborough Lane / Longbottom Lane Junctions Models

Stand-alone junction models have been developed for the Gore Hill and Ledborough Lane / Longbottom Lane priority junctions which reflects typical 2014 base year traffic conditions. A 2031 Do Minimum scenario has also been established for these areas and forms the basis of the study for these sections of the A355.

2031 Forecast year models have been developed for the Gore Hill and Ledborough / Longbottom Lane junctions. The forecast scenarios include growth based on the National Trip End Model (NTEM) via TEMPRO.

The outcomes from the modelling will help inform which elements will be taken forward to be assessed as part of the overall Preferred Scheme at these locations.

Creating microsimulation models that ware independent of each other would mean that any impacts on the network could be directly attributed to each of the specific schemes being tested.

Stakeholder and Officer Engagement

Engaging with main stakeholder groups, Buckinghamshire County Council and District officers is a key element in identifying the aims and objectives of the scheme.

Stakeholder participation has been sought in the form of a stakeholder workshop where information was provided regarding the proposed options for the A355 Improvements Scheme. Buckinghamshire County Council and District officers have also been engaged and involved throughout the process. In addition to the stakeholder

workshop, an on-line questionnaire was sent out to stakeholders to ensure that all viewpoints were collected. The feedback from the stakeholder and officer events can be found in Section 7.6 of this report.

BCC and District Council officers have been engaged and involved throughout the process.

1.5 Structure of Report

The structure of this OAR is as follows:

- **Section 1** – Introduction – Outlines the purpose and background of the report.
- **Section 2** – Policy Review – Reviews relevant policy and strategy documents to establish the strategic policy context in the study area.
- **Section 3** – Current Situation – Describes existing transportation conditions to provide an understanding of existing traffic supply and demand.
- **Section 4** – Future Situation – Presents the forecast traffic conditions under a 'Do Minimum' scenario and describes future land-uses and policies, and changes to the transport system.
- **Section 5** – Need for Intervention – Summarises current and future transport-related problems and underlying causes that establish the need for an intervention.
- **Section 6** – Objectives and Study Area – Sets out the objectives of the study and geographical area of impact.
- **Section 7** – Option Appraisal – Assessment of options identified in Stage 1 OAR for further investigation
- **Section 8** – Scheme Appraisal – Detailed Assessment of the overall Preferred Scheme against the '5 Cases Model' criteria, Appraisal Summary Table and how it relates to local objectives
- **Section 9** – Summary and Conclusions – Summarises the results of this Stage 2 OAR.

2. Policy Review

2.1 Introduction

This section outlines the key strategies and policies relating to planning and transportation within the study area, as articulated at the National, Regional and Local level.

In developing an understanding of the current situation, it is important to establish the strategic policy context in order to identify potential land use, and plans and proposals for development that may have implications for the travel market to which any intervention may relate. Furthermore, it is important to ensure that any interventions identified and assessed are consistent with these policies.

Policy has been and continues to be in a state of change and development; therefore the information presented in this report is accurate at the time of writing but may change during the course of the business case development.

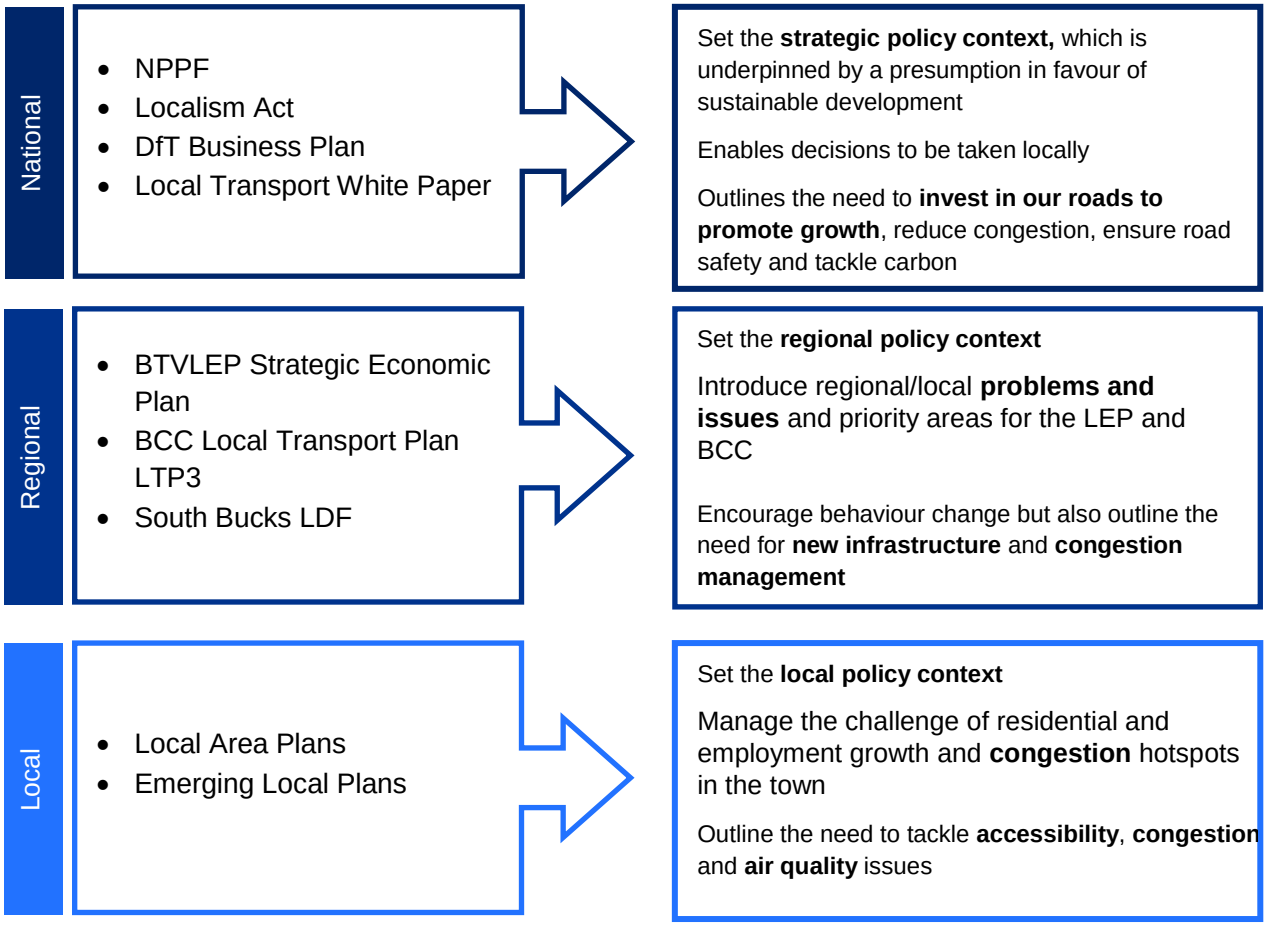

Figure 2-1 : Policy Context

2.2 National Policy

National Planning Policy Framework

Under the previous Coalition Government, planning policy changed significantly. As outlined within the Local Growth White Paper, the focus for planning and future development is one that helps to deliver strong, sustainable and balanced growth, whilst also being tailored to local aspirations and requirements.

In March 2012, the Department for Communities and Local Government published the National Planning Policy Framework (NPPF)[8], which sets out the Government's economic, environmental and social planning policies. The NPPF aims to reform the planning system and is underpinned by a presumption in favour of sustainable development. There is a focus on planning for prosperity, people and places, promoting increased levels of development and supporting infrastructure, whilst also protecting and enhancing the natural and historic environment. It is designed, however, to be interpreted and implemented locally; and delegates responsibility for achieving this vision to local planning authorities.

Localism Act

The Government's Localism Act[9] provides the legislative foundation for this change. The Act decentralises power, giving local government new freedom and flexibilities; provides new rights and powers for communities and individuals; reforms the planning system; and enables decisions to be taken locally.

Department for Transport's Business Plan

The Government's vision for transport is also one that encourages growth, but is greener, safer and improves the quality of life in our communities. The Government's transport priorities and key actions in order to deliver this national vision are set out within the DfT's Business Plan[10] and Road Investment Strategy[11], which are updated frequently. There is a focus on improving road safety, reducing congestion and pollution and making changes at a local level; priority five in particular outlines the need to 'invest in our roads to promote growth, while reducing congestion, ensuring road safety and tackling carbon'. The overall aspiration is that the Strategic Road Network (SRN) will be smoother, smarter and more sustainable by 2040.

The 'Local Transport White Paper – Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen'[12] published in January 2011, sets out the Government's vision for a sustainable local transport system that supports the economy and reduces carbon emissions. The focus is on enabling local authorities to meet local transport needs, through a simplified approach to funding and increased power and flexibility. It emphasises that effective sustainable local transport is achieved through solutions developed for the places they serve, tailored for the specific needs and behaviour patterns of individual communities.

2.3 Regional / Local Policy and Guidance

The Buckinghamshire Thames Valley Local Enterprise Partnership

Included in the Localism Act is the power to abolish Regional Spatial Strategies and with that the South East Plan, which previously set out the region's targets for housing, economy, transport and environmental challenges. Local Enterprise Partnerships (LEPs) have taken on Regional Development Agencies' role in this process, with South Bucks and Chiltern Districts forming part of the BTVLEP.

The vision of the BTVLEP is 'to create a vibrant, balanced, competitive Buckinghamshire economy' through providing the 'conditions that support business to invest, grow, and thrive'[13]. A number of key objectives are identified for the period 2012-2031 in order to achieve this vision. These include a focus on bringing forward the necessary business-critical infrastructure and ensuring major transport infrastructure is fit for its economic purpose.

In March 2014, BTVLEP in conjunction with BCC submitted its SEP[1] to the DfT's Growing Places Fund. This submission identified a portfolio of transport and economic development priorities for Buckinghamshire over the coming years, to deliver transformative growth throughout the county. The key transport objective of the SEP is

[8] Department for Communities and Local Government, 2012. *National Planning Policy Framework.*
[9] HM Government, 2010. *Decentralisation and the Localism Bill: an essential guide.*
[10] DfT, 2013. *Business Plan 2013-15*.
[11] Department for Transport. 2015. *Road Investment Strategy 2015/16 – 2019/20 Road Period*.
[12] DfT, 2011. *Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen.*
[13] *BTVLEP, 2012. Buckinghamshire Local Enterprise Thames Valley Partnership 2012 – 2031 - Plan for Sustainable Economic Growth in the Entrepreneurial Heart of Britain*
http://buckstvlep.co.uk/uploads/downloads/SEQ129_BBF_BusinessPlan_0912_LOW-1.pdf

'to create a smart, integrated, transport network, which provides excellent multi-modal connectivity between key areas of housing and economic growth across the wider sub-region.' The focus of the SEP is about enhancing Buckinghamshire's connectivity. It identifies the A355 Improvements (Gore Hill / Wilton Park) as a priority scheme, which will significantly reduce congestion, improve journey times and journey reliability along this corridor. It states improving the route at the Gore Hill junction (with the A413) through part-time signalisation and at Wilton Park through the provision of a relief road would eliminate bottlenecks as well as provide a new access to the strategic development site to the east of Beaconsfield.

Buckinghamshire's Local Transport Plan 2011-2016

Buckinghamshire's Local Transport Plan 2011-2016[4] was adopted in April 2011. It is the third Local Transport Plan (LTP3) for the county, setting out policies, strategies and priorities to address transport related issues and challenges across the five years to March 2016.

The LTP3 is focused on addressing the five themes of the Sustainable Communities Strategy[14] (SCS), which sets the long-term plan for the county up to 2026:

- delivering a thriving economy
- sustainable environment
- safer communities
- health and wellbeing
- cohesive and strong communities

In supporting the delivery of a thriving economy, LTP3 recognises that encouraging employment growth in the county and delivering sustainable housing growth are two key challenges. To effectively support and facilitate such growth, it recognises that a joined-up, holistic transport strategy is required, which addresses all modes. It therefore adopts an approach that encourages behaviour change but also outlines a need for major new infrastructure and congestion management.

Within the Plan, Beaconsfield is identified as an area suffering from congestion issues and Amersham from bottlenecks. It classifies the A355 Amersham to Beaconsfield as an Interurban 'Priority Congestion Management Corridor'. Other themes relevant to this area include air quality concerns; commuting pressures; accessibility issues; and environmental pressures.

South Bucks Local Development Framework

South Bucks has an emerging Local Development Framework (LDF). The LDF will guide the planning of the District to 2026 and comprises of the following documents:

- Core Strategy for South Bucks, Feb 2011
- Adopted Local Plan, March 1999 (as updated)
- Emerging Development Management Local Plan
- Supplementary Planning Documents (SPD), including:
- Affordable Housing SPD
- Wilton Park SPD
- Mill Lane SPD
- Residential Design Guide, October 2008
- Other Statutory Documents

[14] *Bucks Strategic Partnership, 2009. Sustainable Community Strategy for Buckinghamshire 2009–2026.* *http://www.buckinghamshirepartnership.gov.uk/assets/content/Partnerships/BSP/docs/bsp_scs_visual_county.pdf*

The adopted Core Strategy[5] sets out the vision and spatial strategy for the South Bucks District in the period to 2026. The overall aim of the strategy is to protect the Green Belt, by focusing new development on previously developed land within existing settlements. As a District Centre, Beaconsfield is highlighted as a principal focus, with residential and retail land uses designated within the built up area of the town. Core Policy 14 further identifies Wilton Park to the east of Beaconsfield as an Opportunity Site for comprehensive redevelopment.

The Core Strategy also identifies the necessary infrastructure to support this development, as well as to address demographic change and other local issues, to ensure that sustainable communities are created. Core Policy 7 - Accessibility and Transport outlines key concerns regarding congestion in Beaconsfield, with the identification of the A355 between the Pyebush roundabout and the Amersham Road to the east of Beaconsfield as a particular hotspot. The Core Strategy, informed by Atkins Evaluation of Transport Impacts[15], states a range of measures will be needed to ease road capacity issues, including actions in the Beaconsfield Transportation Study 'refresh', mitigation measures as part of the redevelopment of Wilton Park and potentially an A355 Relief Road later in the Plan period. The SBDC LDF Transport Paper East of Beaconsfield Area[16] assesses options for access to a redeveloped Wilton Park. Core Policy 14 details that Wilton Park redevelopment proposals should:

- Ensure an acceptable means of vehicular access. Any access off the Pyebush roundabout must be constructed so that it is capable of future upgrading and extension to form an A355 Relief Road
- Mitigate traffic impacts on the local and strategic road networks, for example, through the provision of high quality walking, cycling and public transport routes – with the links to Beaconsfield New Town being of particular importance.

Furthermore, saved Local Plan Policy TR5 (Accesses, Highway Works and Traffic Generation) states that regard should also be given to safety, congestion and the environment.

The adopted Wilton Park SPD[17] is consistent with the expectations set out in the Core Strategy, and includes a series of development and design principles for the comprehensive redevelopment of the site. The principles have particular regard to the sites Green Belt location, wider environmental and visual sensitivities, as well as the aspirations of Core Policy 14. In terms of access, the SPD sets out the following:

- Access – the provision of a new vehicle access into the site from the Pyebush Roundabout. The design and alignment of this road is important not only to provide the first section of a relief road for Beaconsfield, but also to facilitate strong pedestrian and cycle linkages between the site and Beaconsfield to support travel by sustainable transport modes. Through context sensitive design to define its character, there is the potential for a stretch of road that performs an effective strategic function whilst avoiding the creation of a physical barrier between Beaconsfield and the new development.

In October 2014, planning permission (Ref:14/01467/FUL) was granted for the construction of this new road that extends from A40 Pyebush Roundabout to the northern boundary of Wilton Park site. This will provide access to the Wilton Park site and form Phase 1 of the A355 Beaconsfield Relief Road.

[15] *Atkins, 2010. Evaluation of Transport Impacts.*
http://www.southbucks.gov.uk/includes/documents/cm_docs/2010/e/evaluationoftransportimpacts_une2010.pdf
[16] *TfB/BCC, 2010. South Bucks Local Development Framework Transport Paper East of Beaconsfield Area.*
http://www.southbucks.gov.uk/includes/documents/cm_docs/2010/t/transport_paper_east_of_beaconsfield_area_bcc_2010.pdf
[17] *SBDC, 2014. Wilton Park Development Brief Supplementary Planning Document: Consultation Draft*
http://www.southbucks.gov.uk/includes/documents/cm_docs/2014/w/1_wilton_park_development_brief_draft_spd.pdf

Local Area Strategies

Buckinghamshire's Local Area Strategies[18] provide an overview of how the countywide strategy detailed in the LTP3 will be applied in order to address locally identified problems and issues. It includes an Urban Strategy for Beaconsfield, detailing an overarching vision and the following priorities for the area:

- Manage the challenge of residential and employment growth
- Manage congestion hotspots in the town - notably A40 and A355
- Review parking problems in Beaconsfield

The approach contains a mix of schemes and initiatives to encourage the use of more sustainable modes of transport, and manage and mitigate the impact of growth with particular reference to the A355. The A355 Relief Road is highlighted as a scheme for further consideration and development.

The Local Area Strategies also include an Urban Strategy for Amersham, which identifies congestion as a priority and the better management of traffic on the network and improved operation of key junctions and routes as a fundamental approach.

Development Plan for Chiltern District

The Development Plan for Chiltern District seeks to guide and manage development in the District over the period to 2026 and comprises of the following:

- Core Strategy for Chiltern District, November 2011[19]
- Saved policies of the Adopted Local Plan for Chiltern District, Sept 1997 (as updated)[20]
- Supplementary Planning Documents
- Emerging Delivery Development Plan Document (DDPD)[21]

The adopted Core Strategy sets the vision, overall strategy and key targets, including housing levels, for the district to 2026.

Following the suspension of the emerging Delivery Development Plan Document (Delivery DPD) in November 2014 the Council withdrew the Delivery DPD 6th January 2015 and therefore it will not form part of the Development Plan for the District.

Emerging Chiltern and South Bucks Local Plan

CDC and SBDC are developing a joint Local Plan covering the period up to 2036. During early 2016 the Councils are carrying out their Initial Regulation 18 Consultation relating to issues and options[22]. Alongside this, SBDC are undertaking a review of the Green Belt[23]. The conclusion of these processes is not expected until into 2017.

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[18] *TfB, 2011. Local Transport Plan Local Area Strategies.* http://www.tfbucks.co.uk/documents/ltp/LTP3_Local_area_strategies.pdf

[19] *CDC, 2011. Local Development Framework Core Strategy for Chiltern District.* http://www.chiltern.gov.uk/corestrategy

[20] *CDC,1997. Chiltern District Local Plan.* http://www.chiltern.gov.uk/planning/localplan

[21] *CDC, 2014. Delivery Development Plan Document for Chiltern District.* http://www.chiltern.gov.uk/CHttpHandler.ashx?id=4122&p=0

[22] http://www.southbucks.gov.uk/planning/localplan2014-2036

[23] http://www.southbucks.gov.uk/article/3889/Green-Belt

Beaconsfield Transportation Study – Transport Strategy

The Beaconsfield Transport Study[24] was produced in April 2003, and set out a vision and aspirations for the town for the subsequent 20 year period with respect to transport. The Study identified a number of existing problems including collisions, traffic speeds and flows (and associated noise and vehicle emissions impacts) on the A355, with the A355 junctions with the A40/Minerva Way and Ledborough Lane / Longbottom Lane highlighted in particular.

A range of transport strategies were tested as part of the Study and a composite demand management strategy recommended, which included traffic calming measures, junction improvement proposals and public transport measures. Aside from traffic calming on Maxwell Road and Ledborough Lane, and improvements to bus stops on Maxwell Road, however, these measures have not been taken forward to date.

In 2009 the Study was refreshed[25] to assess the continued validity of problems and solutions identified. Reference was made to the potential impacts of the Wilton Park development and suggestions included that development proposals might offer a solution to congestion at the A355/A40/Minerva Way junction. It states the need for further investigation of the proposals; however, detailed consideration was assigned to the SBDC LDF Transport Paper.

Reference was also made to the following three major schemes originally proposed as part of the recommended demand management strategy:

- A355 j/w A40 signalisation
- Footbridge over the railway
- Ledborough Lane roundabout

Due to concerns regarding construction and cost, it was concluded that none of these represented good value for money and were therefore not the most appropriate way of addressing identified issues. As a result, no further investigation was undertaken with regard to these schemes. The refresh produced an updated action plan of the remaining strategy measures for Beaconsfield, which amongst others included the following:

- Reduce congestion and conflict at A355/A40/Minerva Way junction by making traffic one-way southbound on Lakes Lane
- Traffic calming on key routes
- Improvements to bus passenger facilities
- Area-wide review of cycle routes for Beaconsfield
- Pedestrian improvements including footway upgrades and safer routes to school measures

Beaconsfield Town Council Strategic Plan

Beaconsfield Town Council's Strategic Plan[26] sets out the Council's fundamental aims and priorities for the 2009 to 2014 period. In order to achieve the fundamental aim 'to preserve and/or enhance the character and environment of Beaconsfield', the Town Council states it intends to 'work to secure improvements to road safety and the traffic situation in the Town' through the following key actions:

- Seeking to influence Bucks County Council's policies and practices
- Continuing to press Bucks County Council to implement the recommendations from the refresh of its 2001 transportation study

[24] *Colin Buchanan and Partners, 2003. Beaconsfield Transportation Study. Transport Strategy Final Report.*
[25] *Jacobs, 2009. Beaconsfield Transport Study Refresh.*
[26] *Beaconsfield Town Council, 2009. Beaconsfield Town Council's Strategic Plan.*

- Encouraging the work of the Police and Neighbourhood Action Group (NAG) in monitoring speeding and blackspots
- Promoting the Eastern Bypass Scheme (now known as the A355 Relief Road)

Chesham and Amersham Transport Study (CATS Study)

In 2007 Jacobs was commissioned by BCC to undertake a feasibility study[27] in and around Chesham and Amersham. The aims of the study were to identify transport problems in the area and present feasibility proposals to address these problems.

The A413/A355 Junction (Gore Hill) was identified as a particular problem location, with queues observed on all approaches. Initial assessment of the junction, however, did not wholly support the observations on site and the report recommended that more complex modelling of the junction be undertaken.

Suggested options to address the queuing and congestion issues, however, included the introduction of part time signals, full time signals or a dedicated left turn lane on the southern arm of the A413/A355 junction. The part time signalisation in peak hours emerged as the preferred BCC option.

[27] *Jacobs, 2007. Chesham and Amersham Transport Study Feasibility Study.* *http://www.transportforbucks.net/Strategy/Chesham-and-Amersham-Transport-Study.aspx*

3. Current Situation

3.1 Introduction

This section reviews the existing land use and transportation infrastructure supply and demand. Travel conditions within the study area are described using a variety of indicators including traffic volume, journey patterns congestion and delay. These indicators are informed by a range of existing data sources and base year traffic and junction models. The details of traffic model development are provided in section 3.2 below. Provision for public transport and non-motorised users is also described with data related to travel volumes where available.

To assist the identification and development of any potential transport options available, physical, legal and institutional constraints, and the opportunities affecting the area of interest have also been identified.

3.2 Traffic Model Development

3.2.1 Strategic Modelling

In November 2013, Jacobs was commissioned through the Transport for Buckinghamshire framework, to build a strategic transport model covering the whole of Buckinghamshire. The model was commissioned with a number of purposes in mind, one of which was to support major scheme business cases. The Buckinghamshire Countywide model covers the whole of the County.

Given the proposed uses of the model and the key design, consideration was given to the best modelling approach for assessing the schemes. Upgrade of the existing Countywide model to WebTAG standards, across the whole of the modelled area of Buckinghamshire was considered but due to timescale and cost constraints was discarded. Recognising that the impacts of the proposed scheme will have a limited geographic scope, it was decided that a cordon of the Countywide model would provide an appropriate modelling platform.

Within Beaconsfield, the Countywide network structure was detailed enough to include all key movements likely to be affected by the proposed scheme. The majority of residential roads were included; these are necessary to ensure that trips generated from within residential areas load on to the wider network appropriately.

The Base Year model represents a 2015 year and was built to represent three time periods:

- AM peak hour (0800-0900)
- PM peak hour (1700-1800)
- Average hour in the interpeak (1000-1600)

The peak periods represent the times at which observed traffic volumes were highest.

The adequacy of the A355 Relief Road transport model to assess the scheme was measured against the criteria set out in TAG Unit M3.1.

WebTAG guidance sets out measures to compare the base year model against observed independent data to quantify the level of fit. The validation of the highway assignment has been quantified using the following measures taken from WebTAG unit M3.1 paragraph 3.2.3

- Assigned flows and counts totalled for each screenline or cordon, as a check on the quality of the trip matrices;
- Assigned flows and counts on individual links as a check on the quality of the assignment; and
- Modelled and observed journey times along routes, as a check on the quality of the network and the assignment.

Further information regarding the model calibration / validation process can be found in the report 'A355 Improvements (Gore Hill/Wilton Park) Business Case Model - Local Model Validation Report' November 2015.

3.2.2 Junction & Micro-simulation Modelling

A micro-simulation model of the A355 within Beaconsfield and its approaches was developed using the PTV software package VISSIM. The model is validated to a 2013 base year and reflects typical weekday morning (08:00 – 09:00) and evening (17:00 – 18:00) peak traffic conditions.

The model includes the A355 and A40 to the east of the urban area of Beaconsfield, as well as the surrounding roads for which traffic data was available. Year 2013 Automatic Number Plate Recognition Surveys (ANPR), manual classified counts (MCC), automatic traffic counts (ATC) and journey time surveys have informed the development of the model. Available queue length survey data was not used, however, as it was not consistent with observations on site.

The ANPR, MCC and ATC surveys were used to define traffic volumes and routing within the model. The model was developoed using the available MCC and ATC data. The journey time data was used to validate the performance of the model. The key characteristics of the base model are summarised in Table 3-1, with the modelled network, data collection locations and validation results shown in Appendix B.

Key Characteristics	A355 Beaconsfield	Gore Hill	Ledborough / Longbottom Lane
Modelling Package	VISSIM 5.3-08	VISSIM 7.0	VISSIM 7.0
Model Structure	Static Assignment	Static Assignment	Static Assignment
Base Model Year	2013	2014	2014
Model Area	A355 Beaconsfield	Gore Hill roundabout	A355 / Ledborough Lane / Longbottom Lane junctions
Time Periods	AM Peak hour (0800-0900) PM Peak hour (1700-1800) 'Shoulder' periods: AM (0700-0800 & 0900-1000) PM (1600-1700 & 1800-1900)	AM Peak hour (08:00-09:00) PM Peak hour (1700-1800) 'Shoulder' periods: AM (0700-0800 & 0900-1000) PM (1600-1700 & 1800-1900)	AM Peak hour (08:00-09:00) PM Peak hour (1700-1800) 'Shoulder' periods: AM (0700-0800 & 0900-1000) PM (1600-1700 & 1800-1900)
Vehicle Types	Car Light goods vehicles (LGV) Heavy goods vehicles (HGV)	Car Light goods vehicles (LGV) Heavy goods vehicles (HGV)	Car Light goods vehicles (LGV) Heavy goods vehicles (HGV)
Calibration/Validation	Calibration – MCC's and ATC's Validation – Journey Times	Calibration – MCC's and ATC's Validation – Queue Lengths	Calibration – MCC's and ATC's Validation – Queue Lengths

Table 3-1 : Characteristics of Traffic models used for Appraisal

Stand-alone Junction models of the Gore Hill roundabout and Ledborough Lane / Longbottom Lane priority junctions have been developed to test potential intervention options at these junctions. The models were developed using the PTV software package VISSIM. Year 2014 MCC, ATC and queue length information provided by BCC has informed the development of the model.

For each of the base year model scenarios developed, the traffic conditions within the models has been confirmed through a series of site visits during the morning and evening peak hours.

3.3 Highway Network

3.3.1 Description of Network

The A355 forms part of the County's primary road network, providing the main north-south connection through the centre of the South Bucks District. It connects Amersham and the A413 in the north to the M40, which provides strategic connections to the M25, London, Oxford and Birmingham. The route aligns to the eastern edge of Beaconsfield, the largest settlement in the South Bucks District, and provides access to the strategic road network at M40 junction 2 to the south-east of the town. To the south of the M40, the A355 continues through Farnham Common and Farnham Royal, on to Slough. This section of the corridor, however, is no longer classified as a primary route.

The route is single carriageway with a single lane in each direction for much of its length, with a multi-lane dual carriageway present only to the immediate north and south of the M40. Figure 3-1 shows the local highway network.

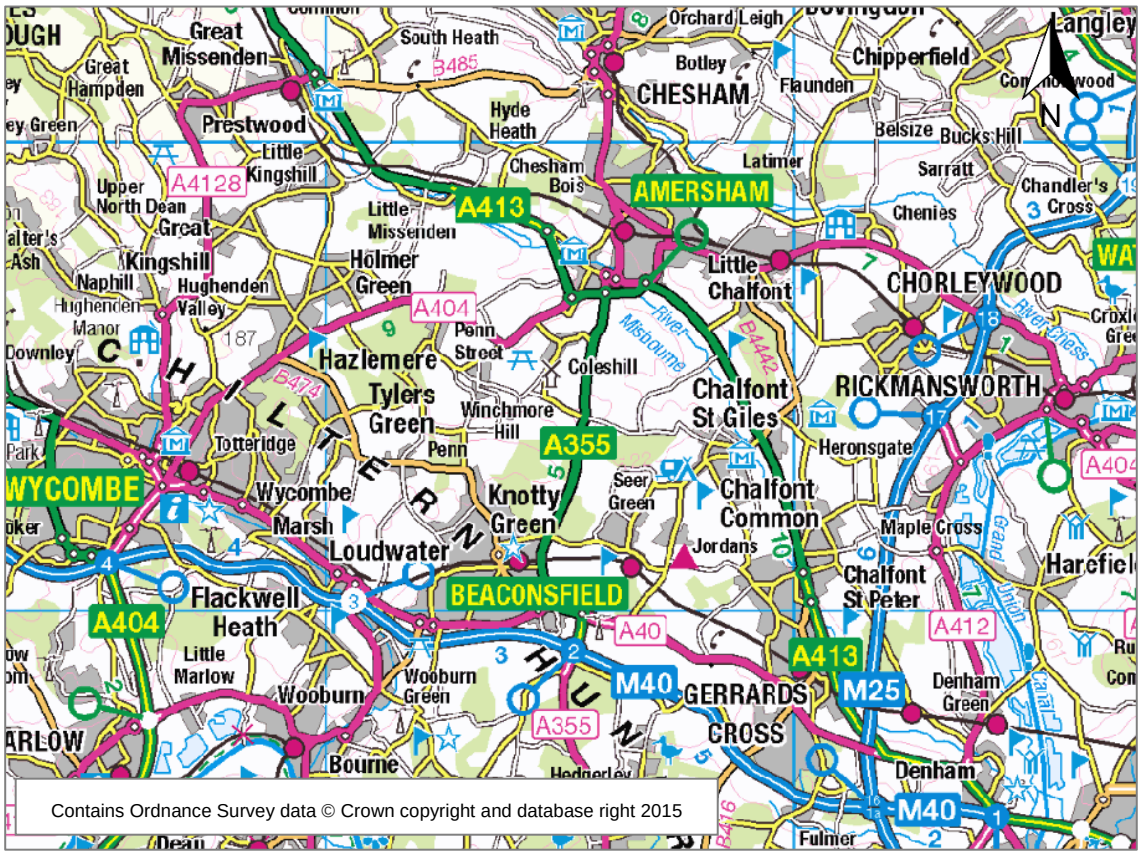

Figure 3-1 : Local Highway Network

In addition to junction 2 of the M40, key junctions include the A355 connections with the A40 and A413 primary routes. The A40 forms a primary east-west route parallel to the M40, and is a diversionary route for the motorway. The A40 provides links through the south of Beaconsfield to High Wycombe in the north-west and Gerrards Cross in the south-east. The A355 connects with the A40 at the 'London End' roundabout to the east of Beaconsfield Old Town, and the Pyebush roundabout some 500m east of this (see Figure 3-2).

The London End roundabout is a small 4-arm roundabout between the A355 (Park Lane/Amersham Road), the A40 London End, the A40 London Road and Minerva Way. Lakes Lane which, given its proximity, can be

mistaken for a fifth arm to this junction, is a left-in/left-out priority junction off the A40 London Road. Minerva Way, which forms the north-eastern arm of the roundabout, is a narrow route that currently provides access to a small number of private dwellings as well as the Wilton Park site. There are no controlled crossing facilities for pedestrians or provision for cyclists at this junction.

To the east, the Pyebush Roundabout is a large three arm junction between the A355 and A40 London Road. It lies some 700m north of junction 2 of the M40.

Approximately 1.5km north of London End Roundabout, Ledborough Lane intersects with the A355 as a three-arm priority junction. Ledborough Lane joins the A355 from the west, linking to the B474. There are traffic calming measures on Ledborough Lane from the junction with the B474 to A355. The Longbottom Lane / A355 priority junction lies 70m north of the Ledborough Lane junction joining the A355 from the east and is also a three-arm priority junction. All moves are currently permitted at both of these junctions.

To the west, the A40 also connects with the B474 at the Windsor End Roundabout, which runs parallel to the A355 through Beaconsfield New Town, serving the station and town centre. To the north-west, the B474 provides a link via Penn to the A404 and Hazlemere near Wycombe. Within Beaconsfield, Ledborough Lane to the north of the railway line, and Maxwell Road and Candlemas Lane to the south, provide east-west links between the B474 and the A355.

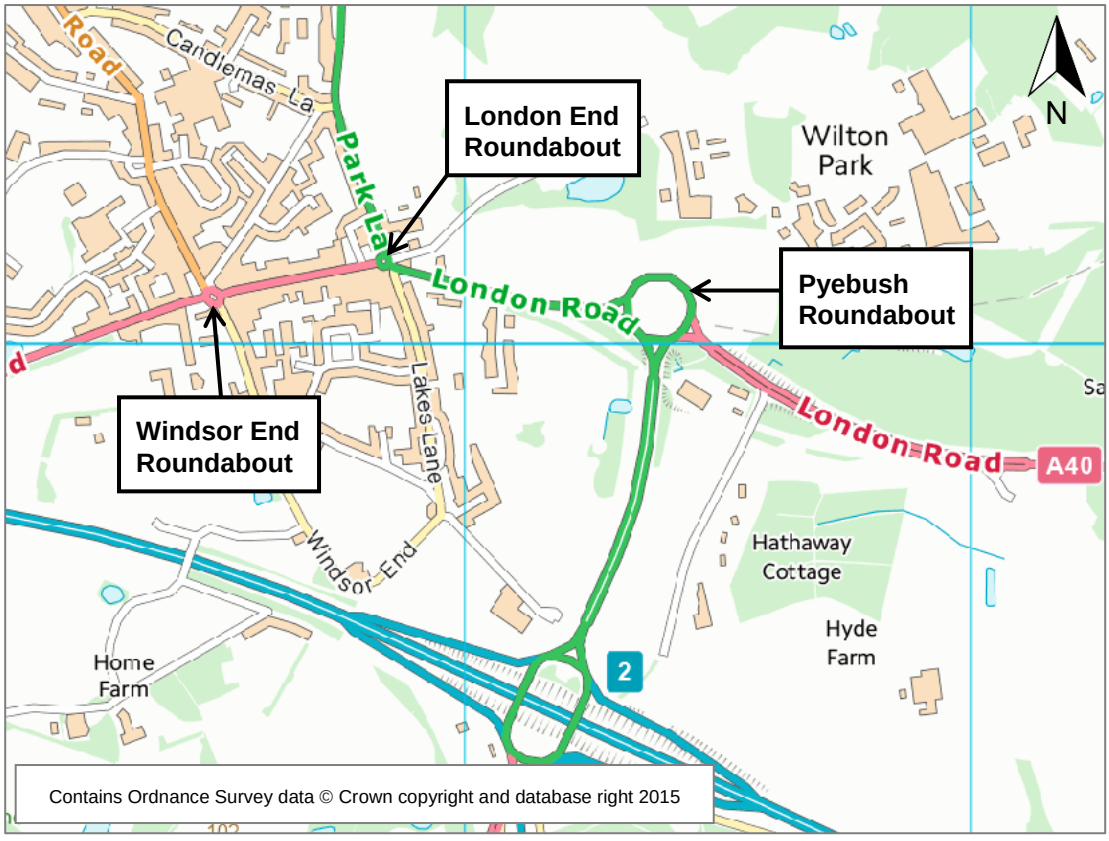

Figure 3-2 : A355 junctions with the A40

To the north, the A355 includes 'Gore Hill' which is a steep section of road situated on the southern edge of Amersham, providing access into the town and to the A413. The A413 provides strategic connections to Aylesbury in the north-west and to Denham, the A40 and M40 at junction 1 in the south-east.

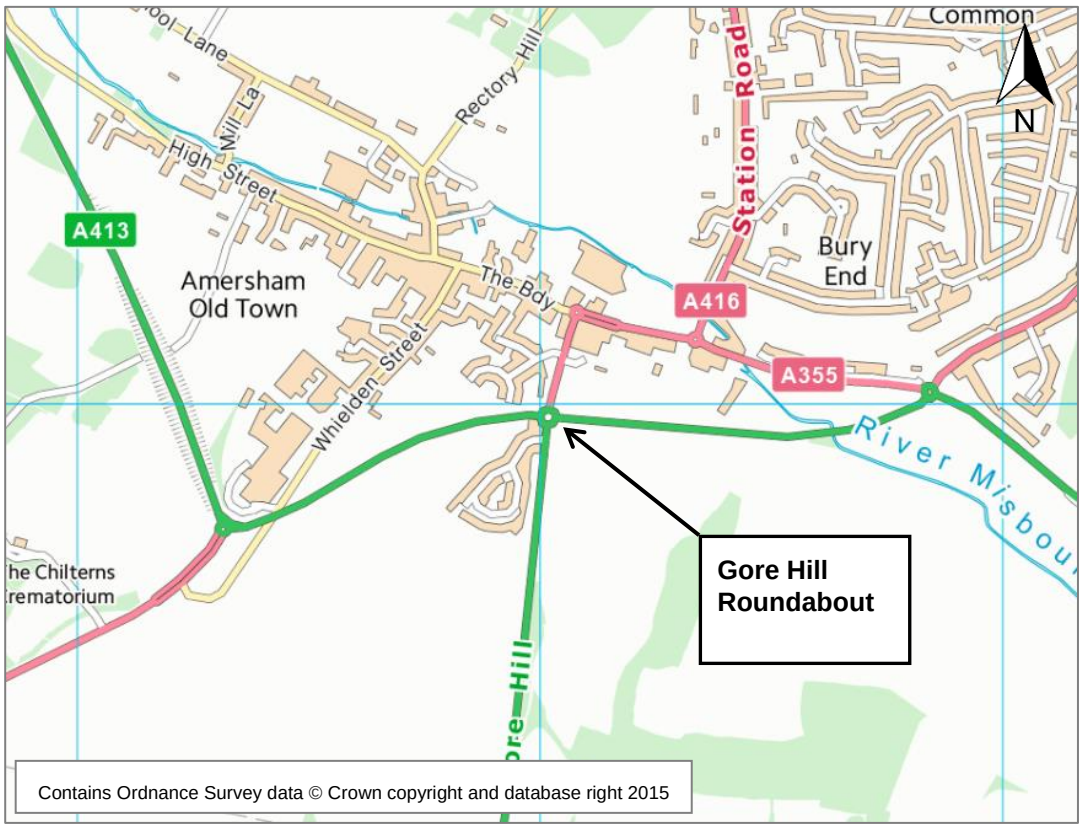

Figure 3-3 : Gore Hill roundabout

The intersection of the A413 and A355 is known as the 'Gore Hill roundabout'. It is a 4-arm roundabout, with no controlled crossing facilities for pedestrians or provision for cyclists. It lies approximately 200m south of the Tesco roundabout; a 4-arm roundabout junction at the eastern end of Old Amersham between Gore Hill, The Broadway, London Road West and Tesco superstore access.

3.3.2 Traffic Volumes

Figure 3-4 and Figure 3-5 shows the modelled link flow in the Beaconsfield area for the AM and PM peak periods.

Figure 3-6 provides a more detailed summary of the relative weekday traffic volumes for the AM (8.00-9.00am) and PM peak periods (5.00-6.00pm), on and around the A355.

The A355 itself accommodates the highest volumes of traffic and a tidal pattern of traffic flow is evident. In the southbound direction, greater volumes of traffic are observed in the AM peak and northbound volumes increase in the PM peak. Northbound traffic, however, is considerably higher than southbound (some 165 to 500 vehicles) and remains relatively heavy in both peak periods.

The busiest road link is on the A355 between the M40 and Pyebush roundabout; traffic volumes reach up to approximately 1,600 in the AM peak and 1,500 in the PM peak, reflecting the higher road standard and number of lanes at this location. Traffic volumes on the A355 Park Lane/Amersham Road are also high, reaching up to 1,100 in the AM and 1,200 in the PM peak periods, and remain high up to the Gore Hill junction. Within Amersham, the A413 also accommodates volumes in excess of 1,100 in both the AM and PM peaks, with tidal traffic flows evident eastbound in the AM peak and westbound in the PM peak.

There are road links with high flows in excess of 800 vehicles per hour on the A40 London End and the A40 London Road. On these links, the eastbound direction accommodates the highest traffic volumes in both the AM

peak and PM peak periods. Side roads from the A355 and A40 accommodate markedly less traffic volumes than the north-south and east-west corridors, and would appear to be predominantly used by local traffic.

Figure 3-4 : 2015 Modelled Link Flow in Beaconsfield Area - AM Peak

Figure 3-5 : 2015 Modelled Link Flow in Beaconsfield Area - PM Peak

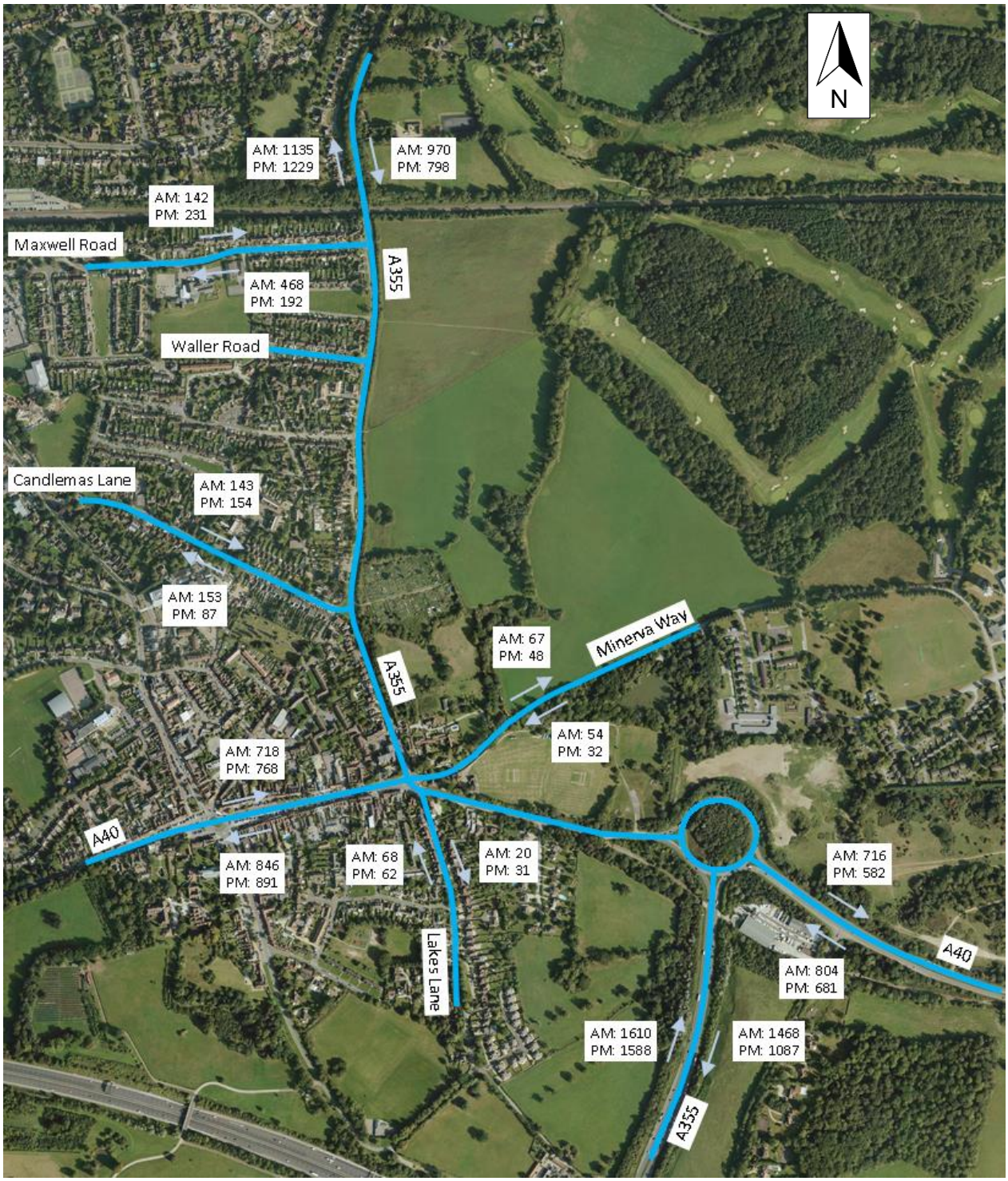

Figure 3-6 : 2013 Observed Peak Hour Traffic Volumes (South A355)

Figure 3-7 and Figure 3-8 provide a summary of the weekday traffic volumes for the AM (8.00-9.00am) and PM peak periods (5.00-6.00pm) for the Gore Hill roundabout and Ledborough Lane / Longbottom Lane priority junctions.

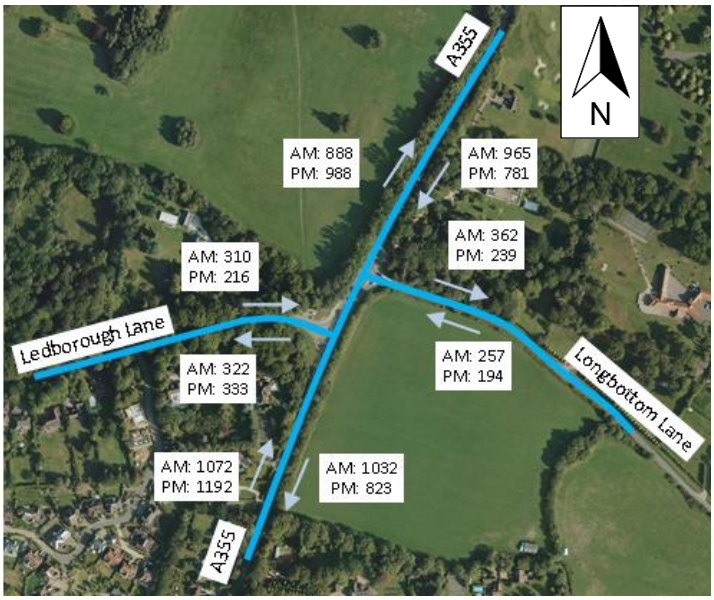

Figure 3-7 : 2014 Peak Hour Traffic Volumes (Ledborough Lane/Longbottom Lane priority junctions)

At the Ledborough Lane / Longbottom Lane junctions the highest volume of traffic is experienced on the A355. For the northbound direction the flow is highest in PM peak period and for the southbound direction the flow is highest in the AM peak period which shows a tidal pattern of traffic flow. Overall traffic flows are higher travelling in the northbound direction.

The Ledborough Lane arm experiences higher traffic volumes compared with the Longbottom Lane arm, in both the AM and PM peak periods.

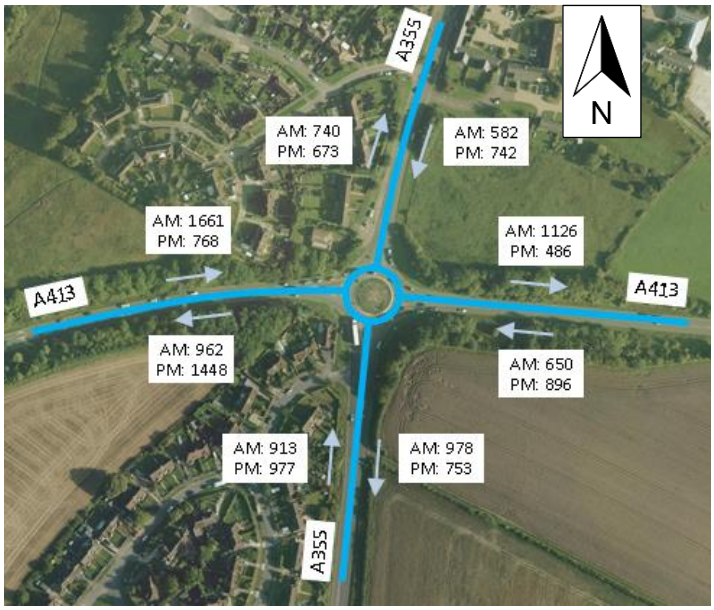

Figure 3-8 : 2014 Peak Hour Traffic Volumes (Gore Hill roundabout)

At the Gore Hill roundabout the busiest approach arm is the A413 (west) in the AM peak period with traffic volumes of approximately 1700. The A413 (east) and Gore Hill (south) each have vehicle flows of approximately 900 whilst the approach from Gore Hill (north) has the lowest flow of all the approaches (c.600).

In the PM peak all approaches have vehicle flows greater than 700. The approaches from Gore Hill south and A413 east have the highest vehicle flows of approximately1000 and 900 respectively.

3.3.3 Journey Patterns

The information presented in Figure 3-6 illustrates southbound flows on the A355 are highest in the AM peak and northbound flows are highest in the PM peak. Through an analysis of an ANPR survey undertaken, the volume and proportion of trips undertaking the north-south through movement have been quantified.

In the southbound direction in the AM peak, 55% of all traffic on the A355 north of Maxwell Road (around 530 vehicles) continues through the area and on to the A355 south of Pyebush roundabout. In the PM peak period there remains a strong pattern of through-trips; however the proportion decreases to 44% (around 350 vehicles). There are similarly high proportions of through trips in a northbound direction, with 39% (around 440 vehicles) and 47% (around 540 vehicles) in the AM and PM peaks respectively.

The semi-rural geography of South Bucks and relative prosperity in the district contributes to higher than average levels of car ownership and use. According to the 2011 Census[28], only 10.2% of households in the District do not have access to a car or van, compared to 25.8% nationally. Use of the car to get to work is also above the national average, with approximately 45% of the South Bucks population commuting by car.

As outlined within LTP3, despite a ratio of jobs to working residents of nearly one in the local area, commuting levels both in and out of the District are high. SBDC's Accessibility & Infrastructure Study[29] highlighted that approximately 64% of South Bucks working population travelled out of the District to work (primarily to Slough and Hillingdon, including Heathrow Airport). According to the 2001 Census, twice as many South Bucks residents travelled 20-40km to work as the national average. Furthermore, of those working in the District, a similar proportion travelled in from elsewhere (primarily Slough and Wycombe).

A dominant level of out-commuting is also highlighted as a key challenge in the Chiltern District. The commuting pattern from Amersham in particular is strongly dominated by the flow outwards to London, with significant volumes also recorded to the south of the county and other urban centres outside the District including Slough, Reading and Wokingham[30]. The average trip length for the journey to work from Amersham is stated to be 18.7 km.

Limited north-south connectivity within the south of the county, in conjunction with the relative prosperity and commuting patterns of the South Bucks and Chiltern Districts, places increasing pressure on routes such as the A355. As outlined above, the A355 provides the main north-south route in South Bucks and access to the strategic road network for onwards connections. Local experience also suggests that conditions on the strategic A413, M25 and M40 corridors can influence journey routing patterns, further increasing the potential for through-trips on the A355 and rat-running through adjacent residential areas.

3.3.4 Journey Time and Delay

The 2013 base year traffic model reflects current traffic conditions, and has been used to establish journey times for a selection of routes on and around the A355 in Beaconsfield. The routes and modelled journey times for the AM and PM peaks are presented in Table 3-2 below. Average journey times reflect the typical volumes of traffic and tidal patterns of flow observed. Maximum journey times are considerably higher and are indicative of journey time variability.

[28] *ONS, 2011. Neighbourhood Statistics.* http://www.neighbourhood.statistics.gov.uk/dissemination/

[29] *SBDC, 2006. Accessibility & Infrastructure Study Main Report.* http://www.southbucks.gov.uk/includes/documents/cm_docs/2009/a/accessibility_infrastructure_study.pdf

[30] *Land Use Consultants, 2007. Chiltern District Travel to Work Study.* http://www.chiltern.gov.uk/CHttpHandler.ashx?id=1659&p=0

No	Description	AM Peak (08:00-09:00) Time (mm:ss)		PM Peak (17:00-18:00) Time (mm:ss)	
		Ave	Max	Ave	Max
1	NB: Pyebush Rbt to Ledborough Ln / Longbottom Ln Crossroads	02:51	06:27	03:10	04:52
2	SB: Ledborough Ln / Longbottom Ln Crossroads to Pyebush Rbt	06:38	18:35	03:09	04:54
3	EB: London End / Aylesbury End / Wycombe End Rbt to Pyebush Rbt	04:16	09:37	03:00	06:47
4	WB: Pyebush Rbt to London End / Aylesbury End / Wycombe End Rbt	02:13	08:58	01:58	04:31

Table 3-2 : 2013 AM and PM peak modelled journey times

Figure 3-9 presents the AM peak hour link speeds (in kilometres per hour) along the A355 and surrounding roads in Beaconsfield. The link speeds are colour coded, with darker colours reflecting slower speeds and greater levels of congestion. The link speeds also reflect the impact of traffic calming measures and different speed limits. Figure 3-10 presents the same information for the PM peak.

The London End roundabout is widely cited as a congestion hotspot, with evidence from a number of studies suggesting it is at or over capacity during peak times. Significant queuing is reported at 3 of the arms (A355, A40 London End and A40 London Road), resulting in considerable delay to vehicles.

In the AM peak period, Figure 3-9 shows reduced vehicle speeds on the A355 southbound, indicating significant queues on the approach to London End roundabout. These queues relate to the high volumes of conflicting movements and limited capacity at the junction. Driver behaviour and the resulting performance of the junction is further influenced by the volume of U-turns performed as a result of those wishing to turn right from Lakes Lane. Average off-peak (or free flowing) journey times on this route are 2 minutes and 37 seconds, indicating an additional 3 and a half minutes on average journey times (with maximum journey time 6 and a half minutes greater). On-site observations show that queuing on the A355 southbound is more severe than conveyed Figure 3-9 with vehicle queues extending back to the Ledborough Lane / Longbottom Lane junctions.

The A40 London End eastbound approach experiences congestion in the offside lane, catering for straight ahead movements towards the A40 London Road, throughout the peak hour. Congestion also occurs on the A40 in a westbound direction, primarily due to delays related to constraints on London End including issues relating to parking. Compared to off-peak (or free flowing) journey times, average AM peak journey times on the A40 are 2 minutes greater eastbound (with off-peak journey times of 2 minutes 10 seconds) and half a minute greater westbound (with off-peak journey times of 1 minute 35 seconds).

A number of side road links are also shown to experience slow speeds in the AM peak, associated with traffic volumes and queues on the A355 contributing to difficult egress conditions. There is anecdotal evidence that this is representative of conditions on side roads up to and including Ledborough Lane.

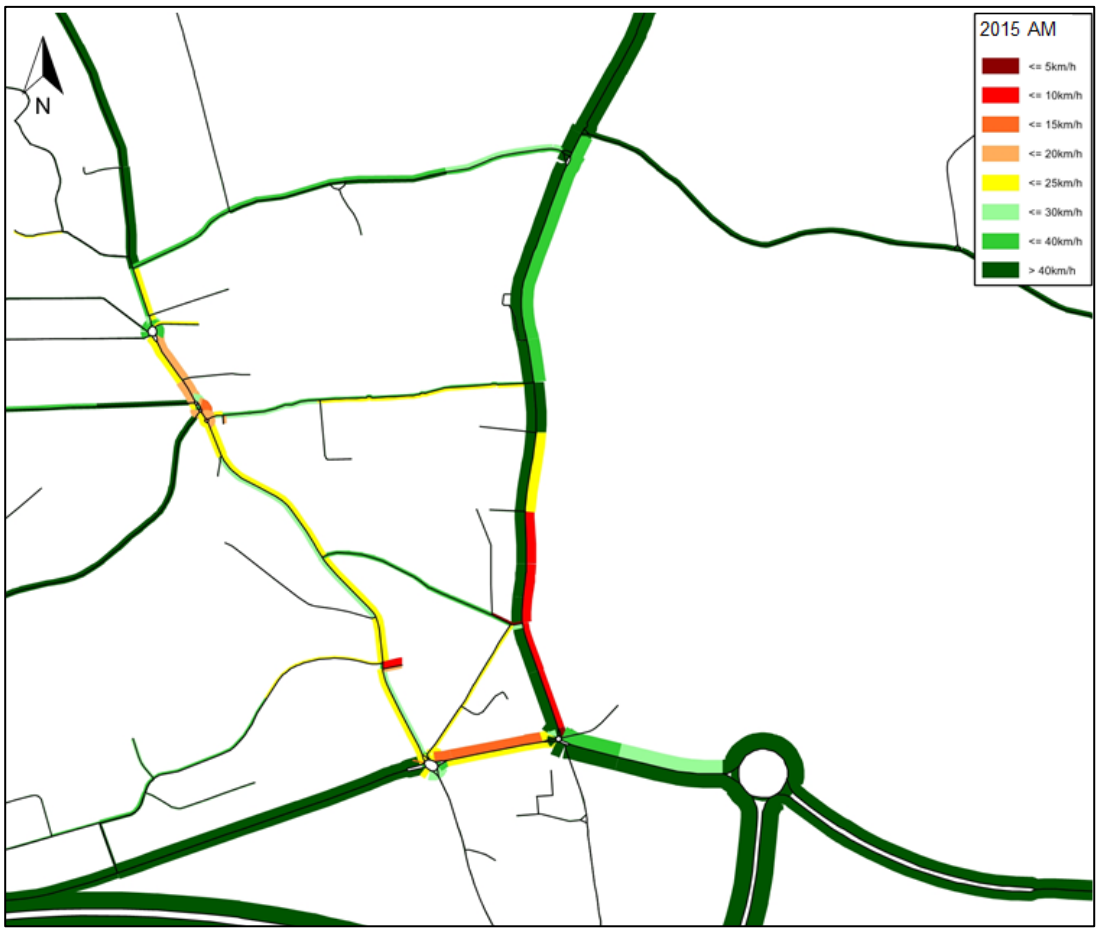

Figure 3-9 : 2015 AM Peak Hour Link Speeds

Figure 3-10 presents link speeds (in kilometres per hour) for the PM peak hour.

This illustrates that the A355 southbound is relatively free flowing during this period, and overall congestion is less than that for the AM peak. However, the issues on the approach to London End roundabout from London End remain, and delays are significant throughout the PM peak. When compared to off-peak (or free flowing) conditions, average journey times on the A40 eastbound are nearly a minute greater (with maximum journey times over 4 and a half minutes greater).

Figure 3-10 : 2015 PM Peak Hour Link Speeds

The Gore Hill roundabout is also highlighted as a bottleneck, with LTP3 classifying the A355 between Beaconsfield and Amersham as an Interurban 'Priority Congestion Management Corridor'. Analysis undertaken within the CATS study revealed significant journey time variations at the junction and anecdotal reports of queuing on the approaches. As a result, rat-running on adjacent roads through Coleshill is stated to occur.

In Amersham, the performance of Gore Hill roundabout has been assessed in detail, with the level of vehicle queuing for each arm of the junction shown in Table 3-3.

Arm	AM Peak (08:00-09:00)		PM Peak (17:00 – 18:00)	
	Average Queue (m)	Mean Max Queue (m)	Average Queue (m)	Mean Max Queue (m)
A413 (west)	127	295	1	17
A355 Gore Hill (north)	33	96	2	22
A413 (east)	2	26	5	41
A355 Gore Hill (south)	1	23	134	313

Table 3-3 : 2014 AM and PM peak queue lengths at Gore Hill roundabout

The modelling results in Table 3-3 show that in the AM peak, the Gore Hill junction is approaching operational capacity, with queuing evident on the A413 approach from the west and Gore Hill approach from the north. In

the PM peak, there is queuing on the Gore Hill approach from the south and a small delay on the A413 approach from the east. The queue patterns shown in the modelling results are similar to on site observations that have been made for this junction during the peak periods.

The performance of the Ledborough Lane and Longbottom Lane priority junctions has also been assessed. The level of queuing is shown in Table 3-4 below.

Arm	AM Peak (08:00-09:00)		PM Peak (17:00-18:00)	
	Average Queue (m)	Mean Max Queue (m)	Average Queue (m)	Mean Max Queue (m)
Ledborough Lane (left turn)	3	27	1	13
Ledborough Lane (right turn)	2	21	1	12
Longbottom Lane (left turn)	1	17	1	9
Longbottom Lane (right turn)	1	8	0	2

Table 3-4 : 2014 AM and PM peak queue lengths at Ledborough Lane and Longbottom Lane junctions

In the AM peak, the longest queues are on the Ledborough Lane approach for both left turning and right turning traffic. The PM peak shows a similar pattern to the AM peak, with the largest queues evident on the Ledborough Lane approach. Overall, queue lengths in the PM peak are smaller than those in the AM peak.

If congestion on the road network becomes severe it is possible that in some instances queues can extend beyond the extents of the modelled network. Queuing that occurs beyond the model extent is not recorded in the results. However, the number of vehicles unable to join onto the network, from each of the approaches in the time period, is recorded as unreleased vehicles. The results in Table 3-4 show that there are no unreleased vehicles in the 2014 Base year scenarios in either the AM or PM peak periods.

3.3.5 Road Safety

Analysis of collision data provided by BCC, for Gore Hill roundabout and the A355 / A40 Beaconsfield from Ledborough Lane / Longbottom Lane junctions to Pyebush roundabout is included in Table 3-5 for the five-year period up to December 2014.

Collisions Involving	A355 / A40 Beaconsfield			Gore Hill roundabout		
	Fatal	Serious	Slight	Fatal	Serious	Slight
Motor Vehicles only (excluding 2-wheels)	1	1	35	1	1	13
2-wheeled motor vehicles	0	2	4	0	0	2
Pedal cycles	0	1	1	0	0	1
Horses and other	0	0	0	0	0	0
Total	1	4	40	1	1	16

Table 3-5 : Collision data for five year period up to December 2014

Analysis indicates a total of 63 collisions recorded within the study area. The locations of these collisions can be seen in Figure 3-11, Figure 3-12 and Figure 3-13.

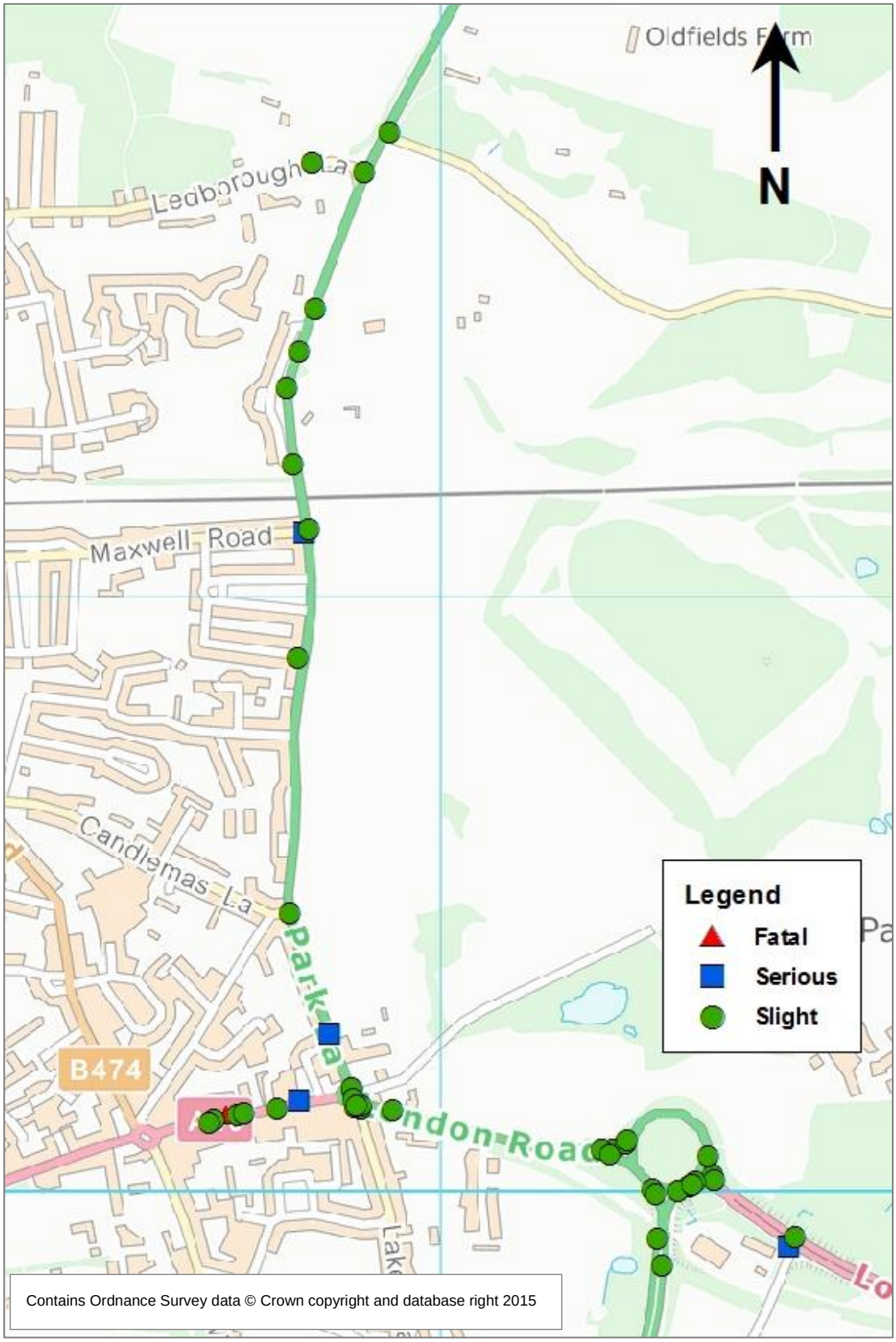

Figure 3-11 : Collision data for A355 / A40 Beaconsfield

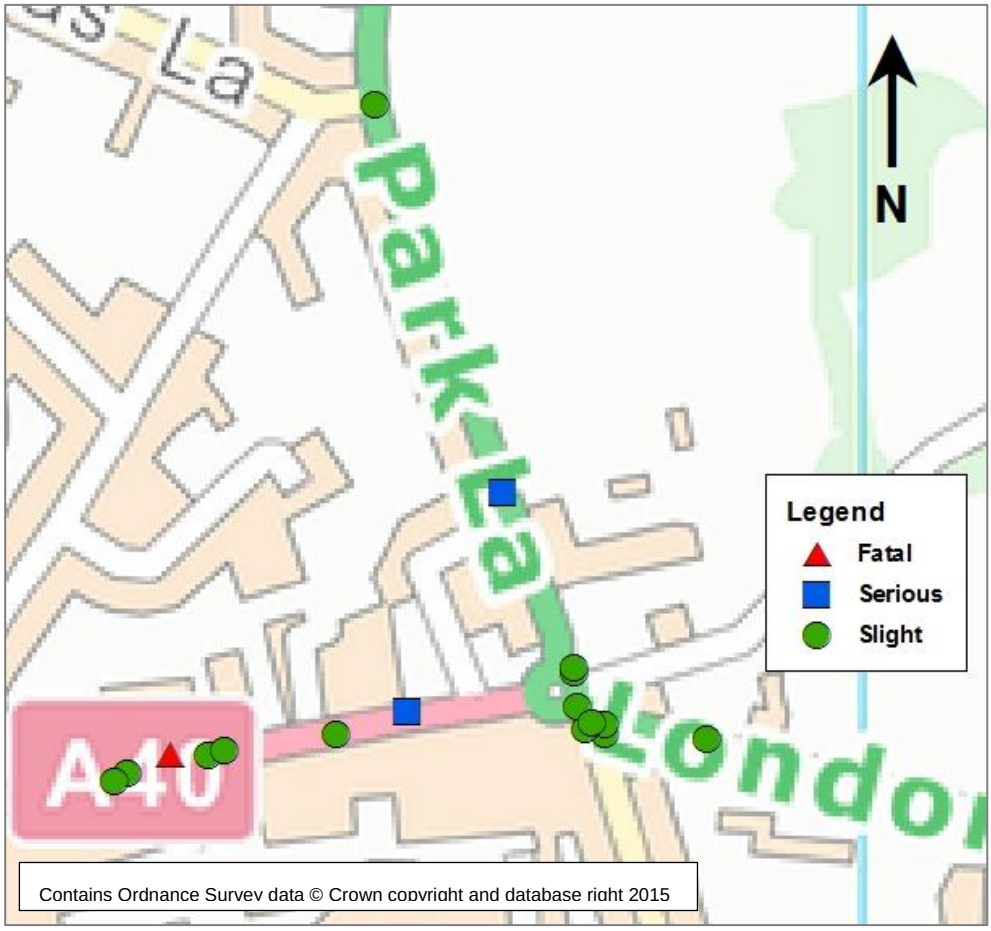

Figure 3-12 : London End Roundabout Collision Data

Of the 45 collisions that occurred in the A355 / A40 Beaconsfield study area, 1 (2%) is classified as fatal, 4 (9%) serious and 40 (89%) as slight. The fatal collision occurred on the A40, west of the London End junction. High densities of vehicular collisions can be seen at the London End Road roundabout and the Pyebush roundabout.

The analysis for the Ledborough Lane / Longbottom Lane junctions show that there have been a total of 3 reported collisions in the vicinity (20 metres) of these junctions, over the 5 year period, with all of the collisions categorised as slight. There are significantly fewer recorded collisions at the Ledborough Lane / Longbottom Lane junctions than at both the London End and Gore Hill roundabouts.

At Gore Hill roundabout there is a total of 18 reported collisions (one of these collisions was fatal, one was serious and 16 were slight). The fatal collision occurred on the A413 westbound, west of Gore Hill roundabout. It is also worthy of note that 7 of the 18 collisions that occurred at this location were on the Gore Hill (south) approach to the roundabout.

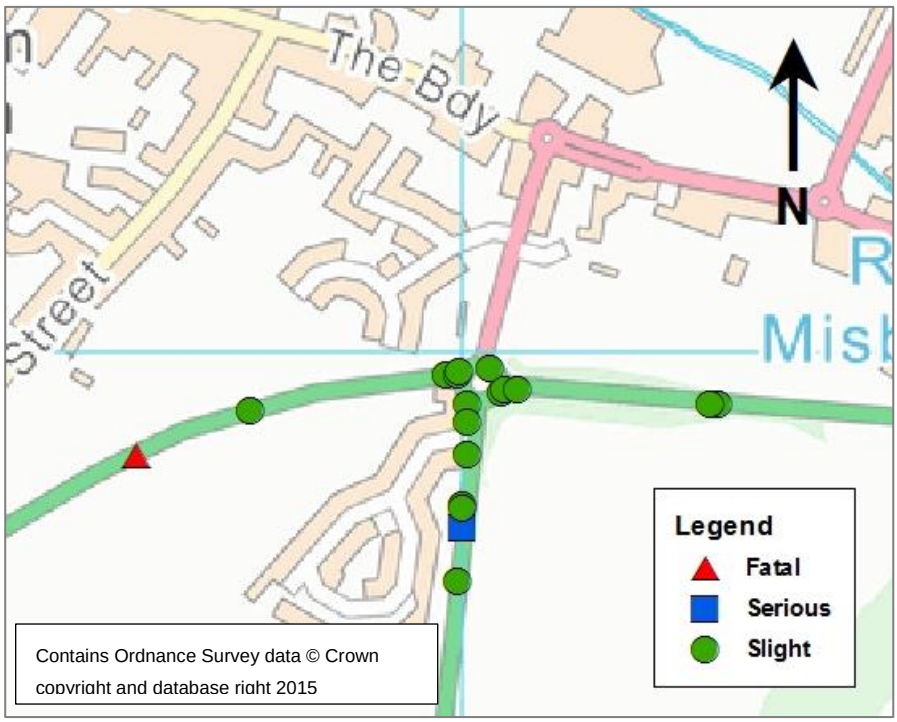

Figure 3-13 : Gore Hill Collision Data

As outlined within SBDC's LDF Transport Paper[16], there is a perceived road safety concern at London End Roundabout, associated with traffic volumes and the junction arrangement. The collision data shows that collisions have occurred on the London End roundabout and also on the approach arms to the roundabout.

It is noted that BCC only has access to collisions that have resulted in injury; details of damage only collisions are not generally available because they are not comprehensively reported. It is therefore likely that the recorded collision data is an underestimation of the actual number of collisions.

3.3.6 Air Quality

The most recent air quality assessment[31] demonstrated that air quality in the South Bucks District is generally good. Owing to its largely rural nature, the only significant sources of pollution are the motorways (M25, M40 and M4) which pass through the district. SBDC declared an Air Quality Management Area (AQMA) comprising these and adjacent land in 2004.

Within Beaconsfield, there are local concerns of deteriorating air quality owing to queuing and stationary traffic, in particular on the A40 London End. Similarly within the Chiltern District, whilst Amersham is not within a designated or planned AQMA, there are concerns regarding air quality at localised hotspots, including the Gore Hill roundabout junction.

3.4 Public Transport

3.4.1 Rail

Beaconsfield station is just over 1.6 km from the London End roundabout, located within the centre of the New Town on the B474 Station Road/Penn Road.

[31] *SBDC, 2012. 2012 Air Quality Updating and Screening Assessment for South Bucks District Council.* *http://www.southbucks.gov.uk/includes/documents/cm_docs/2013/a/airqualityupdatingandscreening_assessment2012.pdf*

The station is on the Chiltern Main Line, which runs between Birmingham and London Marylebone, via High Wycombe. Typical service patterns include six trains per hour, including three to London with journey times of 25 minutes for some services; and additional services during the peak periods. The services provide frequent and convenient rail links to a number of key employment areas, but only on an east-west axis. According to the Office of Rail Regulation (ORR)[32] there were 1.4 million entries and exits at the station in 2011-12; compared to 2010-11 figures this represents a 4% increase and equates to approximately 4,000 entries and exits, on average, daily at the station[33]. According to the Beaconsfield Station Travel Plan[33], 60% of season ticket holders live within Beaconsfield. Across South Bucks, just over 8% of residents travel to work by train which is slightly higher than the national average[28].

Amersham station is situated around 1.7km north of the Gore Hill roundabout along the A416 Station Road. The station is a terminus of the London Underground's Metropolitan Line and is also served by Chiltern Railways, which runs trains between London Marylebone and Aylesbury with journey times to Central London between 33 and 60 minutes. ORR figures reveal annual totals of 2.1 million and 1.78 million entry and exits for the London Underground and railway station respectively.

3.4.2 Bus

As outlined within the Evaluation of Transport Impacts report, the South Bucks District is reasonably well served in terms of bus routes. Current services provide links between the major conurbations; however, services do reduce in the evenings and weekends. Services to more rural areas of the district are also more limited, operating on restricted timetables that do not allow for flexibility.

Beaconsfield is currently served by a network of eight bus routes, as outlined in Figure 3-14 below.

[32] *ORR, 2013. Estimates of Station Usage. http://www.rail-reg.gov.uk/server/show/nav.1529*
[33] *Sustrans, 2013. Beaconsfield Station Travel Plan – Draft.*

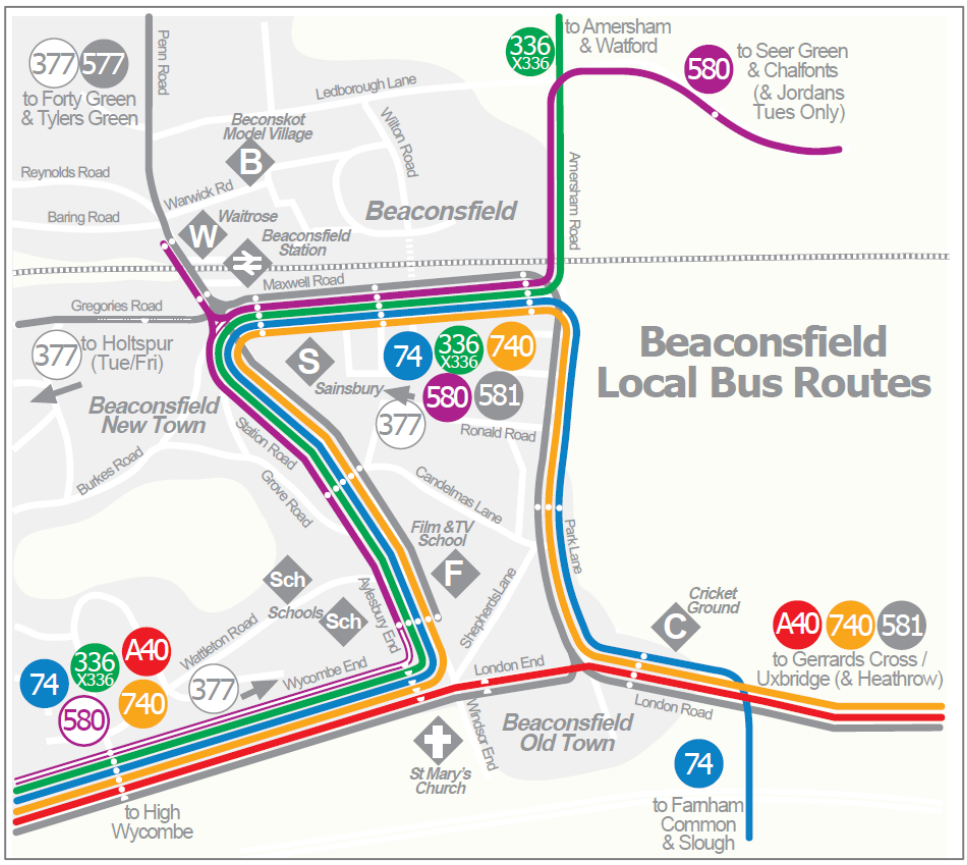

Figure 3-14 : Beaconsfield Local Bus Routes

Regular bus services, with typical headways every 30-60 minutes, as well as a number of more infrequent services operate to neighbouring towns, such as High Wycombe, Gerrards Cross and Amersham, and to transport and employment centres outside of Buckinghamshire including Slough, Uxbridge and Heathrow. The routes also offer connections throughout Beaconsfield, between residential areas, the town's centre and rail station.

The services principally operate along the A40, A355 Park Lane, B474 Station Road and Maxwell Road; as a result of queuing traffic and congestion on these routes, bus punctuality, journey reliability and journey times can suffer. In a bid to improve the reliability of its services, Carousel, which operates the majority of bus routes throughout South Bucks, signed up to a Punctuality Improvement Partnership (PIP) at the end of 2013. Arriva signed a similar agreement in 2009. Despite the local and regional connections offered, however, bus patronage is relatively low with only around 1.5% of work journeys made by South Bucks residents by bus[28].

3.5 Non-motorised Users

3.5.1 Cycling

Cycling currently makes up less than 1% of journey to work trips within the Beaconsfield area[28]. The use of cycling as a mode of travel is limited by a lack of signing and infrastructure provision for cyclists. More significantly, however, is the pattern of journey to work trips in the area, which is predominantly characterised by longer distance journeys where cycling is unlikely to offer a reasonable alternative to the private car. Notwithstanding this, there is a strategic and local aspiration to develop a network of cycle routes across Beaconsfield in order to encourage and facilitate cycling, not only for commuting, but also for school journeys and leisure purposes.

In December 2011 the Beaconsfield Cycle Paths Action Group (BCP) was established, a community and school-led campaign with the aim to begin the process of the funding and eventual construction of a cycle network for the town[34]. In 2012, BCC joined an 'Access to Stations' partnership bid with Sustrans and other Local Authorities for the second tranche of the Government's Local Sustainable Transport Fund (LSTF). Following a successful LSTF bid, work is now taking place on developing and implementing initial plans put forward by the BCP, suggesting there is potential for expansion of the number of cycling trips within the area. By highlighting and improving the travel options available to rail users, the project also aims to support the local economy by tackling congestion and reducing journey times[35].

3.5.2 Walking

Although Beaconsfield is situated on the edge of the Chiltern Hills, the town itself lies on a small plateau and is therefore relatively flat and conducive to walking. According to the 2011 Census, 7% of people travel on foot as part of their journey to work within the Beaconsfield area. The potential for walking as a transport mode for local trips is good given the size and topography of the area.

Within Beaconsfield, footways are present along most of the town centre and residential roads; there are also a number of footpaths and other public rights of way (PROWs) that extend in to the surrounding Area of Outstanding Beauty (AONB). Footways are present along the A355 itself within the more urban areas. The volume and proximity of motor traffic, however, can act as a deterrent to pedestrians. The London End Roundabout in particular is highlighted as a busy and often congested junction within the draft Wilton Park SPD, which forms a hostile environment for pedestrians and cyclists who find it difficult to cross the A355.

3.6 Opportunities and Constraints

The physical, legal and institutional constraints, and the opportunities affecting the A355 and surrounding area, are outlined in the following sub-sections in order to assist the identification and development of any potential transport options available.

3.6.1 Physical Constraints

The A355 runs north-south primarily through a rural and wooded setting; a summary of the landscape and environmental constraints that this presents is provided below. Full details are available in the supporting Preliminary Environmental Assessment Report[36].

Cultural Heritage

Beaconsfield Old Town was originally designated a Conservation Area in 1969, with boundary alterations taking place in 2006[37].

The Conservation Area encompasses the London End roundabout and a proportion of the A355 as depicted in Figure 3-15. Within the Conservation Area there are a number of Listed Buildings, primarily lining the two arterial roads (the A40 and B472).

[34] *Beaconsfield Cycle Paths Action Group* http://www.beaconsfield-cycle-paths.org.uk/content/about-beaconsfield-cycle-paths-action-group
[35] *BCC, n.d. Cycle to the Station.* http://www.buckscc.gov.uk/environment/sustainability/sustainable-travel/cycling/cycle-to-the-station/
[36] *Jacobs, 2014. A355 Improvements (Gore Hill / Wilton Park) Preliminary Environmental Assessment Report.*
[37] *SBDC, 2008. Beaconsfield Old Town Conservation Area Character Appraisal.* http://www.southbucks.gov.uk/includes/documents/cm_docs/2009/a/april_2008.pdf

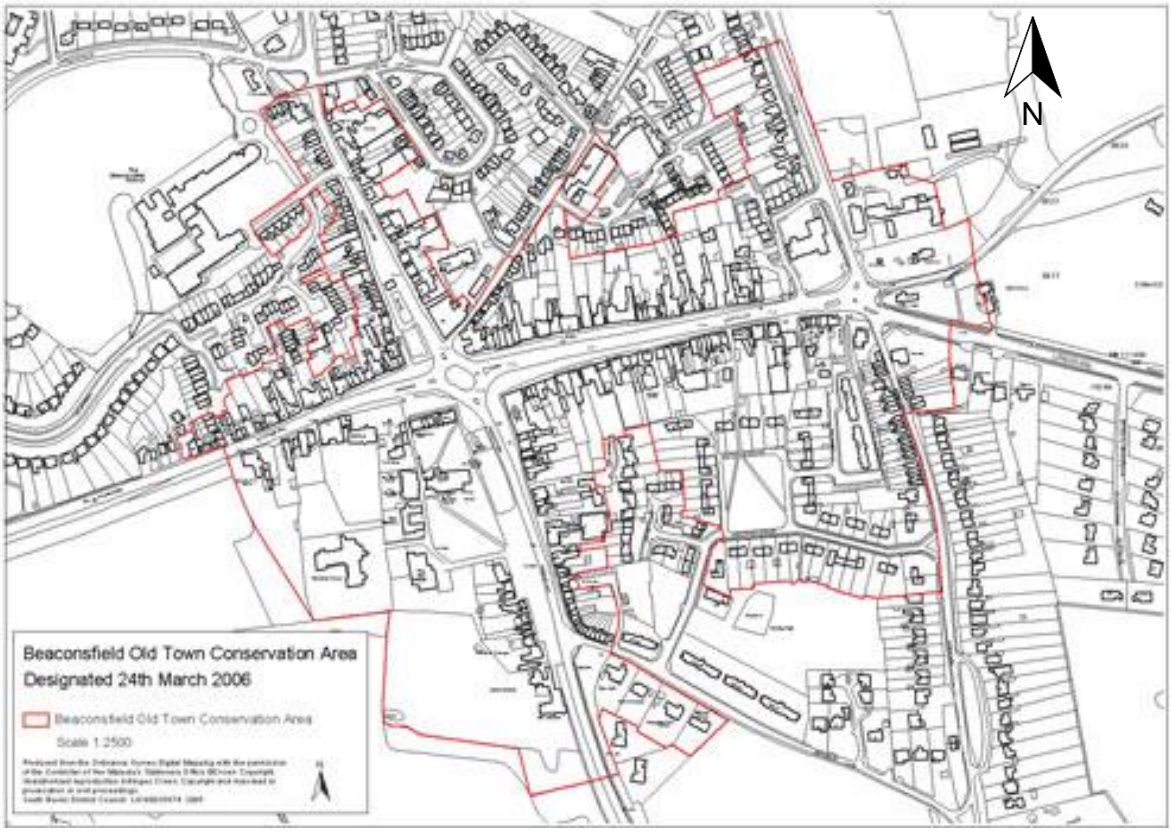

Figure 3-15 : Beaconsfield Old Town Conservation Area Map (Source: SBDC)

Also of note is the nearby Scheduled Monument known as 'The Mount'[38], which is a Bowl barrow on Beaconsfield golf course. A Grade II* Registered Park and Garden called Hill Barn[39] is also located approximately 750m to the south-west of Pyebush roundabout.

Beaconsfield Old Town Conservation Area, Hill Barn Registered Park and Garden, and the nearest Listed Buildings and Scheduled Monuments are shown on the Environmental Constraints Plan in Appendix A of the Preliminary Environmental Assessment Report.

Construction within previous undisturbed land within the Beaconsfield study area has the potential to wholly or partially remove any unknown archaeological remains that may be present. There is some potential for adverse impact as a result of increased noise and visual intrusion.

The A355 alignment at Beaconsfield is forecast to reduce the volume of road traffic travelling adjacent to the Beaconsfield Conservation Area, resulting in a beneficial impact as a result of a reduction in noise and visual intrusion during operation.

In terms of local heritage at the Gore Hill roundabout, the junction is within 300m of a cluster of Listed Buildings within Old Amersham.

The proposed improvement works at Gore Hill and at the Ledborough Lane / Longbottom Lane junction are envisaged to be located within the existing highway boundaries. The construction of existing infrastructure is likely to have truncated or removed any existing archaeological remains. As a result no potential impact on archaeological remains has been identified during construction of these scheme elements. No impacts are predicted for historic buildings during operation at this location.

[38] *BCC, n.d. Unlocking Buckinghamshire's Past.* https://ubp.buckscc.gov.uk/SingleResult.aspx?uid='MBC533'
[39] *SBDC, n.d. Registered Historic Parks and Gardens.* http://www.natureonthemap.naturalengland.org.uk/

Landscape

Beaconsfield is located in the Chiltern Hills, just outside the Chilterns AONB and within the Thames Valley National Character Area[40] which includes fragmented agricultural land and woodland. Beaconsfield also comprises Higher Level Stewardship Land and Greenbelt land. There are good views of the open area to the east of the A355 (Amersham Road) for residents and pedestrians using footpaths BEA/15/1, BEA/15/2 and BEA/16/1 in particular.

During operation the Proposed Scheme and any associated lighting will have an urbanising effect on views from the surrounding visual receptors identified, the landscape character and the wider landscape setting. It will also slightly reduce the openness of this localised part of the Green Belt. The Proposed Scheme will potentially result in loss of vegetation, which will alter the landscape character of the immediate area during operation and potentially exacerbate the visual prominence of highway infrastructure.

Further north the Gore Hill roundabout falls within the Chilterns AONB, Greenbelt land and Higher Level Stewardship Land. Any modifications to the junction must therefore retain the open character of the local area.

The proposed junction improvements will be set within the context of the existing highway, and it is unlikely that they will cause significant landscape and visual effects. It is likely that the proposed junction improvements will have very localised operational landscape impacts on the Chilterns AONB because the changes will be set within the context of the existing highway infrastructure.

Ecology and Nature Conservation

There are no nearby Sites of Special Scientific interest (SSSI) or Local Nature Reserves (LNR). Burnham Beeches Special Area of Conservation (SAC)[41], however, is located approximately 2.5km to the south of Pyebush roundabout.

There is the potential for legally protected and notable species to be active within land adjacent to the A355 corridor. A Phase 1 habitat survey by a qualified ecologist would be required to determine the presence of such species.

Geology and Soils

The underlying geology is chalk and the soil is predominately a gravelly loam with pockets of clay in the area, which can impede drainage. In terms of groundwater, the local area is within Groundwater Source Protection Zone (SPZ) 3[42], i.e. all groundwater recharge is presumed to be discharged at the source. The Gore Hill junction is within groundwater SPZ 1.

The temporary impacts associated with construction for Geology and Soils can be generally managed through the EMP. There are no current operational impacts in relation to Geology and Soils.

As part of the highway design process site investigation is needed to better assess the extent of possible soil contamination and groundwater contamination and whether specific remediation may be required. Both construction and operational impacts for Geology and Soils will be reassessed if the site investigation results identify potential sources of contamination and an appropriate mitigation and remediation strategy will be developed.

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[40] *Natural England, 2013. Thames Valley.* http://www.naturalengland.org.uk/publications/nca/thames_valley.aspx

[41] *Joint Nature Conservation Committee, 2011. Burnham Beeches.* http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0030034

[42] *Environment Agency, 2013. Groundwater source protection zones.* http://www.environment-agency.gov.uk/homeandleisure/37833.aspx

Contaminated Land

In the surrounding area there are a number of historic landfill facilities, agricultural land use and potential sources within the Wilton Park Opportunity site (including a former rubbish tip; petrol/oil/lubricant storage in various locations; an incinerator; and asbestos in buildings), which may have impacts in terms of contaminated land. The Gore Hill junction is within a surface water Nitrate Vulnerable Zone.

Water Environment

Whilst there are no river systems present within the vicinity of the A355 in Beaconsfield, there are a number of isolated ponds, with a large pond just to the south of Minerva Way.

Surface Water Flood risk

The Environment Agency flood maps show an area at risk of flooding from surface water within the study area. It is likely that the Proposed Scheme will cross the areas shown to be at high risk (Environment Agency, 2014). The clay soils underlying the southern section of the Proposed Scheme are classed as slowly permeable. The impeded drainage could cause overland flow where soils are compacted. The northern section of the proposed route is underlain by freely draining, slightly acid loamy soils (Cranfield University, 2014).

Flood Risk from Other Sources

There is no significant likelihood of flood risk from reservoirs or canals in this area.

The study area is rural in character and therefore is thought to be at low risk of sewer flooding. The eastern side of Wilton Park and Minerva Road however will have services associated with them and therefore could present a risk of flooding from sewers and water mains. The general slope of the land in this area is to the south-west towards the A40/A355 road junction.

The Gore Hill junction is situated approximately 400m to the south of the River Misbourne and is outside of the flood risk zone.

The Proposed Scheme is unlikely to have a significant environmental effect in terms of the impact on flood risk. However, a flood risk assessment will be required as part of the planning process for statutory compliance. This will be undertaken separately to the EIA but will be reported in the Environmental Statement.

3.6.2 Institutional or Legal Constraints

Institutional or legal constraints which are important to consider are outlined below.

Common Land

There is over 1.5 hectares of common land within Beaconsfield, primarily lining the A40 and B474, over which there is a ‘right to roam’. SBDC are the managers of the common land which is owned in part by BCC and in part by Hall Barn Estates. The common land currently provides free parking for approximately 425 cars along London End, Windsor End, Aylesbury End and Wycombe End.

3.6.3 Opportunities

Wilton Park Opportunity Site

Wilton Park is a 37.5 hectare site located to the east of Beaconsfield. It is designated within the South Bucks Core Strategy as an Opportunity Site, which establishes the policy framework for the site’s comprehensive redevelopment.

The site will require a new means of vehicular access; the use of Minerva Way is not deemed acceptable for general vehicle access. The Core Strategy and adopted SPD expect this to be taken as a fourth arm from the Pyebush Roundabout, and to be constructed in such a way that lends itself to forming the first stage of an A355

Relief Road. The first phase of the Relief Road / Wilton Park access has now been granted planning permission (Ref:14/01467/FUL). This section of road extends from the A40 Pyebush Roundabout to the northern boundary of Wilton Park site. The provision of a new access to the site also offers the opportunity for Minerva Way to become a more attractive and safer direct link between Wilton Park and Beaconsfield for public transport, pedestrians and/or cyclists. The Core Strategy states the redevelopment of the site should provide improved local access to Beaconsfield, environmental enhancements, recreational opportunities and new housing and employment accommodation.

The redevelopment of the Wilton Park site offers potential transport opportunities for further consideration/development. Any transport interventions along the A355/surrounding area, however, also provide the opportunity to further integrate the site with the Beaconsfield urban area, reducing local severance and accessibility issues.

Sustainable Transport Initiatives

Transport interventions should be developed in line with work currently being undertaken by the BCP and Sustrans, to support local aims and have positive impacts on the provision of a cycle network across Beaconsfield.

Environmental Enhancements

Through addressing congestion and associated issues on the A355, there are opportunities to contribute positively to the local environment, preserving and enhancing conditions within the Beaconsfield Old Town Conservation Area and Chilterns AONB.

3.7 Summary

This section has set out evidence which describes the current supply and demand for transport within the Beaconsfield area and along the A355 corridor. The evidence is based on observed data and validated transport modelling tools, and reflects the current typical transport volumes, journey patterns, journey time, delay and queuing.

The A355 provides the main north-south route through the South Bucks District, connecting Amersham and the A413 in the north to the M40 and on to Slough in the south. It aligns to the eastern edge of Beaconsfield and is a major influence on the transport conditions in the area, providing for longer distance journeys to the north and south as well as east-west via the strategic road network. The District has higher than average levels of car ownership and use and commuting levels both in and out of the District are high.

The A355 is understood to experience congestion at peak times, with reduced link speeds and increased vehicular delays in particular at the London End roundabout and Gore Hill roundabout. The high traffic volumes and queues on the A355 contribute to difficult egress conditions for side roads on this route notably at the Ledborough Lane and Longbottom Lane junctions with the A355.

4. Future Situation

4.1 Introduction

This section provides an assessment of the forecast transport conditions along the A355 corridor and surrounding area. The data in this section is derived from the 2031 Do Minimum A355 Beaconsfield Forecast Model and also the stand alone junction models at Gore Hill and Ledborough / Longbottom Lane. The details of which are presented in section 4.2 below.

4.2 Forecast Model Development

4.2.1 A355 Beaconsfield Forecast Model

Forecast year scenarios have been developed to assess the likely future 'without intervention' situation. Using the 2013 traffic model as a base, a forecast model based on a horizon of 2031 has been produced. This forecast year is consistent with the timeframe for BTVLEP's 2012 - 2031 Growth Strategy.

The 2031 Do Minimum scenario includes traffic growth associated with all 'committed' forecast land uses. These were identified through reviewing:

- sites with planning permission
- sites that do not yet have planning permission, but are approved in principle, subject to the completion of a Section 106 or planning obligation agreement
- sites consistent with the Core Strategy expected to come forward within the period defined within the current plans (to 2026)

From the above, the most significant land use development is the Wilton Park Opportunity Site in Beaconsfield, which includes provision for around 300 dwellings (with a potential range of plus or minus 50), commercial floor space (likely to comprise B1 office accommodation and for modelling purposes assumed to be 1000m^2) and a community hub of between 1,500 and 2,000 m^2 gross external area. The TRICS database was interrogated to provide trip rates and absolute trip generation estimates for this development.

In addition, there are a number of smaller development sites, and sites outside of the study area. The highway trip growth due to these additional developments is assumed to be captured in the TEMPRO (version 6.2) background growth rates. The overall level of growth forecast in the 2031 Do Minimum scenario is consistent with TEMPRO growth rates.

4.2.2 Gore Hill / Ledborough Lane Forecast Models

For the stand-alone junction models that have been created for Gore Hill roundabout and Ledborough Lane / Longbottom Lane priority junctions, the junction model described in section 3.2 has been used as a basis for developing a forecast scenario.

A 2031 Do Minimum scenario has also been developed to establish the likely future traffic conditions at these junctions. The level of growth has been taken from the National Trip End Model (NTEM) via the TEMPRO database.

The traffic model and stand-alone junction models do not forecast the re-assignment of traffic from one route to another as a result of increasing levels of congestion in the wider area. Therefore, the assessment assumes journey patterns would remain consistent with current observed conditions. Furthermore, no assessment of suppressed or induced traffic is made as part of any forecast year or subsequent scheme assessment.

4.3 Highway Network

4.3.1 Traffic Volume

Figure 4-1 and Figure 4-2 shows the modelled link flow in the Beaconsfield area for the 2031 forecast year in the AM and PM peak periods respectively.

Figure 4-1 : 2031 Modelled Link Flow in Beaconsfield Area - AM Peak

Figure 4-2 : 2031 Modelled Link Flow in Beaconsfield Area - PM Peak

Figure 4-3 presents the forecast traffic volumes in the 2031 AM and PM peak hours. In terms of overall traffic growth for the Beaconsfield area, there is forecast to be an average increase in link flows of between 14.5% and 15% in the peak periods as a result of:

- New land use development generating new travel demand
- Changes in fuel price and income affecting travel choices
- Demographic factors including population age profiles which affect timing and purpose of travel

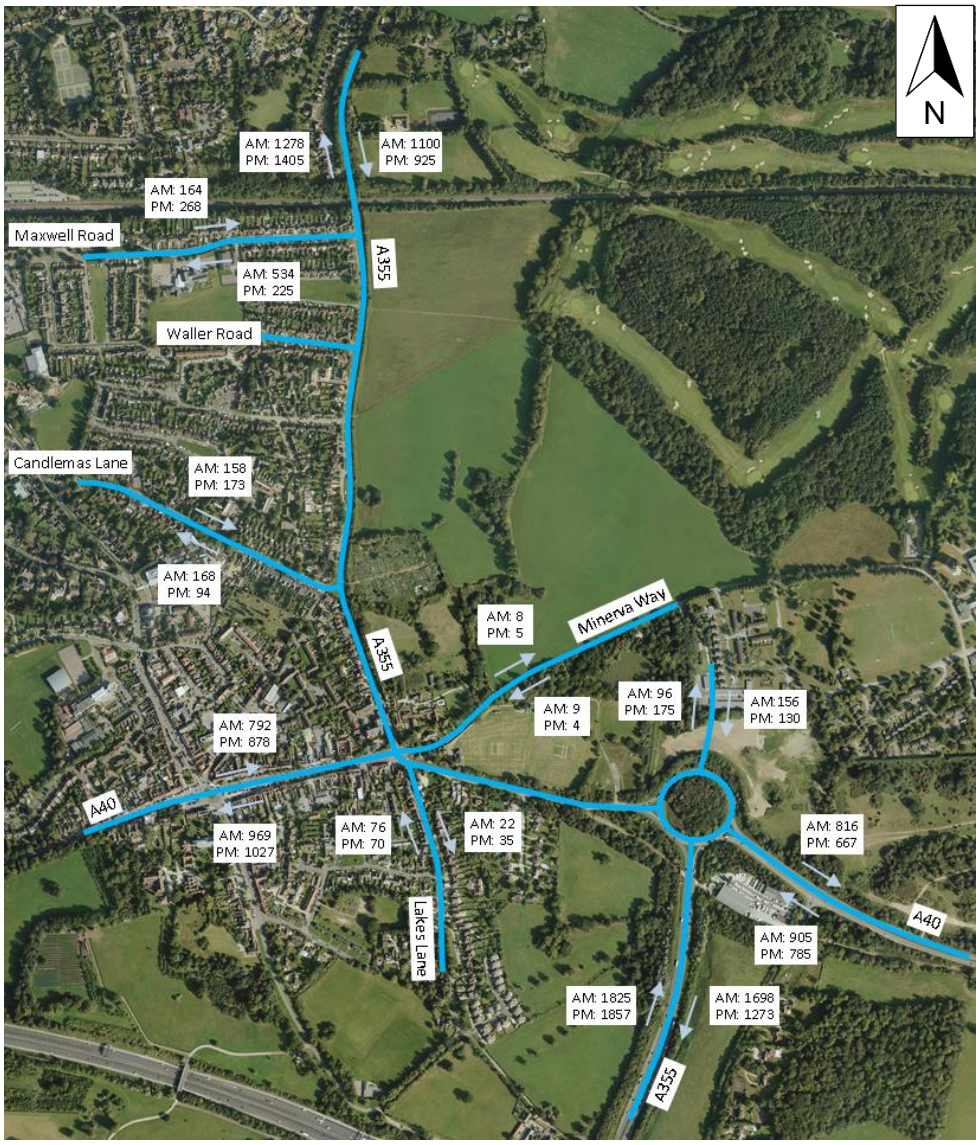


Figure 4-3 : 2031 Do Minimum Peak Hour Traffic Volumes

Within Beaconsfield, there are notable traffic volume changes across the network, arising in part as a result of the Wilton Park redevelopment and associated access alterations. As per the Core Strategy expectation, access to the site is in the form of a fourth arm from the Pyebush roundabout.

The largest traffic volume increases occur on the A355 between the M40 and Pyebush roundabout, with approximately 450 additional vehicles (two-way) in both the AM and PM peaks. On the A355 Park Lane/Amersham Road, traffic volumes are forecast to increase by between 250 and 320 vehicles per hour (two-way).

As a result of the Wilton Park access alterations, traffic volumes on Minerva Way reduce significantly to an assumed level of less than 10 vehicles per hour per direction related to local access requirements. On other local routes, traffic volume increases are limited to less significant levels, typically less than 50 vehicles per hour per direction, or just under 1 additional vehicle per minute, as a result of the overall growth forecast for the area.

The Ledborough Lane and Gore Hill areas are forecast to experience a growth in demand traffic on the network of approximately 15% and 20% respectively in both the AM and PM peak hours. Figure 4-4 and Figure 4-5 illustrate the AM and PM peak forecast traffic volumes.

Figure 4-4 : 2031 Peak Hour Traffic Volumes (Ledborough Lane / Longbottom Lane priority junctions)

The largest increase in traffic volume at the Ledborough Lane/Longbottom Lane priority junctions is the south to north movement on the A355. This movement is unopposed so is unlikely to see an increase in delay. However, an increase in flow on the main carriageway will reduce the capacity for movements turning into and out from the side roads, Ledborough Lane and Longbottom Lane, increasing delay for traffic performing these movements. This increase in traffic volume could have a negative impact upon the main carriageway if queueing vehicles, that are waiting to turn right into the side roads, block back onto the main carriageway.

Figure 4-5 : 2031 Peak Hour Traffic Volumes (Gore Hill roundabout)

At the Gore Hill roundabout junction the growth in demand traffic, between the 2014 and 2031 forecast years, is forecast to increase by 20% for the AM and PM peak periods. However, the modelled increase in total vehicle throughput at the junction has only increased by 8% in the AM peak and 9% in the PM peak. This is because many approaches to the roundabout are currently operating close to or over capacity in the 2014 scenario, confirmed against observed data. This means that any increase in vehicle flow is likely to result in a corresponding increase in delay at the roundabout.

4.3.2 Journey Patterns

The strategic journey patterns throughout the area are assumed to remain consistent with current observed conditions. A local shift associated with the redevelopment of Wilton Park, however, has occurred as a result of the revised access arrangements for the Wilton Park site.

The highest absolute changes in traffic volume are identified as being on the A355, with growth in both local and longer distance through trips. This increase in traffic volume would add additional pressure to the London End roundabout and Gore Hill roundabout junctions. An increase in traffic on the A355 is also likely to result in more difficult egress conditions from side roads. This could lead to a redistribution of traffic toward other less congested routes and access points to the A355. This may result in a greater increase of traffic volumes on sensitive local routes.

4.3.3 Journey Time and Delay

As traffic volumes increase by 2031, average peak hour journey times are also forecast to increase. Table 4-1 presents the 2031 Do Minimum forecast corridor journey times compared against the base year. The most significant increase in average journey times is experienced on the A355 southbound in the AM peak, increasing by an additional 4 and a half minutes. The increase in journey times is a result of the growth in traffic forecast on the road network in 2031.

No	Description	AM Peak (08:00-09:00) Journey time (mm:ss)			PM Peak (17:00-18:00) Journey time (mm:ss)		
		2013 Base	2031 DM	Time diff.	2013 Base	2031 DM	Time diff.
1	NB: Pyebush Rbt to Ledborough Ln / Longbottom Ln Crossroads	02:51	03:27	+00:36	03:10	04:21	+01:11
2	SB: Ledborough Ln / Longbottom Ln Crossroads to Pyebush Rbt	06:38	11:09	+04:31	03:09	06:08	+02:59
3	EB: London End / Aylesbury End / Wycombe End Rbt to Pyebush Rbt	04:16	04:47	+00:31	03:00	04:17	+01:17
4	WB: Pyebush Rbt to London End / Aylesbury End / Wycombe End Rbt	02:13	03:03	+00:50	01:58	03:22	+01:24

Table 4-1 : 2031 AM and PM peak modelled journey times

The model outputs in Table 4-2 compares the overall network performance for the 2013 Base and 2031 Do Minimum scenarios, for both the AM and PM peak periods. Average travel time and delay per vehicle are presented for the AM and PM peak periods respectively, as well as average network speed.

Performance Indicator	AM Peak (08:00-09:00)			PM Peak (17:00-18:00)		
	2013 Base	2031 Do Min	Diff. to 2013 Base	2013 Base	2031 Do Min	Diff. to 2013 Base
Average Speed (km/h)	31	22	-9	40	24	-16
Average Delay per vehicle (mm:ss)	01:49	03:19	+01:30	00:58	03:00	+02:02
Average travel time per vehicle (mm:ss)	04:01	05:27	+01:26	03:23	05:20	+01:57
Key	*Improvement compared to 2013 Base*			*Deterioration compared to 2013 Base*		

Table 4-2: Network Performance Indicators

4.3.4 Queue Length Data

Average queue lengths have been analysed for all approach arms at the Gore Hill roundabout and Ledborough Lane / Longbottom Lane junctions. Table 4-3 and Table 4-4 compare the modelled queue length data, between the 2014 and 2031 forecast year, for each of the approach arms at the Gore Hill roundabout for the AM and PM peak hours respectively.

The queue length results show a marked deterioration in traffic conditions particularly in the AM peak, with queue lengths increasing on the A413 eastbound approach and on the A355 Gore Hill southbound approach when compared against the 2014 Base year scenario. In the PM peak there is an increase in queue length experienced on the A413 approach from the east and both A355 approaches from the north and south.

Arm	2014 AM Peak (08:00-09:00)			2031 AM Peak (08:00-09:00)		
	Average Queue (m)	Mean Max Queue (m)	Unreleased Vehicles	Average Queue (m)	Mean Max Queue (m)	Unreleased Vehicles
A413 (west)	127	295	0	540	639	409
A355 Gore Hill (north)	33	96	0	137	250	12
A413 (east)	2	26	0	5	37	0
A355 Gore Hill (south)	1	23	0	10	57	0

Table 4-3 : 2014 AM and 2031 AM peak queue lengths at Gore Hill roundabout

Arm	2014 PM Peak (17:00-18:00)			2031 PM Peak (17:00-18:00)		
	Average Queue (m)	Mean Max Queue (m)	Unreleased Vehicles	Average Queue (m)	Mean Max Queue (m)	Unreleased Vehicles
A413 (west)	1	17	0	1	20	0
A355 Gore Hill (north)	2	22	0	9	63	0
A413 (east)	5	41	0	536	688	36
A355 Gore Hill (south)	134	313	0	426	631	301

Table 4-4 : 2014 PM and 2031 PM peak queue lengths at Gore Hill roundabout

Table 4-5 and Table 4-6 compare the modelled queue length data, between the 2014 and 2031 forecast year, for each of the approach arms at Ledborough Lane and Longbottom Lane junctions for the AM and PM peak hours respectively. The Ledborough Lane / Longbottom Lane priority junctions show an increase in queue lengths in the 2031 forecast when compared against the 2014 Base year. In the AM peak there is a significant increase in queue lengths on the Ledborough Lane approach for both left and right turning traffic. The PM peak also shows an increase in queue lengths on both the Ledborough and Longbottom Lane approaches, although these increases are not as severe as those observed in the AM peak.

Arm	2014 AM Peak (08:00-09:00)			2031 AM Peak (08:00-09:00)		
	Average Queue (m)	Mean Max Queue (m)	Unreleased Vehicles	Average Queue (m)	Mean Max Queue (m)	Unreleased Vehicles
Ledborough Lane (left turn)	3	27	0	160	187	33
Ledborough Lane (right turn)	2	21	0	156	184	33
Longbottom Lane (left turn)	1	17	0	23	59	0
Longbottom Lane (right turn)	1	8	0	20	54	0

Table 4-5 : 2014 AM and 2031 AM peak queue lengths at Ledborough Lane and Longbottom Lane priority junctions

Arm	2014 PM Peak (17:00-18:00)			2031 PM Peak (17:00-18:00)		
	Average Queue (m)	Mean Max Queue (m)	Unreleased Vehicles	Average Queue (m)	Mean Max Queue (m)	Unreleased Vehicles
Ledborough Lane (left turn)	1	13	0	4	26	0
Ledborough Lane (right turn)	1	12	0	2	19	0
Longbottom Lane (left turn)	1	9	0	1	15	0
Longbottom Lane (right turn)	0	2	0	1	8	0

Table 4-6 : 2014 PM and 2031 PM peak queue lengths at Ledborough Lane and Longbottom Lane priority junctions

In the AM peak there are 395 unreleased vehicles, from the A413 west approach, that are unable to load onto the road network as a result of queuing on this link. Observed data shows that this approach at Gore Hill roundabout is already operating at capacity in the AM peak. The increase in conflicting flow travelling from the Gore Hill south approach further constrains the capacity for this movement, reducing vehicle flow and increasing queue lengths and delay for this approach.

In the PM peak there are 300 vehicles that are unable to load onto the modelled network from the Gore Hill south approach. The Observed data shows that this approach is congested and currently operating at capacity in the PM peak period. The increase in demand flow in the 2031 scenario adds to the existing queue for this link.

The Ledborough Lane/Longbottom Lane priority junctions show that there are 33 vehicles that are unable to load onto the modelled network from the Ledborough Lane approach in the AM peak. This is consistent with the increase in queue lengths that occur on this link between the 2014 and 2031 scenarios.

4.3.5 Air Quality

An increase in traffic volume and corresponding increase in queuing would likely result in a degradation of air quality. There is forecast to be potential for the degradation of conditions at key locations where link capacity issues and junction delays have increased, particularly at and on the approaches to the London End roundabout. These issues are expected to have the greatest tangible impact on the A355 and A40 London End, given the proximity of residential and employment related properties.

4.4 Public Transport

BCC works with the DfT, public transport operators and developers in order to deliver public transport improvements for Buckinghamshire. There are forward plans to upgrade existing bus stops with real time passenger information (RTPI) systems, to continue to roll out UTMC programmes in urban areas and other improvements across the county.

There are also a number of major public transport projects that are expected to impact upon the Beaconsfield and Amersham areas:

Chiltern Railways Evergreen 3 / East West Rail

This project is the latest set of planned service improvements to be implemented as a part of Chiltern Railways franchise agreement. This follows earlier Evergreen 1 and 2 improvements which included track doubling between Bicester and Banbury, measures to improve line speed and signalling, and additional platforms at London Marylebone

Chiltern Railways envisages operating two London – Oxford trains each hour in each direction throughout the day. This will be delivered by constructing a short connecting line just south of Bicester where the Chiltern Railways London to

Birmingham line crosses over the planned East – West railway line. Stations in South Bucks on the Chiltern Line, such as Beaconsfield, will benefit from improved access to Oxford.

High Speed 2

High Speed 2 (HS2) is a new high speed rail route that would initially link London to Birmingham (phase 1) and subsequently extend to Manchester and Leeds (phase 2). The route would bisect Buckinghamshire for approximately 60km from the south-east to north-west, about a third of the total route between London and Birmingham. It would not, however, provide any new stations or connections to the existing rail network within the county.

HS2 would not offer any potential accessibility or journey time benefits for Buckinghamshire. The route itself, however, would affect existing transport networks across the county and impacts would be felt on key routes during the construction period.

Within the HS2 formal Environmental Statement (ES), the A355 Gore Hill/Amersham Road is highlighted as a route that is forecast to experience a substantial increase in traffic flow (i.e. more than 30% for HGV or all vehicles) during construction. This is stated to significantly increase traffic related severance for non-motorised users along the corridor. BCC has highlighted this as a road safety concern within their consultation response to the ES, and stated within their mitigation plan[43][44] that the routing of vehicles from Junction 2 (Beaconsfield) to reach the A413 could be made acceptable by the construction of the Wilton Park Relief Road. There is no commitment or indication, however, that this would be delivered by HS2 and it is not suggested as a proposal/mitigation measure within the ES.

4.5 Non-motorised Users

As part of the delivery of any 'committed' land use development sites, BCC and SBDC would work with developers to ensure a package of transport measures for non-motorised users is delivered. These could include new infrastructure such as pedestrian crossings and widened footways to provide shared use footway/cycle paths, and soft measures such as travel planning. Core Policy 14 within the SBDC Core Strategy requires the delivery of a coordinated package of measures to improve accessibility, with new and enhanced routes and facilities for pedestrians, cyclists and public transport users as part of the redevelopment of Wilton Park.

4.6 Summary

This section has set out a forecast of traffic conditions in 2031. The growth in traffic volumes and changes in journey time and delay are described in order to understand the future situation in terms of travel demands and levels of service, as well as to provide a reference for the consideration of transport intervention options.

Future changes to the transport system, including key improvements in public transport and provision for non-motorised users are also described.

[43] *BCC, 2013. Buckinghamshire's Mitigation Blueprint for HS2. http://www.transportforbucks.net/High-Speed-2/HS2-Blueprint.aspx*
[44] *BCC, 2014. Buckinghamshire's Mitigation Blueprint for HS2Part 2. http://www.transportforbucks.net/High-Speed-2/HS2-Blueprint.aspx*

5. Need for Intervention

5.1 Introduction

This section summarises the findings of sections 3 and 4, and outcomes of previous and current consultation and engagement processes that have been undertaken. Current and future transport-related problems are highlighted and underlying causes identified that establish the need for an intervention on the A355 corridor.

5.2 Current Transport-Related Problems

North-south links within Buckinghamshire are limited. The A355 provides the main north-south route through the South Bucks District, connecting Amersham and the A413 in the north to the M40 and on to Slough in the south. As a result it accommodates high volumes of traffic, with volumes on the A355 Park Lane/Amersham Road reaching up to 1,100 in the AM and 1,200 in the PM peak periods, and remaining high up to the Gore Hill junction. In combination with the relative affluence of the area and local commuting patterns, a tidal pattern of traffic flow is evident comprising high proportions (up to 55%) of through traffic.

The London End roundabout is widely cited as a congestion hotspot, with evidence indicating reduced speeds and increased vehicular delays on approaches to the junction at peak times. In the AM peak in particular, reduced vehicle speeds occur on the A355 southbound, with maximum journey times recorded of over 18 minutes. This reflects significant queues on the approach to the roundabout, which relates to the high volumes of conflicting movements, limited capacity and unusual geometry at the junction.

The volumes of traffic and congestion on this route contributes to difficult egress conditions from the residential side roads, with particular concerns raised at the junctions of Ledborough Lane and Maxwell Road with the A355. There are also safety concerns at a number of junctions along this route including London End roundabout.

The A40 London End experiences congestion throughout the AM and PM peak hours, with queues of slow moving traffic (less than 10km/h) extending through Beaconsfield Old Town. This has negative consequences for the environmental quality of the conservation area and for local businesses. The extent of these queues can consequently impact upon the A40 London End junction with the B474 Aylesbury End, contributing to queues and congestion on Station Road in to Beaconsfield New Town. As a result, rat-running on residential roads between the B474 and A355 can occur.

Congestion also occurs on the A40 in a westbound direction, primarily due to delays related to constraints on London End, including issues relating to parking on London End, and can block back toward Pyebush roundabout. Journey times of up to nearly 10 minutes were recorded.

The Gore Hill roundabout is also highlighted as a bottleneck on the A355 corridor, resulting in queues and congestion at peak times and rat-running through surrounding areas such as Coleshill. Analysis indicates the junction is approaching capacity in the AM peak period with queuing experienced on the A413 approach from the west and Gore Hill from the north. During the PM peak there is queuing on the Gore Hill approach from the south. This is supported by anecdotal accounts and observations on site.

In general, congestion affects journey time reliability on the A355 and approaching roads, and reduces accessibility. The LTP3 classifies the length of A355 between Beaconsfield and Amersham as an Interurban ‘Priority Congestion Management Corridor’, elevating the status of the route as a priority for investment.

5.3 Future Transport-Related Problems

By 2031 there is forecast to be an average increase in overall traffic volume of up to 15% during peak periods on the A355 and approaching roads in Beaconsfield. The most significant new land use development in the area is Wilton Park; a 39 hectare site just to the east of Beaconsfield. The SBDC Core Strategy designates it as an Opportunity Site and establishes the policy framework for the site’s comprehensive redevelopment. By 2026 it is expected that the site will have delivered between 250 and 350 homes in addition to a level of commercial

floorspace. Throughout this period a number of smaller committed development sites are also expected to have been completed.

An increase in traffic volume would add additional pressure to key junctions including the London End roundabout and Gore Hill roundabout junctions. On the A355 and A40 corridors in Beaconsfield, network speeds are expected to reduce by 5.6mph to 13.7mph in the AM peak and by 9.3mph to 15.5mph in the PM peak. Journey times are forecast to increase, most significantly on the A355 southbound in the AM peak (by an additional 4 and a half minutes). The reliability of public transport journeys would be increasingly affected on these routes, leading to potential issues associated with service viability. Existing concerns regarding road safety, severance and the environment would be exacerbated, with negative consequences for local business in particular in Beaconsfield Old Town Conservation Area.

Toward Amersham, the Gore Hill area is forecast to experience a higher level of overall traffic growth of up to 20% during peak periods based on information from NTEM. The 2031 forecast indicates that the Gore Hill roundabout would have exceeded capacity in both the AM and PM peaks. Results indicate a marked deterioration in traffic conditions particularly in the AM, with a significant increase in queue lengths on the A413 eastbound approach and on the A355 Gore Hill southbound approach. In the PM peak there are increases in queue lengths on the A413 approach from the east and both A355 approaches.

5.4 Impacts of Not Changing

Transport-related problems on the A355 corridor and surrounding area are reflected in Figure 5-1 and can be summarised as:

- Congestion and delay on the A355 and A40, which impacts on strategic movements and local traffic
- Lack of resilience in the A355 corridor, often impacting on local road traffic
- Increased number of incidents and reduced road safety on the A355

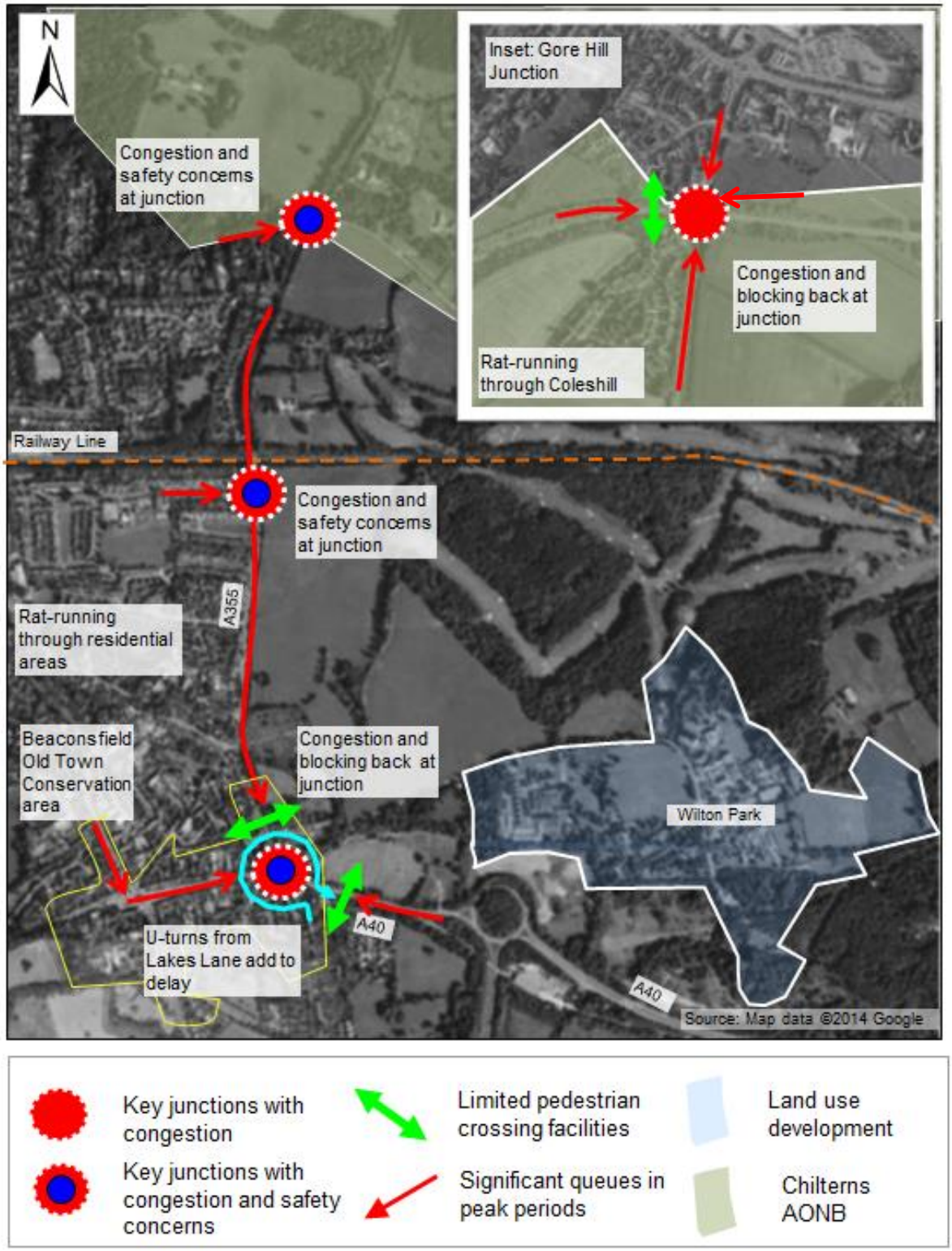


Figure 5-1 : Transport-Related Problems on the A355 Corridor

Such issues are anticipated to worsen in the future, exacerbated by forecast traffic growth both locally and strategically. Increases in traffic volume and corresponding reductions in speeds across the network, as outlined in section 5.4, could have negative implications in terms of:

- Accessibility, both between urban centres and to the strategic road network (SRN)
- Journey time reliability
- Noise and air quality
- Redistribution of traffic, e.g. toward other less congested routes/sensitive local routes

Wider challenges associated with these implications may include broader economic, social and environmental impacts.

Supporting Economic Growth and Prosperity

Congestion, and associated journey time variability and unreliability, can result in lost productive time to business and freight traffic, impacting on productivity and placing additional costs on businesses. It can also affect commuting patterns and reduce labour market catchment areas; South Bucks and Chiltern are both characterised by high commuting levels in/out of the Districts.

As a District Centre, Beaconsfield is highlighted as a principal focus for growth within the SBDC Core Strategy. Trade-offs between housing and employment growth and the costs from associated traffic growth, however, may impede the deliverability of designated residential and retail land uses within the town and the Wilton Park opportunity site.

Lost productive time and reduced accessibility are likely to increase over time as traffic growth exacerbates current transport problems. Transport-related constraints may therefore fail to support and sustain local (and wider) economic prosperity and productivity.

Impact on Quality of Life (Social / Environmental Impacts)

The level of emissions (and noise) relates to the volume of traffic, and is exacerbated when congestion and delay is more acute. Disbenefits can also be felt in terms of welfare; in addition to the direct time costs, there is evidence of welfare disbenefits associated with travel conditions (e.g. frustration and annoyance).

Traffic volumes may also create community severance and affect the integration of the Wilton Park opportunity site with Beaconsfield, hindering movement by non-motorised modes and access to goods and services.

The resultant welfare, air quality and noise disbenefits of transport-related problems would negatively impact quality of life and well-being within the local communities.

5.5 Underlying Drivers or Causes

The underlying drivers/causes of the transport-related problems identified are summarised below in Table 5-1.

Driver	Description	Transport-Related Problems
Lack of north-south connectivity	The A355 provides the main north-south route through the South Bucks District. Limited public transport alternatives.	• Congestion and delay on the A355 and A40, which impacts on strategic movements and local traffic • Lack of resilience on the A355 corridor, often impacting on local road traffic • Safety concerns on the A355 Wider Impacts: *Economic Growth/Prosperity* • Hinders growth • Lost productive time • Restricted access to labour markets and the SRN *Social/Environmental* • Reduced air quality and increased noise • Reduced quality of life/welfare
Relative prosperity	Higher than average levels of car ownership and use in both the South Bucks and Chiltern Districts.	
Level of travel demand	Excess of travel demand over available capacity, which is forecast to increase.	
Commuting patterns	High commuting levels both in and out of the South Bucks District and out of the Chiltern District. High average trip length for the journey to work.	

Table 5-1 : Underlying Drivers/Causes

6. Objectives and Study Area

6.1 Objectives

Through the initial prioritisation of transport schemes from BCC's Infrastructure Register, the A355 Improvements have already been shown to perform well against the strategic objectives drawn from BTVLEP's Manifesto for Growth[13]. In bringing forward the necessary business-critical infrastructure, the scheme supported the following BTVLEP's policy priorities:

- Unblocking major commercial property investments which support the needs of business
- Making major transport infrastructure fit for economic purpose
- Ensuring housing growth develops appropriately to meet the needs of businesses & communities

In line with these objectives, as well as local and regional transport and land use objectives, a set of intervention-specific objectives has been established. These reflect the problems and opportunities identified in sections 3 and 4, and are as follows:

1) To provide high quality transport improvements required to support and facilitate sustainable housing and employment growth in Beaconsfield as identified in the South Bucks Core Strategy
2) To manage identified congestion hotspots and maintain or improve the reliability of journey times on the A355
3) To improve connectivity and access between key centres and the strategic road network
4) To maintain a high quality of life and natural environment, promoting more sustainable travel solutions, improved safety and security for all road users and reduced carbon emissions
5) To promote both social inclusion and community cohesion through supporting the provision of integrated public transport networks and facilitating improved access to these services

The objectives support Buckinghamshire's SCS themes, to which regional and local policy objectives can be aligned (as summarised in Figure 6-1). The objectives provide a framework for future appraisal and evaluation of each transport option that might be appropriate for the A355.

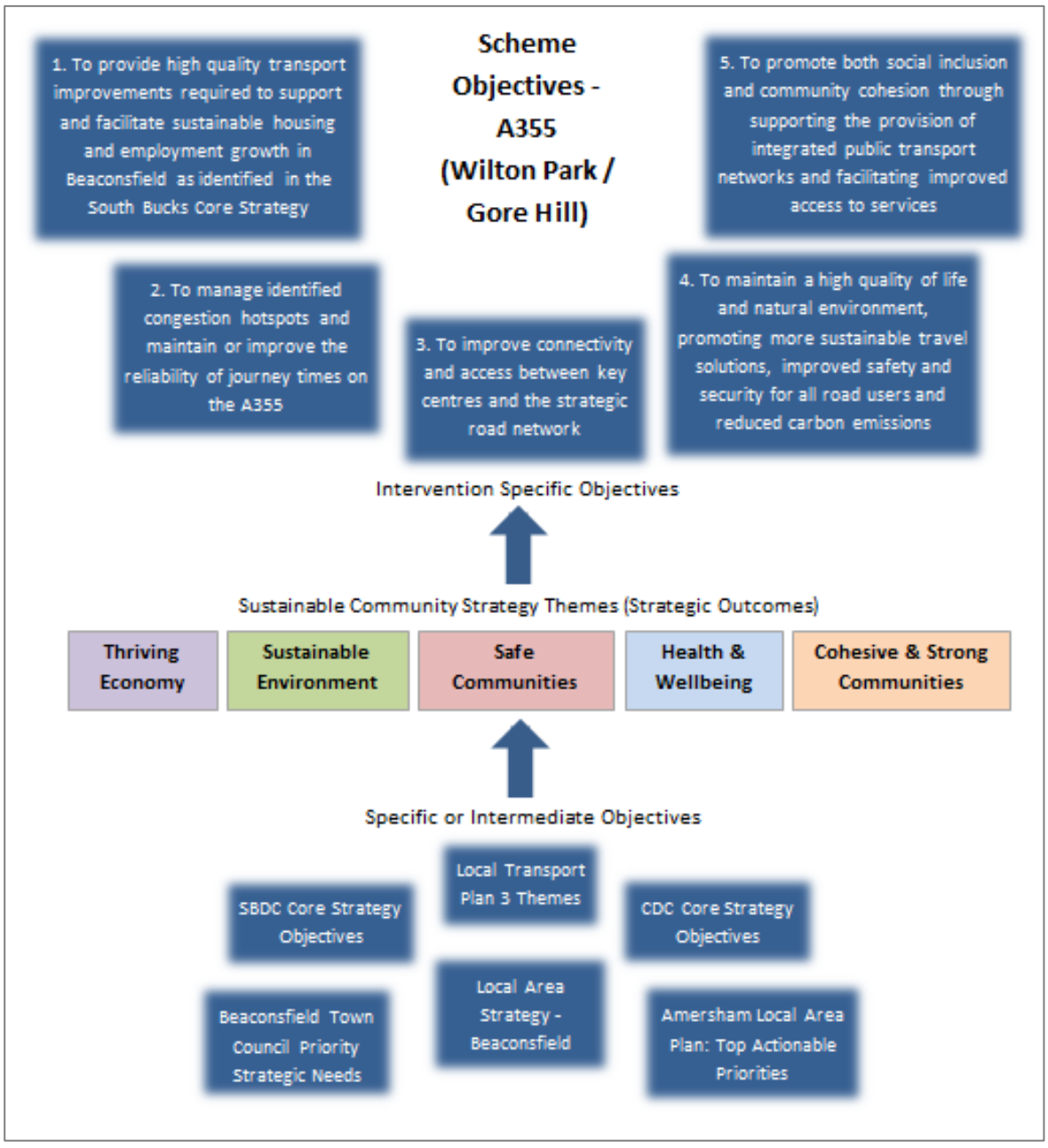


Figure 6-1 : Scheme Objectives – A355 Improvements

6.2 Targets

The transport improvements of the intervention options will result in a range of measurable impacts on traffic and travel conditions. Impacts and measurable indicators relevant to improving conditions on the A355 could include:

- Delivery of identified housing and employment growth in line with the Core Strategy – measured by the number of homes/jobs delivered/occupied by 2026
- Reduced congestion and improved journey reliability - measured by traffic volume and relative difference in peak/off-peak journey times compared against the 2013 current situation
- Improved connectivity – reflected by absolute journey times on key routes compared against the 2013 current situation

- High quality of life and natural environment – reflected through a reduction in collisions, carbon emissions and level of noise (dB) compared against the 2013 current situation
- Social inclusion and community cohesion – reflected through the delivery of a public transport link to the Wilton Park development and reliability of services, reliability could be measured in terms of journey times, punctuality and excess passenger wait time

Setting targets is an iterative process and they will evolve as further evidence is collected. Final targets would be developed during full Business Case development, in line with the principles listed above, and set out as 'SMART' (Specific-Measurable-Accepted-Realistic-Time defined) targets.

6.3 Study Area

The geographical area of impact to be addressed by potential intervention has been informed through evidence reviewed in sections 2, 3 and 4 which have outlined the current scope of the travel market and key origins and destinations, as well as the extent of current and future transport problems and underlying drivers.

The geographical area of impact comprises the length of A355 to the east of Beaconsfield and the junction of the A355 with the A413 as outlined in Figure 6-2 below. Based on stakeholder feedback, the Beaconsfield extent of the A355 study area includes the A355 / Ledborough Lane / Longbottom Lane junction.

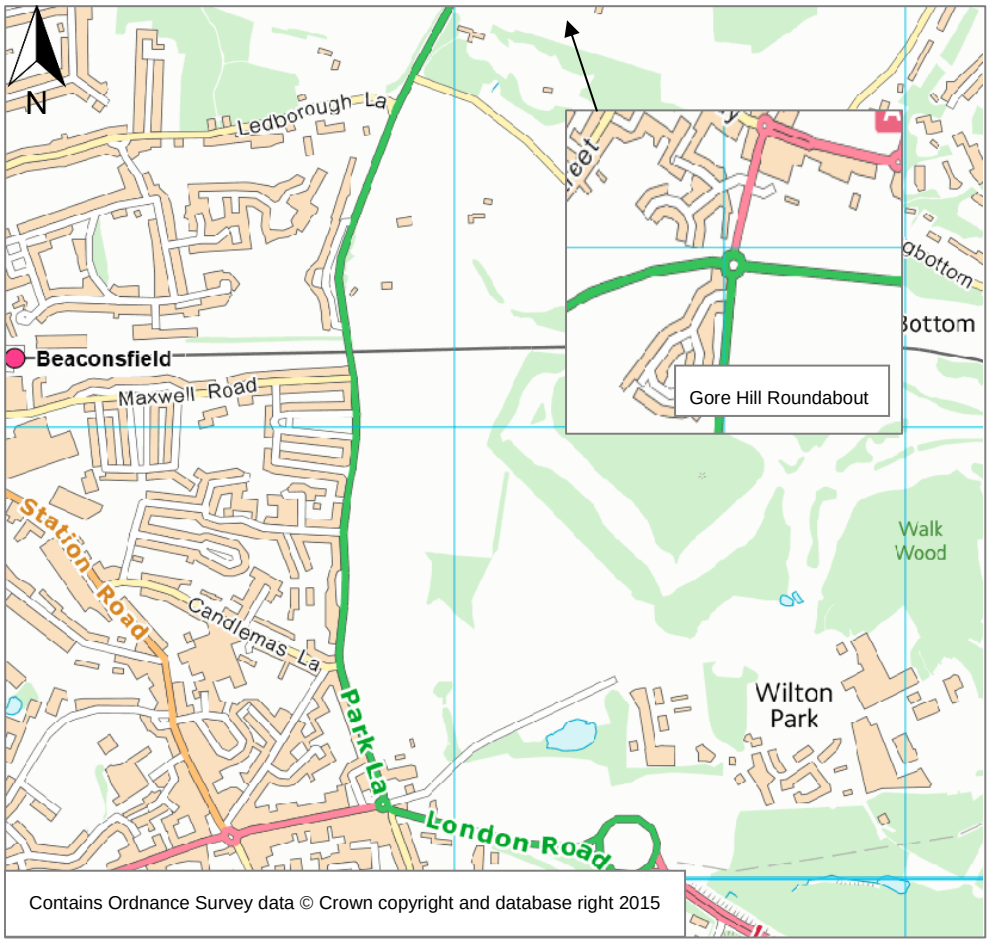


Figure 6-2 : Geographical Area of Impact

7. Scheme Option Appraisal

7.1 Introduction

This section presents the assessment for the individual intervention options that have been identified for the A355 corridor. It has been undertaken in line with the methodology prescribed within the Appraisal Specification Report (ASR) and best practice contained within TAG.

It aims to distinguish the relative benefits and impacts of the options under consideration. Results have allowed the identification of the better performing options.

The scheme appraisal is structured as follows:

- Section 7.4 : A355 Relief Road Option Assessment
- Section 7.5.1 : Gore Hill Junction Option Assessment
- Section 7.5.2 : Ledborough Lane / Longbottom Lane Junction Option Assessment

After the better performing intervention options have been identified at each of these locations a full assessment of the overall Preferred Scheme package will be undertaken. This is detailed in section 8 of this Stage 2 OAR.

7.2 Overview of Approach

The impact of each option on overall network performance has been assessed using the same indicators as for the base year and 2031 Do Minimum scenario. For the purposes of this report, the potential options are referred to as 'Do Something' scenarios.

At this stage of scheme appraisal, any wider strategic distribution of traffic volumes has not been considered. Furthermore, the potential for induced or suppressed traffic demand impacts have not been assessed. The potential for the strategic re-assignment of traffic will be considered on the basis of a collective assessment of the overall Preferred Scheme package which is assessed in section 8 of this Stage 2 OAR.

7.3 A355 Relief Road 'Do Something' Model Development

The potential intervention options have been assessed within the 2031 forecast traffic model with each option modelled individually. The 2031 Do Minimum scenario establishes a forecast of traffic conditions within Beaconsfield, against which infrastructure interventions have been assessed comparatively in terms of journey times along the A355 and A40 corridors, queuing at key junctions and congestion on the surrounding road network.

With the implementation of the A355 Relief Road it is anticipated that there will be a level of traffic reassignment on the road network. Where applicable traffic has been redistributed according to the preferred/best alternative path based on modelled journey time. The A355 Relief Road options assume a 40mph speed limit for the route, reducing to 30mph through Wilton Park.

7.4 A355 Relief Road Options Identified for Appraisal

Table 7-1 details the options for the A355 Relief Road that have been identified for more detailed appraisal in this Stage 2 OAR. Concept drawings of all the modelled options are presented in Appendix C.

Ref.	Option	Description
1	Roundabout (no direct access to Maxwell Road)	This option would involve the introduction of a new roundabout towards the northern end of the Relief Road (located just east of the junctions with Hyde Green) linking the Relief Road from the southwest side of the roundabout to Amersham Road just north of Waller Road . Whilst there would be no direct access to the Relief Road from Maxwell Road, Maxwell Road would gain access to Amersham Road and to the Relief Road via the old Amersham Road and the new link from the southwest side of the roundabout.
2	Roundabout (direct Maxwell Rd access)	This option would involve the introduction of a new roundabout towards the northern end of the Relief Road (located just east of the junctions with Hyde Green) linking the Relief Road to Amersham Road. This is as for Option 1. There would however be direct to the link road from Maxwell Road via a major/minor junction to the north of the roundabout. The section of Amersham Road between Maxwell Road and Waller Road would be closed to through traffic and be used to form part of a shared pedestrian/cycle link.
3	Traffic Signals	This option would involve the provision of a signalised junction in a similar location to the roundabout junction described in Options 1 and 2 with no direct link to Maxwell Road as in Option 1. There would be two lane approaches on each arm with the Relief Road being the major arms and the new link to Amersham Road being the minor arm. The main benefits of traffic signal controlled junctions are that there is greater control over the traffic movements and that priority can be given to preferred approaches.
Next Best Option 1D	Dedicated Left Turn Lane at London End Roundabout and A40 Widening	This option would provide a dedicated left-turn lane for traffic on the A355 Park Lane heading east on to the A40. This would involve widening the A355 southbound approach to the London End roundabout and the A40 eastbound exit to two lanes.

Table 7-1 : A355 Relief Road Intervention Options

There are two alignment options proposed for the A355 Relief Road;

- Central alignment and;
- Eastern alignment

The alignment options proposed for the Relief Road makes little to no difference with regard to how well the scheme works in operational terms. It was therefore deemed unnecessary to specifically model the different alignments as the chosen alignment of the Relief Road would not be guided by the outcomes of the technical evidence.

7.4.1 Overall Network Performance

The model outputs in Table 7-2 and Table 7-3 demonstrate the overall performance of the network across each of the potential Relief Road intervention options for the AM and PM peak periods, compared with data from the 2013 Base and 2031 Do Minimum scenarios. Average travel time and delay per vehicle are presented for the AM and PM peak periods respectively, as well as average network speed.

Performance Indicator	AM Peak (08:00-09:00)					
	2013 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3	2031 NB 1D
Average Speed (km/h)	31	22	30	26	27	25
Average Delay per vehicle (mm:ss)	01:49	03:19	01:41	02:30	02:17	02:46
Average travel time per vehicle (mm:ss)	04:01	05:27	04:03	04:37	04:26	04:53
Key	*Improvement compared to 2031 Do Min*		*Deterioration compared to 2031 Do Min*			
Note	*'Opt.' = option, 'Do Min' = Do Minimum*					

Table 7-2 : AM Peak Network Performance Indicators

In the AM peak, the network performance data indicates that all the Relief Road intervention options show a reduction in average travel time and delay per vehicle when compared against the 2031 Do Minimum. Option 1 has the highest average speed of all the proposed options and also the lowest average delay and average travel time per vehicle. The Next Best option has the least beneficial impact of all the options.

Performance Indicator	PM Peak (17:00-18:00)					
	2013 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3	2031 NB 1D
Average Speed (km/h)	40	24	39	36	31	29
Average Delay per vehicle (mm:ss)	00:58	03:00	01:00	01:17	01:46	02:08
Average travel time per vehicle (mm:ss)	03:23	05:20	03:27	03:36	04:06	04:29
Key	*Improvement compared to 2031 Do Min*		*Deterioration compared to 2031 Do Min*			
Note	*'Opt.' = option, 'Do Min' = Do Minimum*					

Table 7-3 : PM Peak Network Performance Indicators

In the PM peak, all the options show an improvement in average speed, average delay and average travel time per vehicle when compared against the 2031 Do Minimum scenario. Option 1 shows to have the highest average speed over the modelled network with the lowest average delay and average travel time per vehicle of all the intervention options.

7.4.2 Journey Times

Table 7-4 and Table 7-5 present the AM and PM peak journey times for key routes under each of the Relief Road intervention options. For comparison purposes the corresponding data for the 2013 base and 2031 Do Minimum is also included.

Route	Description	AM Peak (08:00-09:00) Journey time (mm:ss)					
		2013 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3	2031 NB 1D
1	NB: Pyebush Rbt to Ledborough Ln / Longbottom Ln Crossroads	02:51	03:27	02:03	01:56	02:31	03:10
2	SB: Ledborough Ln / Longbottom Ln Crossroads to Pyebush Rbt	06:38	11:09	02:20	03:15	03:34	05:15
3	EB: London End / Aylesbury End / Wycombe End Rbt to Pyebush Rbt	04:16	04:47	02:51	02:17	02:42	04:21
4	WB: Pyebush Rbt to London End / Aylesbury End / Wycombe End Rbt	02:13	03:03	03:19	03:03	03:13	03:44
Key	*Improvement compared to 2031 Do Min*		*Deterioration compared to 2031 Do Min*				
Note	*'Opt.' = option, 'Do Min' = Do Minimum*						

Table 7-4 : AM Peak Modelled Journey Times

In the AM peak, there are reductions in journey times on routes 1, 2 & 3 when compared against the 2031 Do Minimum and 2013 Base scenario. This is attributable to new routes and dedicated lanes respectively. There is a slight increase in journey time on route 4 for Option 1, 3 and the 'Next Best' option when compared against the 2031 Do Minimum scenario. The largest time savings occur on the southbound route between Ledborough Lane and Pyebush roundabout. This route is showing a time saving of over 7 minutes for all the Relief Road options when compared against the 2031 Do Minimum scenario.

Route	Description	PM Peak (17:00-18:00) Journey time (mm:ss)					
		2013 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3	2031 NB 1D
1	NB: Pyebush Rbt to Ledborough Ln / Longbottom Ln Crossroads	03:10	04:21	02:06	01:56	02:39	03:47
2	SB: Ledborough Ln / Longbottom Ln Crossroads to Pyebush Rbt	03:09	06:08	01:58	03:17	03:06	03:16
3	EB: London End / Aylesbury End / Wycombe End Rbt to Pyebush Rbt	03:00	04:17	01:54	02:19	02:08	04:19
4	WB: Pyebush Rbt to London End / Aylesbury End / Wycombe End Rbt	01:58	03:22	02:28	03:07	02:29	02:31
Key	*Improvement compared to 2031 Do Min*		*Deterioration compared to 2031 Do Min*				
Note	*'Opt.' = option, 'Do Min' = Do Minimum*						

Table 7-5 : PM Peak Modelled Journey Times

In the PM peak, there are reductions in journey times for all routes, under each of the Relief Road options, when compared against the 2031 Do Minimum scenario. Option 1 and Option 2 experience the most significant improvement in journey times, with reductions of up to 2 minutes for the northbound direction and 4 minutes for the southbound direction.

The disparity in the southbound journey time on route 2 between Option 1 and Option 2 is mainly attributable to the difference in access arrangements for Maxwell Road between the two scenarios. In Option 1, vehicles travelling southbound on the A355, access Maxwell Road to the south of the proposed roundabout with the Relief Road. In Option 2 access to Maxwell Road is located north of the roundabout. Vehicle flows on the A355 are lower south of the roundabout than north of the roundabout. This means that there is less opposing traffic for vehicles traveling southbound on the A355 wishing to turn into Maxwell Road for option 1. This also results in vehicles exiting Maxwell Road joining onto the A355 encountering less opposing traffic. The option of providing a dedicated right turn lane, for option 2, from the A355 southbound into Maxwell Road has been ruled out due to the physical constraints of the existing Railway bridge just north of this junction.

7.5 Gore Hill / Ledborough Lane Junction Modelling

The Stage 1 OAR identified that in order to achieve the A355 improvement objectives (section 6.1), there would be a need for intervention at the Gore Hill roundabout junction and Ledborough Lane/Longbottom Lane junctions along the A355 corridor, along with a complementary package of sustainable transport measures.

To appraise the proposed intervention options at the Gore Hill and Ledborough Lane / Longbottom Lane junctions, stand-alone junction models were created for each of the junctions using PTV software package VISSIM. A 2014 Base year model was created and calibrated using observed flow data and validated against observed queue data.

A 2031 forecast year model was developed using NTEM growth factors that were applied to the 2014 base year flows to create 2031 year forecast flows. This would form the 2031 Do Minimum scenario against which the impact of the Schemes can be assessed.

7.5.1 Gore Hill Junction Modelling

Table 7-6 details the intervention options that have been identified for appraisal in this Stage 2 OAR for the Gore Hill junction. Drawings of all the options can be found in Appendix C.

Ref.	Option	Description
1	Additional Eastbound Exit Lane & Associated Road Markings	This option would involve widening the circulatory carriageway on the northern side of the junction and the exit carriageway (A413) on the eastern side of the junction. This would encourage greater concurrent use of the two lanes that are currently marked for vehicles travelling west to east at the junction.
2	Additional Northbound Entry Lane	This option would involve widening of the A355 carriageway northbound approach to the junction and the westbound exit lane on the west side of the junction to provide an additional left turn only lane. This would provide an additional entry lane to the roundabout increasing capacity for vehicles to enter the junction but would be a departure from standard (DMRB TD16/07 CI7.8 AND 7.25.) However, this would create a larger area of carriageway at this location and reduce the physical deflection for drivers approaching the junction particularly northbound and this could encourage higher approach speeds.
3	Left Turn Only Lane Northbound	This option would involve widening the carriageway as in Option 2 but dividing the carriageway into two lanes with the nearside lane being dedicated to left turning vehicles only. However, this would create a larger area of carriageway at this location and reduce the physical deflection for drivers approaching the junction particularly northbound and this could encourage higher approach speeds.
4a	Physical Segregated Left Turn Northbound	This option would involve the introduction of a segregated left turn between the A355 northbound to A413 west. A physical island would be constructed to prevent other traffic using the left turn lane. In order to accommodate the physical island the carriageway would need to be widened on southern and western sides of the junction. This would however involve the need for some land take to the rear of the Green End Cottages. The introduction of a segregated left turn lane would mean that traffic approaching the junction intending to use this lane would not need to give way to traffic on this approach and may not reduce their speed accordingly, this could result in an increase in the likelihood of collisions at the junction with The Fieldway.
4b	Non-Physical Segregated Left Turn Northbound	This option would involve the introduction of a segregated left turn between the A355 northbound to A413 west similar to Option 4a but without a physical island. Whilst visually this would retain some deflection it would not physically prevent drivers from

		crossing the road markings particularly at quieter times of the day. The introduction of a segregated left turn lane would mean that traffic approaching the junction intending to use this lane would not need to give way to traffic on this approach and may not reduce their speed accordingly, this could result in an increase in the likelihood of collisions at the junction with The Fieldway.
5	Two-Lane Eastbound Approach Extension	This option would involve extending the two-lane approach from A413 east.
6	Signalised Approach Gore Hill Northbound	This option would involve the introduction of traffic signals on the approach from Gore Hill south. The signals would temporarily halt traffic entering onto the roundabout from the Gore Hill south approach which in turn allows traffic approaching from A413 west to be able to gain access onto the roundabout. The traffic signals are only proposed to be utilised in AM peak period where there is queuing on the A413 west approach.

Table 7-6 : Gore Hill Junction Intervention Options

For the Gore Hill junction option testing, option 4a and option 4b have not been modelled individually. They have been modelled once as option 4. The reason for this is because the difference between the two scenarios will have no impact in regards to the way that they are modelled.

Table 7-7 and Table 7-8 present the vehicle flow on each of the arms approaching the Gore Hill roundabout junction in the AM and PM peak periods for each of the intervention options. The tables also summarise the total exit flow at the roundabout for each option. For comparison purposes the corresponding data for the 2014 base and 2031 Do Minimum is also included.

Link	AM Peak (08:00-09:00)							
	2014 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3	2031 Opt. 4	2031 Opt. 5	2031 Opt. 6
Gore Hill North SB	584	686	675	627	705	703	678	639
Gore Hill North NB	728	776	790	798	719	699	782	778
A413 East-WB	658	793	791	794	793	802	792	794
A413 East-EB	1169	1152	1190	1212	1063	1066	1164	1192
Gore Hill South NB	910	1085	1087	1086	1009	942	1086	1039
Gore Hill South SB	927	1006	1013	993	984	999	1008	1001
A413 West-EB	1630	1509	1574	1615	1386	1431	1532	1610
A413 West-WB	958	1139	1134	1119	1127	1114	1134	1111
Total Exit Flow	**3782**	**4073**	**4127**	**4122**	**3893**	**3878**	**4088**	**4082**

Table 7-7 : AM Peak Modelled Vehicle Flow – Gore Hill Junction

In the AM peak, Option 1 provides the highest increase in vehicle throughput at the junction with Option 2 the second highest. Option 3 and Option 4 show an overall reduction in vehicle throughput at the junction when compared against the 2031 Do Minimum. In Option 3 and Option 4 the largest decrease in flow occurs on the approaches from Gore Hill south and A413 west.

Link	PM Peak (17:00-18:00)							
	2014 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3	2031 Opt. 4	2031 Opt. 5	2031 Opt. 6
Gore Hill North SB	743	888	890	891	890	889	890	888
Gore Hill North NB	698	671	663	808	638	708	654	651
A413 East-WB	907	1040	1045	1031	1040	707	1087	1030
A413 East-EB	481	535	534	580	524	548	530	530
Gore Hill South NB	980	852	836	1160	778	940	816	812
Gore Hill South SB	753	887	890	896	889	831	897	885
A413 West-EB	767	921	920	920	920	921	920	920
A413 West-WB	1465	1608	1604	1718	1577	1370	1632	1584
Total Exit Flow	**3397**	**3701**	**3691**	**4002**	**3628**	**3457**	**3713**	**3650**

Table 7-8 : PM Peak Modelled Vehicle Flow – Gore Hill Junction

In the PM peak, Option 2 provides the highest vehicle throughput at the Gore Hill Junction with the largest increase in flow occurring on Gore Hill south northbound. Option 4 provides the lowest overall vehicle throughput at the junction.

The model outputs in Table 7-9 and Table 7-10 demonstrate the overall performance of the network at the Gore Hill roundabout junction across each of the potential intervention options, and compares with the data for the 2014 Base and 2031 Do Minimum scenarios. Average travel time and delay per vehicle are presented for the AM and PM peak periods respectively, as well as average network speed.

Performance Indicator	AM Peak (08:00-09:00)							
	2014 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3	2031 Opt. 4	2031 Opt. 5	2031 Opt. 6
Average Speed (km/h)	47	30	31	31	26	22	30	25
Average Delay per vehicle (mm:ss)	00:41	01:34	01:30	01:32	02:00	02:30	01:35	02:05
Average travel time per vehicle (mm:ss)	01:42	02:37	02:34	02:36	03:05	03:39	02:39	03:11
Key	*Improvement compared to 2031 Do Min*			*Deterioration compared to 2031 Do Min*				
Note	*'Opt.' = option, 'Do Min' = Do Minimum*							

Table 7-9 : AM Peak Overall Network Performance – Gore Hill Junction

In the AM peak, Option 1 and Option 2 show a slight reduction in average delay and average travel time per vehicle when compared against the 2031 Do Minimum scenario. Option 3, 4, 5 and 6 show an increase in average delay and average travel time per vehicle and a decrease in average speed when compared against the 2031 Do Minimum.

Performance Indicator	PM Peak (17:00-18:00)							
	2014 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3	2031 Opt. 4	2031 Opt. 5	2031 Opt. 6
Average Speed (km/h)	51	28	29	35	27	23	33	27
Average Delay per vehicle (mm:ss)	00:31	01:42	01:38	01:11	01:50	02:09	01:19	01:47
Average travel time per vehicle (mm:ss)	01:31	02:45	02:41	02:13	02:54	03:16	02:20	02:51
Key	*Improvement compared to 2031 Do Min*			*Deterioration compared to 2031 Do Min*				
Note	*'Opt.' = option, 'Do Min' = Do Minimum*							

Table 7-10 : PM Peak Overall Network Performance – Gore Hill Junction

In the PM peak, Option 2 shows the largest improvements with regard to Average speed, Average Delay and Average Travel Time per vehicle. Option 1 and Option 5 also show improvements when compared against the 2031 Do Minimum scenario. Option 3, 4 and 6 show an increase in average delay and average travel time per vehicle when compared against the 2031 Do Minimum.

Option 3 and Option 4 show the highest delay and travel time per vehicle of all the options. This is mostly due to the lane allocation for the approach from Gore Hill south. Currently it is possible to use both lanes for the straight ahead movement, to Gore Hill north, whereas in Option 3 and Option 4 only the offside lane can be used for this movement. This creates an increase in queuing for this lane which can stretch back and block the left turning movement from Gore Hill south to A413 west.

In the 2031 Do Minimum scenario many of the approach arms at the Gore Hill junction are operating at capacity in both the AM and PM peak periods. The consequence of providing additional capacity to any one particular arm / movement will most likely result in reduced capacity for other approaches / movements at the junction.

7.5.2 Ledborough / Longbottom Lane Junction Modelling

Table 7-11 details the intervention options that have been identified for appraisal in this Stage 2 OAR for the Ledborough Lane / Longbottom Lane junctions. Drawings of all the options can be found in Appendix C.

Ref.	Option	Description
1	Mini-roundabouts	Mini-roundabouts can only be introduced where the speed limit is 30mph or less and as such this option would require the introduction of a 30mph speed limit to cover the extent of the junctions and sufficiently in advance to encourage compliance with the posted speed limit. In addition speed reducing measures would need to be introduced on the A355 and possibly Ledborough Lane approaches to the mini-roundabouts to achieve appropriate vehicle speeds. Measures would be required to provide sufficient deflection to ensure that drivers negotiate the mini-roundabouts at appropriate speeds and could not “see through” the junction in order to negotiate the mini-roundabouts at higher speeds. This type of junction works best where there is relatively equal traffic flow on all arms of the roundabout
2	Traffic Signals (Two ahead lanes on the A355 with merge on exit)	The main benefits of the introduction of traffic signals at these side road junctions are that they would enable greater control over all the traffic movements at the junction (and could be adjusted to suit differing traffic demands at different times of the day) and that priority could be given to preferred arms of the junctions

3	Traffic Signals (Single ahead lane with opposed right turn)	The introduction of traffic signals at these side roads would enable greater control over all the traffic movements at the junction and could be adjusted to suit differing traffic demands at different times of the day. By having just one ahead lane on the A355 the right turning traffic could be controlled separately. This also removes the risk of collision associated with gap acceptance particularly where vehicle speeds are higher (above 35mph) and where opposing flows are high. The main benefits of the introduction of traffic signals at these side road junctions are that they would enable greater control over all the traffic movements at the junction (and could be adjusted to suit differing traffic demands at different times of the day) and that priority can be given to preferred arms of the junctions. Vehicles turning right from the main A355 carriageway into Ledborough Lane / Longbottom Lane are included in the same phase as the straight ahead movement in the opposite direction. An additional stage has been included in the signal program so the right turn movement operates unopposed.

Table 7-11 : Ledborough / Longbottom Lane Junction Intervention Options

Table 7-12 and Table 7-13 present the vehicle flow on each of the arms approaching the Ledborough / Longbottom Lane priority junctions in the AM and PM peak periods for each of the intervention options. The tables also summarise the total exit flow for each option. For comparative purposes the corresponding data for the 2014 base and 2031 Do Minimum is also included.

Link	AM Peak (08:00-09:00)				
	2014 Base	2031 Do Min	2031 Option 1	2031 Option 2	2031 Option 3
A355 SB (north of Longbottom Lane)	970	1158	1161	930	1050
A355 NB (north of Longbottom lane)	901	1057	1081	660	1049
A355 SB (south of Ledborough Lane)	1034	1217	1234	1006	1108
A355 NB (south of Ledborough lane)	1063	1260	1270	734	1240
Longbottom lane WB (east of A355)	256	301	306	262	256
Longbottom lane EB (east of A355)	352	383	415	322	389
Ledborough lane EB (west of A355)	307	310	367	331	338

Ledborough lane WB (west of A355)	309	372	374	269	338
Total Exit Flow	**2498**	**2885**	**2988**	**2259**	**2751**

Table 7-12 : AM Peak Modelled Vehicle Flow – Ledborough / Longbottom Lane Junction

In the AM peak, Option 1 (mini roundabouts) provides the highest level of vehicle throughput at the Ledborough / Longbottom Lane junctions, with Option 3 second best. When comparing Option 1 against the Do Minimum scenario the volume of traffic that can egress from both Ledborough Lane and Longbottom Lane is higher which suggests that egressing from the side roads is easier in this scenario than it is in the 2031 Do Minimum. Option 2 has the lowest overall vehicle throughput which is approximately 600 fewer vehicles than that in the 2031 Do Minimum.

	PM Peak (17:00-18:00)				
Link	2014 Base	2031 Do Min	2031 Option 1	2031 Option 2	2031 Option 3
A355 SB (north of Longbottom Lane)	779	933	932	931	933
A355 NB (north of Longbottom lane)	983	1194	1190	700	1081
A355 SB (south of Ledborough Lane)	820	976	974	983	987
A355 NB (south of Ledborough lane)	1191	1425	1423	767	1267
Longbottom lane WB (east of A355)	194	231	230	260	257
Longbottom lane EB (east of A355)	235	269	268	208	252
Ledborough lane EB (west of A355)	214	255	252	255	257
Ledborough lane WB (west of A355)	340	405	405	322	394
Total Exit Flow	**2211**	**2656**	**2646**	**2198**	**2582**

Table 7-13 : PM Peak Modelled Vehicle Flow - Ledborough / Longbottom Lane Junction

In the PM peak, none of the options match the level of vehicle flow of the 2031 Do Minimum although Option 1 shows similar results. Option 2 has the lowest vehicle throughput of all the intervention options.

The model outputs in Table 7-14 and Table 7-15 demonstrate the overall performance of the network at the Ledborough Lane / Longbottom Lane priority junctions for each of the potential intervention options for the AM and PM peak periods. Average travel time and delay per vehicle are presented for the AM and PM peak periods respectively, as well as average network speed. The corresponding data for the 2014 Base and 2031 Do Minimum scenarios has also been included as a means of comparison.

Performance Indicator	AM Peak (08:00-09:00)				
	2014 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3
Average Speed (km/h)	38	34	36	26	29
Average Delay per vehicle (mm:ss)	00:37	00:49	00:41	01:27	01:11
Average travel time per vehicle (mm:ss)	01:58	02:07	01:59	02:52	02:31
Key	*Improvement compared to 2031 Do Min*		*Deterioration compared to 2031 Do Min*		
Note	*'Opt.' = option, 'Do Min' = Do Minimum, 'RR' = Relief Road*				

Table 7-14 : AM Peak Network Performance Indicators - Ledborough / Longbottom Lane Junction

In the AM peak, Option 1 shows a decrease in average delay and average travel time per vehicle when compared against the 2031 Do Minimum scenario. Option 2 and Option 3 both show an increase in average delay and travel time with a corresponding decrease in average speed.

An increase in delay and vehicle travel time is anticipated for the signalised options (Option 2 and Option 3) as the main northbound and southbound flow on the A355 will get interrupted by the operation of the traffic signals.

Performance Indicator	PM Peak (17:00-18:00)				
	2014 Base	2031 Do Min	2031 Opt. 1	2031 Opt. 2	2031 Opt. 3
Average Speed (km/h)	42	42	40	31	34
Average Delay per vehicle (mm:ss)	00:26	00:26	00:28	01:03	00:47
Average travel time per vehicle (mm:ss)	01:51	01:47	01:50	02:31	02:10
Key	*Improvement compared to 2031 Do Min*		*Deterioration compared to 2031 Do Min*		
Note	*'Opt.' = option, 'Do Min' = Do Minimum*				

Table 7-15 : PM Peak Network Performance Indicators - Ledborough / Longbottom Lane Junction

In the PM peak, all the intervention options show an increase in average delay and average travel time per vehicle when compared against the 2031 Do Minimum. However, the results for Option 1 are similar.

Option 1 (Mini roundabouts) provides the highest capacity of all the intervention options with the modelling results showing an improvement in traffic conditions in the AM peak period, when compared against the 2031 Do Minimum scenario. In the PM peak the results for Option 1 are similar to the Do Minimum scenario.

Option 2 provides the least vehicle capacity of all the intervention options.

For signalised options, 2 and 3, the right turning traffic into Ledborough Lane and Longbottom Lane only gets to proceed when the right turn only signal phase is running. This is because the straight ahead movements on the

A355 are heavy for both the northbound and southbound direction. This can result in the right turning traffic blocking back to the previous junction which has a negative impact for the straight ahead movement

The stacking capacity on the A355 between the two junctions of Ledborough Lane and Longbottom Lane is limited. This requires the signal stage timings to be shorter than is optimum to avoid queuing and blocking back from the right turning movements into Ledborough Lane / Longbottom Lane. This results in 'lost' capacity at the junction as a result of the increase in intergreen times.

7.6 Stakeholder Workshops

Engaging with stakeholders is a vital part of the Business Case process. Stakeholders consulted as part of the Scheme development process included local and regional stakeholders, plus the regional offices of several national organisations. It also includes environmental interests, transport users and operators, as well as community representatives and local community groups.

A stakeholder workshop was held on 7th October 2015 to gain feedback and assess the design options identified for the A355 improvements scheme. All aspects of the A355 Improvement Scheme were presented at the workshop. These included;

- Proposed alignments of Relief Road
- Junction arrangements for the Relief Road
- Proposed intervention options for Ledborough Lane / Longbottom Lane junctions
- Proposed intervention options at Gore Hill roundabout

The key points and observations that were raised at the stakeholder workshop are detailed below.

7.6.1 Relief Road Alignment

There were no strong preference / views to either of the alignments for the Relief Road. The eastern alignment was preferred by some as noise levels may be less for residents in Beaconsfield although others noted that the central alignment might have less of an environmental impact as it fitted between existing openings in the treeline.

7.6.2 Northern Junction of Relief Road with A355

There was support for both a roundabout with changes to Maxwell Road access and also for a signalised option.

It was mentioned that the option with Maxwell Road joining onto the A355 north of the junction would not mitigate the current issues where vehicles have difficulty turning right into and out from Maxwell Road.

Potentially, at the southern access option for Maxwell Road, vehicles could re-route onto other parallel routes instead

Concerns were voiced about whether Maxwell Road would get busier. It was noted that Maxwell Road has schools located on it so an increase in traffic flow would be undesirable. It was discussed whether there was a way to discourage additional through trips on Maxwell Road but retain access for HGV's and buses.

The wider question about trips south from Penn to the M40 and which route these might use was discussed. The Relief Road wouldn't necessarily solve this problem but could influence route choice.

7.6.3 Ledborough Lane / Longbottom Lane Junctions with A355

The overall opinion was that the signalised option would provide more control over traffic flow and increased safety although a mini roundabout option would better facilitate the main flow of vehicles on the A355.

It was discussed how difficult it was to turn right out of the side roads and whether this could be improved. However, it was also discussed that improving access from side roads may encourage more traffic to use these routes, and would increase delays on the A355.

There was a discussion as to whether alternative traffic calming measures could be introduced on Ledborough Lane replacing the existing speed bumps with chicanes/ strategic parking.

Concerns were raised regarding safety at this junction which may worsen as a result of the Relief Road.

There was discussion regarding whether the mini-roundabouts option would help solve the queuing problem, especially between the two mini-roundabouts.

7.6.4 Gore Hill Roundabout

There was no clear overall preference identified thus other potentially more expansive options need to be considered. The general view was that traffic needs to be separated more efficiently for the different turning movements at the Gore Hill Roundabout.

Additional suggestions for improving the roundabout included;

- Clear road markings
- Providing additional slip roads merging into a single lane (for left turning traffic)
- One way between Gore Hill and Tesco
- A ‘bigger’ solution than those already proposed

Further to the stakeholder workshops, BCC conducted an online survey to capture additional feedback from the stakeholders. The results of the feedback are summarised below:

- The results showed that there was a clear preference for an eastern alignment for the A355 Relief Road with 69% voting for the eastern alignment.
- A roundabout was the preferred option at the northern end of the Relief Road although results were split in regard to whether it was with direct or indirect access to Maxwell Road.
- There was a clear preference for mini-roundabouts at the junctions where Ledborough Lane and Longbottom Lane meet the A355. 40% of the votes were in favour of mini roundabouts over traffic signals, another alternative option or no changes to the current arrangement.
- It was acknowledged that changes had to be made at the Gore Hill roundabout although there was no clear preference. Additional extended lanes with associated road markings or segregated left turn northbound were both popular options with 32% of the votes each.

7.7 Summary

The modelling results show that the better performing A355 Relief Road scheme is option 1. This option is showing the greatest reduction in average travel time and delay per vehicle for both the AM and PM peak periods. Option 1 also shows significant reductions in journey times when compared against the Do Minimum scenario. It was documented from the stakeholder workshop that option 1 would address the current issue of right turning traffic from the A355 into Maxwell Road blocking the main A355 carriageway which causes delay for southbound headed traffic.

The current layout of the Ledborough Lane / Longbottom Lane junctions means that vehicle delay and congestion is not forecast to increase, with the largest increase in vehicle flow occurring on the main A355 carriageway which is an unopposed movement. The technical evidence shows that the majority of the proposed options, for the Ledborough / Longbottom Lane junctions, have negligible impact on the road network when

compared against the 2031 Do Minimum scenario. The outcomes from the stakeholder workshop indicated that there was no clear preference for any of the proposed options at this location.

At the Gore Hill roundabout, the transport model forecasts there to be a significant increase in vehicle delay by 2031. The technical evidence shows that the scheme options proposed at this location do not address the concerns and issues that currently afflict the roundabout. As such, it is considered that a larger scheme is required at this location. This was supported by feedback from the stakeholder groups which suggested that no single proposed option would have the desired effect of sufficiently relieving congestion, instead a combined package of measures or larger scale solution would be required at this roundabout.

8. Preferred Scheme Appraisal

8.1 Introduction

Chapter 7 of this report appraises the scheme options that were identified in the Stage 1 OAR for further appraisal. The identified options were independently modelled in order to ascertain the overall better performing options at each of the locations on the A355 that have been identified for improvement.

The technical evidence, obtained from the transport modelling in section 7 of this report, in conjunction with the outcomes from the stakeholders workshops has helped inform the decision as to which elements comprise the Preferred Scheme for the A355 Improvements package.

This chapter of the report assesses the overall Preferred A355 Improvements scheme package as a whole.

The assessment of the Preferred A355 Improvements package has been carried out using the Option Assessment Framework as set out in the DfT's Transport Appraisal Process, with evidence presented in relation to the:

- Strategic Case – The Strategic Case determines whether or not an investment is needed, either now or in the future. It demonstrates the case for change – that is, a clear rationale for making the investment its strategic fit and how an investment will further the aims and objectives of the organisation.
- Economic (Value for Money) Case – The economic case considers the economic, environmental and social impacts which when combined with estimated costs determine the overall Value for Money (VfM) of a proposal.
- Financial Case – The Financial Case for the scheme considers the overall cost (both in terms of its initial development and construction, and the later operating and maintenance costs). It also considers significant risks that may impact upon those costs and considers the likely funding source(s) for the scheme;
- Commercial Case – The commercial case provides evidence on the commercial viability of a proposal and the procurement strategy that will be used to engage the market. It should clearly set out the financial implications of the proposed procurement strategy. It presents evidence on risk allocation and transfer, contract and implementation timescales as well as details of the capability and skills of the team delivering the project and any personnel implications arising from the proposal.
- Managerial (Delivery) Case – The management case assesses whether a proposal is deliverable. It tests the project planning, governance structure, risk management, communications and stakeholder management, benefits realisation and assurance (e.g. a Gateway Review). There should be a clear and agreed understanding of what needs to be done, why, when and how, with measures in place to identify and manage any risks. The management case sets out a plan to ensure that the benefits set out in the economic case are realised and will include measures to assess and evaluate this. All projects and programmes are expected to have a risk management plan, proportionate to their scale.

8.1.1 Overall Preferred A355 Improvement Scheme Package

The Overall Preferred Scheme consists of the following package:

A355 Relief Road

A355 Relief Road option 1 (eastern alignment) – Includes a roundabout at the northern end of Relief Road with no direct access to Maxwell Road. Maxwell Road would gain access to Amersham Road and to the Relief Road via the old Amersham Road and the new link from the southwest side of the roundabout.

Ledborough Lane / Longbottom Lane Junctions

At Ledborough Lane it was decided that none of the proposed options will be taken forward as part of the overall Preferred Scheme. The technical evidence suggests that there was little to no benefit in providing any of the options and the outcomes from the stakeholder workshops failed to identify a Preferred Scheme.

Instead of providing any the proposed options outlined in this report, minor improvements will be made which include signing and lining, along with a monitoring and evaluation exercise at this location.

The range of measures to be provided at this location will be further detailed in the next stage of the business case.

Gore Hill Roundabout

At Gore Hill roundabout, the technical evidence and feedback from the stakeholders workshop suggests that the current proposals would not be sufficient to address the existing traffic concerns at this location and that a larger scale scheme would be required. This will require further scheme designs and appraisal.

Additional options for the Gore Hill roundabout will be detailed in the next stage of the business case.

8.2 Strategic Modelling

The transport modelling undertaken for the overall Preferred Scheme will assess the wider strategic distribution of traffic volumes and the potential for induced or suppressed traffic demand impacts. The outputs from the model will also provide input to the economic assessment.

In order for the impacts of the Preferred Scheme to be fully assessed it was considered important that the model accurately represented movements through Beaconsfield and on all routes that would be affected by the scheme. More specifically it was necessary to ensure that movements on the A355 Amersham Road, A355 Dorney Hill, the A40 to the East and West, the B474, M40, Longbottom Road, Ledborough Lane and the interaction of these links with the rest of the strategic road network were well represented.

Further information regarding the model calibration / validation process can be found in the report ‘A355 Improvements (Gore Hill/Wilton Park) Business Case Model - Local Model Validation Report’ November 2015.

8.2.1 Forecasting Approach

The approach to forecasting was set out in the Appraisal Specification Report, 2014, and is consistent with WebTAG guidance. Two forecast years were modelled, and for each year a “with scheme” and “without scheme” model was built. The “Scheme” referred to being the proposed A355 Relief Road Improvements.

The proposed opening year for the scheme is 2019; that has therefore been used as the first forecast year. A second forecast year of 2031, being 12 years after the opening year has also been modelled. Data from these two forecast years will be used to inform the economic (60 year) appraisal.

For each forecast year, the specific inclusion of certain developments and infrastructure will be consistent with current expectations and advice from Buckinghamshire County Council (the highway authority) and South Bucks District Council (the planning authority). For example, infrastructure that is expected to be completed by 2015 will be present in both forecast years. The infrastructure does not form part of the scheme that is being assessed, so it will therefore be included in both the ‘with scheme’ and ‘without scheme’ scenarios.

8.3 Scheme Appraisal

The following plots show the vehicle flow and link speed differences, for the wider and local road network, comparing the 2031 ‘Do Something’ scenario (with Preferred Scheme) against the 2031 ‘Do Minimum’ scenario. A red line indicates a decrease whereas a green line represents an increase.

It should be noted that any new link included in the Do Something modelled network that is not present in the Do Minimum modelled network will show an increase. Therefore, the large increases that are shown for the proposed Relief Road and links adjoining the junction at the northern end of the Relief Road are because they are new links that are not present in the Do Minimum network not because there is an increase between the two scenarios.

Figure 8-1 illustrates the AM peak link flow differences between the 2031 Do Minimum and Do Something scenarios on the road network. Figure 8-2 illustrates the AM peak link speed differences between the 2031 Do Minimum and Do Something scenarios on the road network.

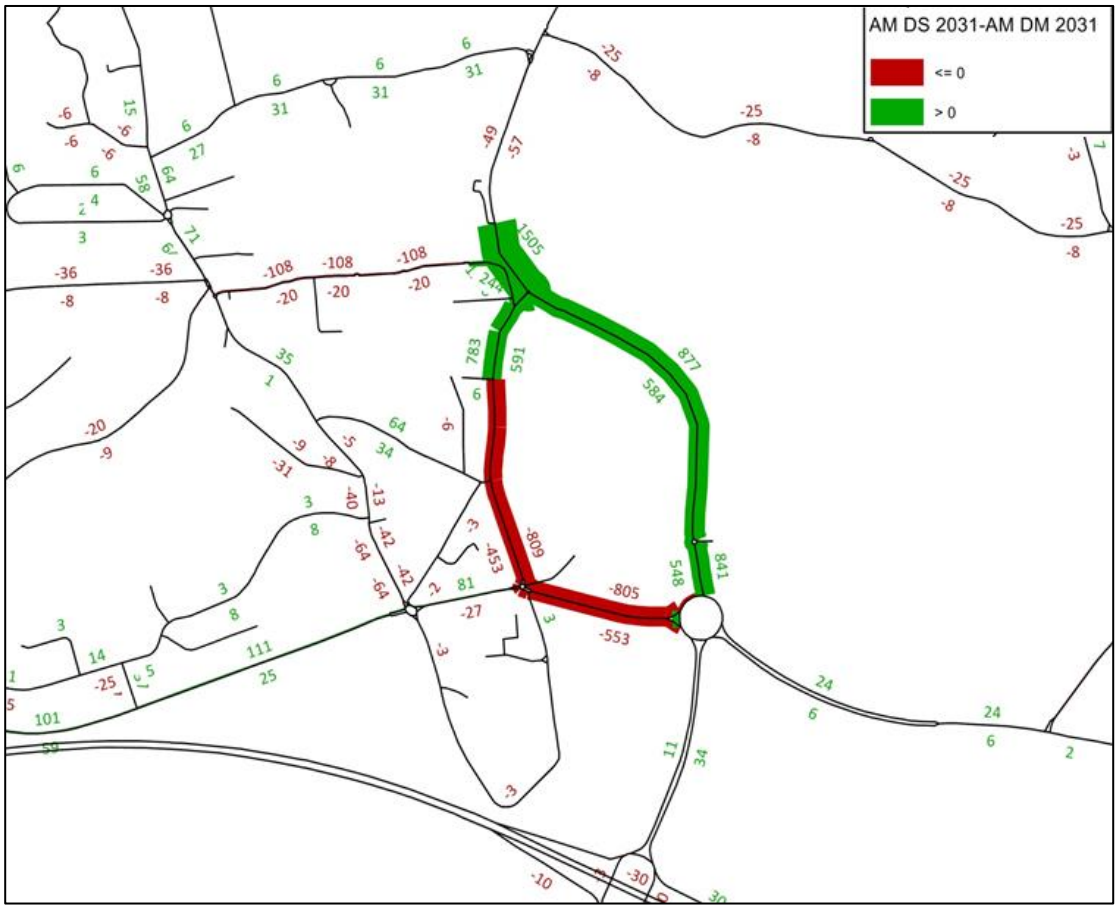


Figure 8-1 : AM Peak Link Flow Comparison

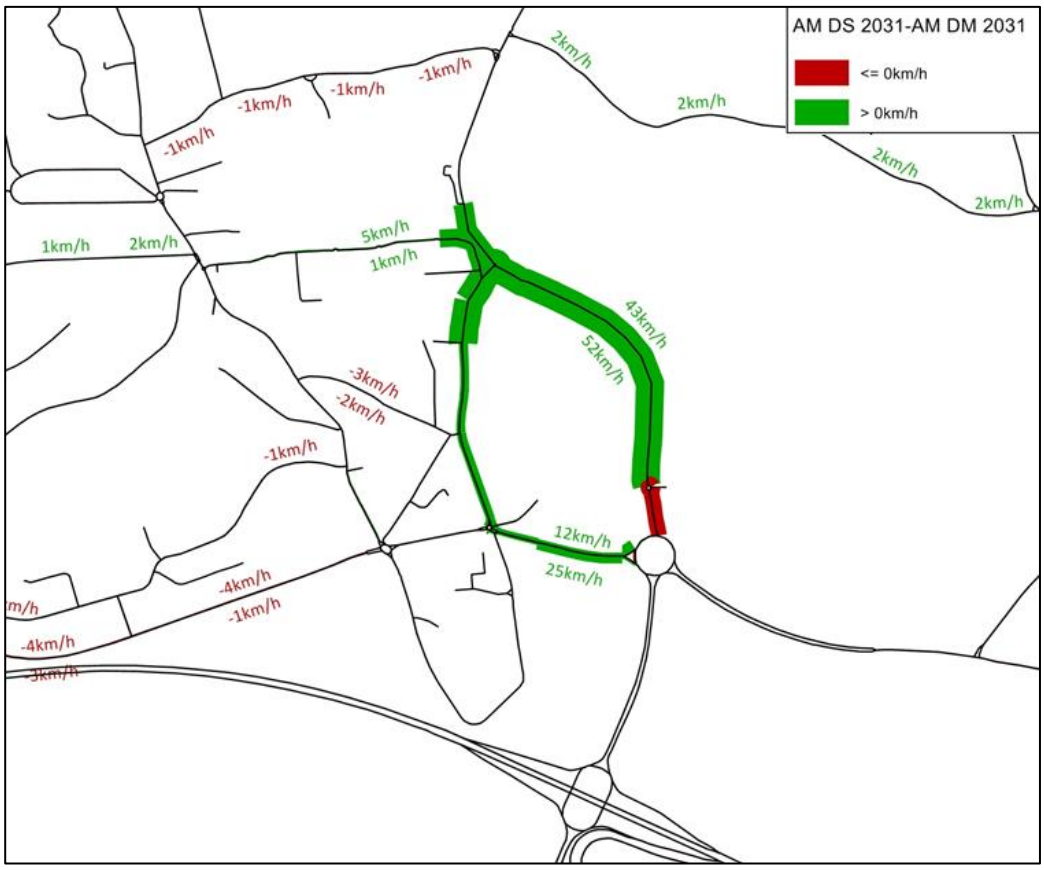


Figure 8-2 : AM Peak Link Speed Comparison

The AM peak model outputs illustrate that:

- In the 'Do Something' (Preferred Option) scenario there have been two-way flow decreases on the A355 (south) and A40 (between the London End roundabout and Pyebush roundabout) when compared against the 'Do Minimum' scenario.
- The eastbound approach to Pyebush Roundabout on the A40 London Road shows a reduction in flow of approximately 800 vehicles when compared against the 'Do Minimum' scenario. Link flow on the A40 London Road (westbound), travelling towards the London End Roundabout, has decreased by 550 vehicles. These decreases in flow are a result of traffic reassigning from the A355 and A40 London Road onto the A355 Relief Road.
- Maxwell Road has a two-way flow decrease of 130 vehicles whilst Candlemas Lane shows a two-way increase of 100 vehicles.
- Ledborough Lane and the A40 London End show a negligible difference in two-way vehicle flow when comparing the 'Do Minimum' and 'Do Something' scenarios.
- The impacts of reassigning traffic are mostly contained on the local road network with only relatively small flow differences experienced in the wider area.
- Link speeds on the A355 (south) and A40 (between London End roundabout and Pyebush roundabout) increase in the Do Something scenario as a result of traffic reassigning onto the A355 Relief Road

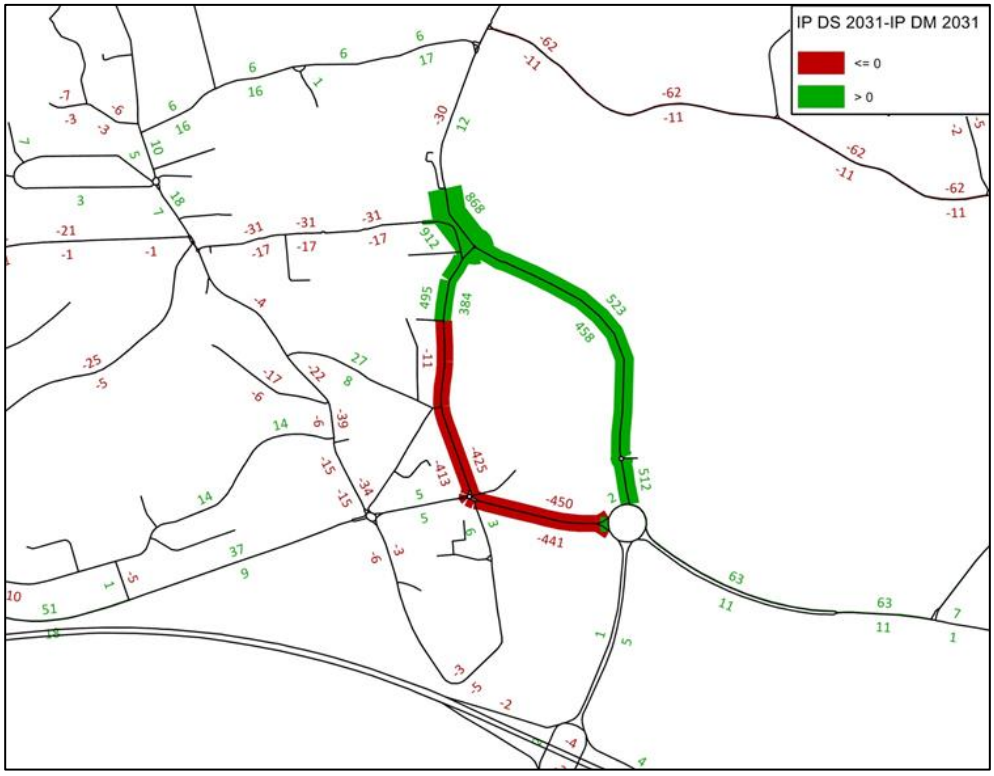


Figure 8-3 : Interpeak Link Flow Comparison

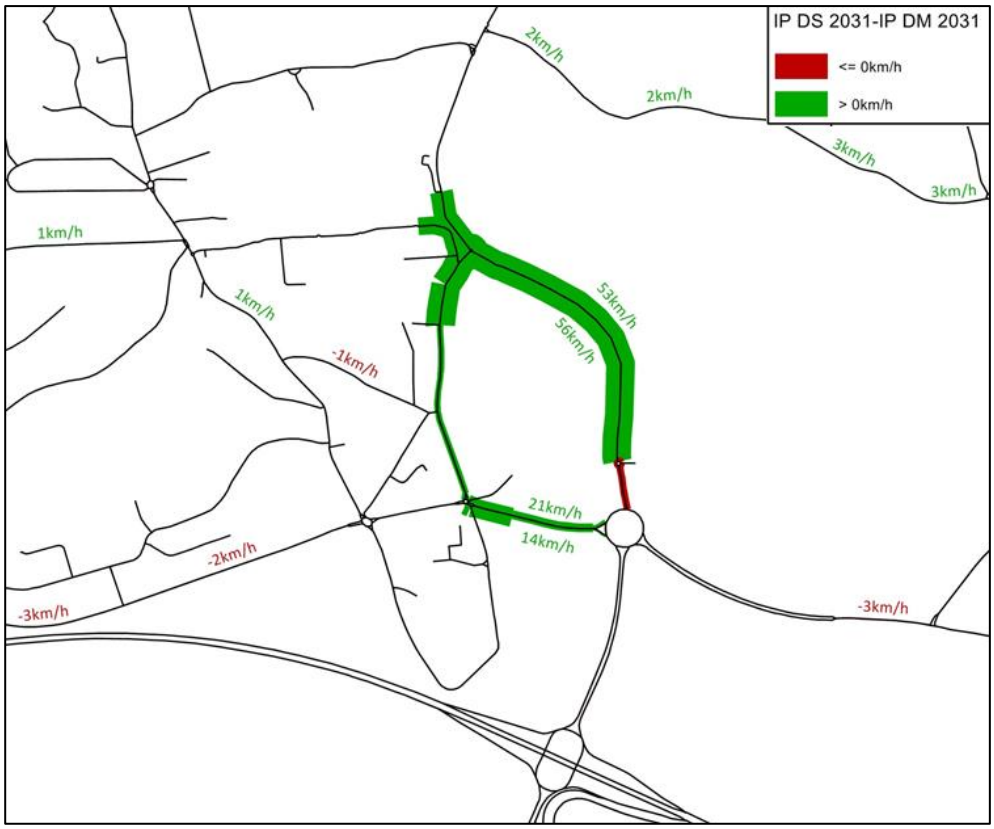


Figure 8-4 : Interpeak Link Speed Comparison

Figure 8-3 shows the Interpeak flow differences between the 2031 Do Minimum and Do Something scenarios on the road network. Figure 8-4 illustrates the Interpeak link speed differences between the 2031 Do Minimum and Do Something scenarios on the road network.

The interpeak model outputs show that;

- There is a decrease in two-way vehicle flow on the A355 (south) and A40 London Road of approximately 800-900 vehicles. This decrease in traffic is a result of vehicles reassigning from these links and onto the A355 Relief Road.
- Maxwell Road shows a two-way decrease in flow of 50 vehicles whilst the other parallel routes of Candlemas Lane and A40 London End show negligible differences. Longbottom Lane is showing a two-way decrease in vehicle flow of 70 between the two scenarios.
- Link speeds on the A355 (south) and A40 (between London End roundabout and Pyebush roundabout) increase in the Do Something scenario as a result of traffic reassigning onto the A355 Relief Road

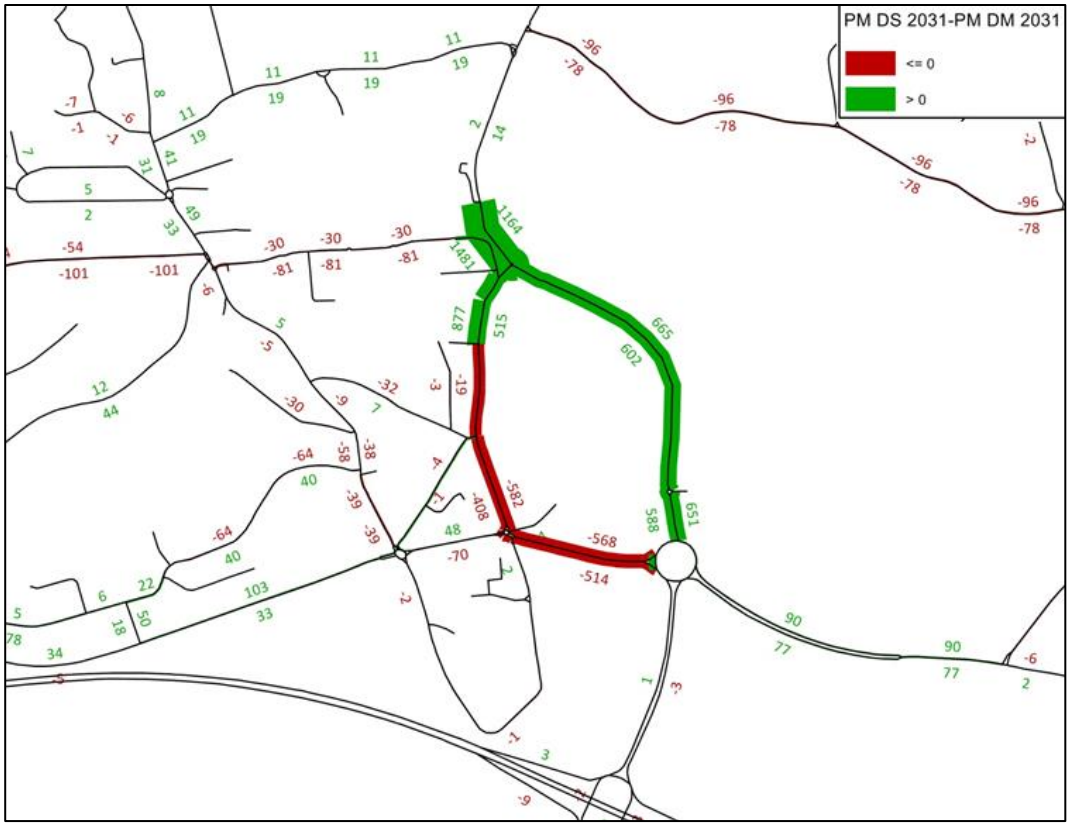


Figure 8-5 : PM Peak Link Flow Comparison

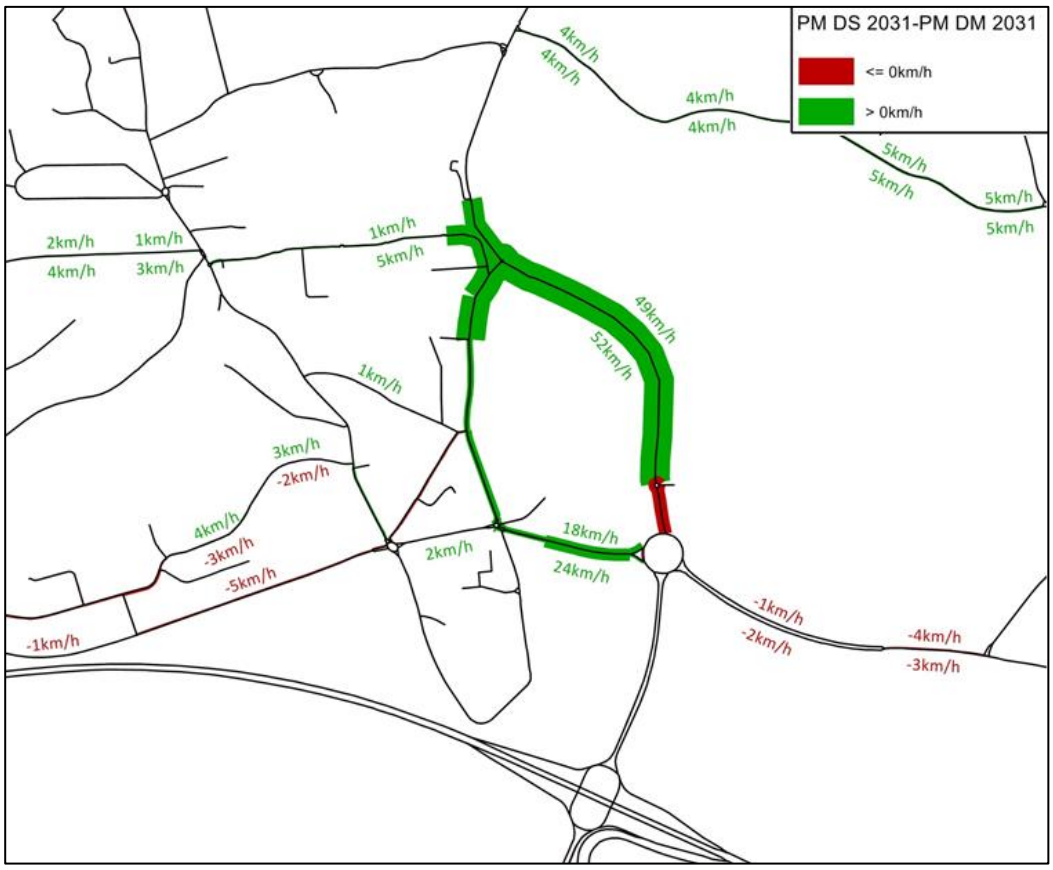


Figure 8-6 : PM Peak Link Speed Comparison

Figure 8-5 shows the PM peak flow differences between the 2031 Do Minimum and Do Something scenarios on the road network. Figure 8-6 illustrates the PM peak link speed differences between the 2031 Do Minimum and Do Something scenarios on the road network.

The PM peak model outputs show that;

- There is a reduction in flow on the A40 (between London End roundabout and Pyebush roundabout) of approximately 1000 vehicles when comparing the two scenarios. The A355 (south) also shows a two-way decrease in vehicle flow of approximately 1000. These flow decreases are a result of traffic reassigning from the A40 London and A355, onto the A355 Relief Road.

- Two–way vehicle flow on the A40 (east of Pyebush roundabout) shows an increase of 170 vehicles.

- Maxwell Road and Longbottom Lane show a two-way decrease of 110 and 170 vehicles, respectively when comparing the Do Minimum and Do Something scenarios.

- Link speeds on the A355 (south) and A40 (between London End roundabout and Pyebush roundabout) increase in the Do Something scenario as a result of traffic reassigning onto the A355 Relief Road

8.3.1 Summary

The flow difference plots comparing the ‘Do Something’ (Preferred Scheme) and ‘Do Minimum’ scenarios show that with the implementation of the A355 Relief Road there is a significant shift in vehicle flow from the A355 and A40 London Road onto the A355 Relief Road for all the peak periods (AM, interpeak and PM). This is a result of vehicles reassigning to avoid the current congestion issues experienced at London End roundabout.

This reduction in vehicle flow on the A355 will reduce the congestion and delay issues at the London End roundabout and also for roads that have junctions with A355 in the Beaconsfield area.

The technical evidence indicates that the overall impact on the road network is predominantly constrained to the local road network with limited impact on the wider area. Re-assigning traffic, outside of the study area, is relatively minimal with negligible impact on the parallel routes of Ledborough Lane and Maxwell Road.

8.4 Economic Assessment

For the purposes of the economic appraisal, it has been necessary to develop scheme costs for the overall Preferred Scheme. These have been based on concept drawings for the scheme, from which capital costs have been estimated and assumptions made about the overall scheme budget. Allowances for improvements to the Gore Hill and Ledborough Lane / Longbottom Lane junctions have been included through uplifting initial cost estimates. However, Any benefits that would occur as a result of schemes at these localities are not taken account of in the economic appraisal, and are therefore assumed to deliver nil detriment to journey time overall.

In order to develop the cost estimates for use in the economic assessment of the schemes, the following adjustments have been applied:

- Allowances for design, preparation and supervision costs (assumed to be 20% of roadworks and preliminary cost)
- Allowances for land and property purchase (based on an estimated cost of £200,000)
- A scheme risk budget of 20% is included within the cost estimate to broadly reflect a level of design development risk, construction risk, employer change risk and employer other risks
- An Optimism Bias adjustment of 15% has been assumed.
- The costs used, reflect construction projects of a similar size and nature and are at current day prices (1st Quarter 2015)
- Inflation is included for construction costs over and above general inflation rate. General inflation rate of 2% pa (Banks of England MPC's inflation target), construction cost inflation rate of 4.5% pa (Faithful & Gould construction inflation report)
- Value Added Tax (VAT) is excluded
- The estimate produced at this stage is assumed to have an accuracy level of -20% to +20%

An additional allowance of 20% of highway and preparatory cost has also been assumed as private sector contribution associated with the delivery of the southern section of the route by the Wilton Park development.

Summarised costs for the A355 Relief Road Improvement scheme are provided in . The table also includes cost estimates for -20% and +20% accuracy levels. A detailed breakdown of these costs is available in the report 'A355 Improvements (Gore Hill/Wilton Park) – Outline Business Case, March 2016'.

For the economic assessment optimism bias of 15% has been used to calculate the overall cost of the Preferred Scheme

Expenditure Item	Preferred Option (-20% cost)	Preferred Option	Preferred Option (+20% cost)	Notes
Preparatory	£649	£811	£973	20% of preliminaries and works
Highway Works (inc. preliminaries and site supervision)	£3,243	£4,054	£4,865	
Land	£160	£200	£240	
Risk allowance	£778	£973	£1,168	20% of preparatory and highway works
Optimism Bias	£701	£876	£1,051	15% uplift of subtotal inc. risk
Construction Cost Inflation	£455	£569	£683	
Total	£5,986	**£7,483**	£8,980	

Table 8-1 : A355 Relief Road Preliminary Scheme Cost Estimates - 15% Optimism Bias (£000's)

The economic assessment of the A355 Relief Road Improvement Scheme has used the DfT TUBA software (version 1.9.5), in order to capture transport user benefits in terms of potential journey time savings and vehicle operating cost savings. The primary inputs to the TUBA process were:

- Number of trips, journey time and distance matrices from the traffic model for the 2019 and 2031 Do Minimum and Do Something scenario for each hourly time slice within the model period (weekday AM (0800-0900), inter-peak (1000-1600) and PM (1700-1800) peak periods) and modelled vehicle type (Car, LGV and HGV);
- Scheme costs and delivery programme; and
- Standard TUBA economic parameters for the growth in values of time and fuel costs over the appraisal period.

8.4.1 Economic Indicators

A summary of the economic statistics for the Scheme options are presented in Table 8-2, with full details provided in the Transport Economic Efficiency (TEE), Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB) Tables in Appendix D of this report.

	Economic Appraisal Results
	Preferred Option
Monetised Costs and Benefits	
Greenhouse Gases	£0.4m
Consumer User Benefits (Commuting)	
Travel Time *Vehicle operating costs*	£7.5m £0.6m
Consumer Users (Other)	
Travel Time *Vehicle operating costs*	£14.6m £0.9m
Business Users and Providers	
Travel Time *Vehicle operating costs*	£16.1m £1.3m
Wider Public Finances (Indirect Taxation Revenues)	£1.0m
Present Value of Benefits (PVB)	£39.5m
Broad Transport Budget	£5.5m
Present Value of Costs (PVC)	£5.5m
Overall Impact	
Net Present Value (NPV)	£33.9m
Benefit to Cost Ratio (BCR)	**7.2**

Table 8-2 : Economic Summary Statistics (Present Value)

From the summary statistics, it is clear that the Preferred Option would bring substantial benefits and value for money. The value is reflected most clearly by the BCR which is 7.2. This is greater than the threshold value of 4.0 which represents 'very high' value for money against DfT guidelines[45].

As expected for a scheme of this nature, the majority of economic efficiency benefits are generated in the form of journey time savings, of which 65% will be experienced by consumers and 35% by business users. Smaller proportions of the schemes overall PVB are attributable to vehicle operating costs (7%) and greenhouse gas emissions (1%). At this stage, however, potential benefits/disbenefits to be accrued from sub-objectives such as noise, local air quality and accident savings have not been accounted for.

The economic assessment forms a key part of the scheme appraisal process, however, needs to be considered in line with other WebTAG objectives. The TUBA analysis concludes that the preferred scheme is considered economically viable, representing 'very high' value for money.

[45] *DfT, 2013. Value for Money Assessment: Advice Note for Local Transport Decision Makers*
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/267296/vfm-advice-local-decision-makers.pdf

8.5 Preferred Scheme Assessment

The subsequent assessment of the preferred scheme package has been carried out against the '5 Cases Model' criteria within the Option Assessment Framework. These are:

- Strategic Case
- Value for Money Case
- Delivery Case
- Financial Case and;
- Commercial Case

8.5.1 Strategic Fit

The impacts of the Preferred Scheme package should be regarded in the context of the intervention-specific objectives identified for the scheme in section 6.1. These can be summarised as:

1) Support growth
2) Manage congestion hotspots and maintain or improve journey time reliability
3) Improve connectivity
4) Maintain a high quality of life
5) Promote both social inclusion and community cohesion

The journey time benefits of the Preferred Scheme package identified through the TUBA strongly support the identified objectives 1-3 above. Objectives 1-3 are all complementary by managing the congestion hotspots and improving journey time reliability, connectivity is improved, which in turn supports growth.

The reduced journey times demonstrated through the TUBA assessment are themselves indicative of reductions in congestion, and as detailed in TAG unit A1.3 a reduction in journey times leads to improved journey time reliability. The journey time savings also suggest an improvement in connectivity, particularly north-south connectivity due to the increased capacity in the highway network to facilitate this movement. Connectivity is improved with the Relief Road as the inevitable reassignment of traffic from existing routes on to the Relief Road frees up capacity on those routes for other trips.

Finally, the improvements in journey times and connectivity support economic growth as the reduction in time spent travelling reduces the amount of non-productive time for business travellers. Journey time reductions are likely to have the wider impact of increasing "effective density" (see section 8.5.2) leading to agglomeration benefits for the local economy. The reduced travel times may also encourage more people in to work, again supporting growth.

Although it has not been assessed at this stage, the reductions in journey times and congestion indicate improvements to noise and air quality (indeed, the TUBAs have already demonstrated a reduction in greenhouse gases) which can contribute to maintaining a high quality of life (objective 4). The reduction in traffic flow around London End roundabout as a result of the Relief Road means traffic is removed from populated to unpopulated areas, which will have a positive impact on the local population in that area.

The journey time savings and reliability improvements for private transport users (i.e. cars and goods vehicles) will similarly be experienced by public transport vehicles on the highway network. This will lead to improved connectivity and accessibility to local services for everyone, not just car owners, and will therefore promote social inclusion and community cohesion, satisfying objective 5 above. The schemes also have complementary measures to promote cycling and pedestrian accessibility, which will also contribute to meeting this objective.

In summary, the Preferred Scheme scores highly in meeting the five objectives for the scheme.

Fit with wider transport and government objectives

The identified scheme objectives are consistent with the wider transport policy objectives, thus by meeting the former, a scheme satisfies the latter. As detailed above the Preferred Scheme strongly contributes to:

- Leading to decongestion benefits to the A355, an Interurban 'Priority Congestion Management Corridor'
- Improving accessibility and north/south connectivity
- Supporting economic and residential growth
- Facilitating the delivery of complementary sustainable transport measures and improved local air quality which may bring minor health benefits

8.5.2 Value for Money Case

The Economic (Value for Money) Case considers the likely benefits and disbenefits of the Preferred Scheme in terms of economic, environmental and social impacts as well as impacts on public accounts.

The results of the Value for Money assessment of the Preferred Scheme are presented in the Appraisal Summary Table included in Appendix E, and summarised in Table 8-3.

Table 8-3 provides an indication of the performance of the Preferred Scheme against each of the Economic Case criteria. The assessment is presented in a matrix format and a colour coded scoring system has been applied.

Impacts		Assessment Criteria	Preferred Scheme
Economy	Business users & transport providers	Impact on journey time and cost	+2
	Reliability impact on Business users	Impact on number of incidents and day to day variability in journey times or average minutes of lateness.	+2
	Regeneration	Impacts on a designated regeneration area	Not assessed
	Wider Impacts	Wider economic impacts	Not quantified at this stage
Environmental	Noise	Noise Impact	+1
	Air Quality	Effects on AQMAs - Impacts on local air quality.	+1
	Greenhouse gases	Change in CO2 emissions.	+1
	Landscape	Impact on open countryside	-2
	Townscape	Impact on built-up areas	+2
	Historic Environment	Impact on designated sites	+1
	Biodiversity	Impact on	-2
	Water Environment	Impact on drainage	-1
Social	Commuting & Other users	Impact on journey time and cost	+2
	Reliability impact on Commuting and Other users	Impact on number of incidents and day to day variability in journey times or average minutes of lateness.	+2
	Physical activity	Impacts on levels of walking and cycling	+1

	Journey quality	Impacts on journey experience	+1
	Accidents	Change in number and severity of transport-related collisions.	+1
	Security	Impact on security risk	+1
	Access to services	Change in ease of access to key locations	+1
	Affordability	Affordability impacts of the transport system to users	Neutral impact - no impact on user charges.
	Severance	Effects on movement by non-motorised modes	+1
	Option and non-use values	Introduction of new transport options	+1
Public Accounts	Cost to Broad Transport Budget	Capital cost (£ million, 2010 prices)	5.5
	Indirect Tax Revenues	Indirect tax and revenue impacts on public sector	-1

Notes to table:
1 Scoring system: +2 = moderate positive impact; +1 = slight positive impact; 0 = mixed or negligible impact; -1 = slight negative impact; -2 = moderate negative impact
2 The scores attributed to each option are intended to illustrate the relative performance against each of the appraisal criteria, based on the assessment undertaken to date. Scores should not be considered as absolute.

Table 8-3 : Summary of assessment against Economic Case

Agglomeration

Agglomeration benefits come about when businesses have better accessibility to other business and workers, increasing the "effective density". It has been demonstrated that increases in the effective density lead to an improvement in productivity. The Preferred Scheme will bring about a benefit in this sense as it will reduce north/south journey times, improving the accessibility between business in Beaconsfield and Slough, as well as improving access to the M40, and thereby businesses in other areas of the country. Traffic reassigning on to the Relief Road will have knock on effects for other business in the town, as existing junctions such as London End Roundabout will experience a reduction in traffic and delays, thereby improving accessibility for business in the Old Town. The proposed scheme will therefore bring about agglomeration benefits to the local economy as a whole, and not just those which are able to use the proposed Relief Road.

Output change in imperfectly competitive markets

The output change in imperfectly competitive markets arises as a result of increases in the output of goods and services being valued more highly by consumers than cost of producing this output. TAG unit A2.1 recommends a simplified method of calculating this by assuming it is equal to 10% of the business transport user benefit, derived using TUBA.

Tax revenue from labour market impacts

The proposed transport scheme is forecast to bring about a reduction in transport costs which will in theory encourage more people in to work, and therefore result in an increase in GDP with increased tax revenues to the exchequer. There is insufficient modelled data to quantify this impact, however given the relatively high transport user benefits, this could be a significant wider benefit.

Environmental impacts

The scheme will deliver environmental impacts to the areas surrounding the existing highway network which will be relieved by the Preferred Scheme.

The effects from the Proposed Scheme will relate to changes in pollutant concentrations from vehicle emissions using the roads in the local area. There are already areas in the wider locality and specifically around the M40 identified as having high concentrations of NO2 and have been declared as AQMAs.

Changes to the pollutant concentrations are dependent on a number of variables such as changes related to vehicles and their locations. Examples of changes related to vehicles which can have an effect on the overall impact are;

- Vehicle numbers;
- Vehicle speed;
- Traffic congestion; and
- Numbers of heavy duty vehicles.

Changes related to vehicle location will have an effect based on their proximity to sensitive human or ecological receptors. Moving traffic away from local receptors will result in air quality improvements at these locations. Mitigation of this nature can be very effective in reducing exposure to high pollutant concentrations.

Congestion along the existing A355 and associated minor roads including London End and London Road is anticipated to be alleviated by the Proposed Scheme. This will lead to an improvement in air quality on a local scale at the receptors identified.

Noise and air quality is likely to improve around Beaconsfield Old Town and on the southern section of the A355, from Maxwell Road to London End, as traffic reassigns onto the Relief Road. These improvements will be offset by the disbenefit of the new road, however, there will be fewer noise receptors associated with the new route, and therefore an overall noise benefit would be expected. The TUBA detailed previously has already demonstrated a reduction in greenhouse gases as a result of the scheme.

The impact on properties immediately adjacent to Maxwell Road, where the Proposed Scheme will tie into the existing A355 by a roundabout, are anticipated to experience a negligible change in air and noise quality. Analysis of the technical data shows that whilst the Preferred Scheme relieves congestion on the local road network the level of induced traffic remains relatively low.

As the scheme reduces the amount of traffic through Beaconsfield Old Town, there is the potential for benefits to the town scape and historic environment in that area.

There could, however, be potential visual and landscape impacts. These are identified as;

- An urbanising effect on the landscape character and the wider landscape setting;
- Localised landscape impacts on the Chilterns AONB, albeit in the context of the existing highway infrastructure;
- Reduction of the openness of a localised part of the Green Belt;
- Vegetation removal, which might exacerbate views towards the Proposed Scheme;
- Views of the Proposed Scheme (A355 Beaconsfield section) from residential properties along the A355, users of public rights of way, vehicle travellers on the A355 and travellers on the railway line to the north and
- Views towards the Ledborough Lane/Longbottom Lane Junctions and Gore Hill Junction from residential properties and users of public rights of way.

It is not anticipated that all of these potential impacts will lead to significant environmental effects.

Journey Quality

Journey quality is anticipated to improve with the Preferred Scheme, due to improved road geometry and layout, and through reduced congestion on the A355, A40 and Beaconsfield area.

It is anticipated that the Preferred Scheme will also deliver improvements in the walking and cycling environment, especially with the significant reduction in vehicle flow on the southern section of the A355 that will result in perceived journey quality benefits for pedestrians and cyclists. Improved provision of off-road shared use footway/cycleways will also contribute towards improving journey quality

Accidents

The collision data, in section 3.3.5 of this report, suggests that the London End junction currently suffers from safety issues. The technical evidence shows that with the implementation of the Relief Road there is a reduction in traffic flow travelling through this junction as a result of traffic reassigning onto the new Relief Road.

The Relief Road will have relatively fewer pedestrians and cyclists, as well as off-road cycle facilities, than the existing highway routes, and there is anticipated to be a reduction in the likelihood of injuries to more vulnerable road users as a result.

8.5.3 Financial Case

Preliminary scheme costs for Preferred Scheme have been developed based on Q1 2015 prices as outlined in Section 8.4. Summarised costs for the Preferred Scheme are provided in Table 8-1, with a detailed breakdown available in the report 'A355 Improvements (Gore Hill/Wilton Park) – Outline Business Case, March 2016'.

The financial case for the scheme is based on scheme development to date, including optioneering and the identification and costing of the emerging Preferred Scheme and Next Best options.

The cost of implementing the scheme has been estimated, with consideration of the guidance set out in TAG Unit A1.2. The overall approach incudes derivation of base costs, application of appropriate inflation assumptions to account for changes in real costs over time, and adjustments for risk and optimism bias.

Affordability has been considered in light of the following potential budget contributions to the proposals:

- BTVLEP Strategic Economic Plan capital budgets
- Buckinghamshire Local Transport Board devolved major scheme funding
- BCC Capital Expenditure budgets for highways
- BCC Revenue budgets for transport and highways maintenance
- Private funding sources e.g. S106 funding contributions

Deployment of a funding mix from these sources is available to meet both the initial capital costs of the scheme and to support on-going maintenance costs, following construction, to ensure that the proposals are sustainable in the long term.

The overall Preferred Scheme cost is approximately £7.5m. Costs, however, will be reduced through the delivery of the southern section of the route by the Wilton Park development.

The cost estimates include preparatory costs associated with scheme design, planning application and planning and statutory processes etc., land acquisition costs, construction preliminaries and scheme construction. The cost estimates have been developed according to a set of assumptions which reflect the following:

- The cost estimate has been prepared from the design information produced to date for each element of the scheme, using approximate quantification for the major elements of the works (Method of Measurement for Highway Works) that reflects our current understanding of the proposed scheme
- The rates used reflect construction projects of a similar size and nature and are at current day prices (1st Quarter 2015)
- An allowance has been included to account for construction cost inflation over and above general inflation
- A risk budget is included to broadly reflect a level of design development risk, construction risk, employer change risk and employer other risks, in addition to Optimism Bias

- Value added Tax (VAT) is excluded

Cost estimates have been based on a specification for minor improvements to the A355 junctions with Ledborough Lane and Longbottom Lane, to include signing and lining.

Cost estimates for Gore Hill Improvements have been excluded at this stage as it was concluded that none of the proposed scheme designs are deemed appropriate solutions to be taken forward at this stage. It is acknowledged that a larger scale scheme is required to address the current transport issues at this location. Alternative options and funding streams will be explored, for the Gore Hill roundabout junction, at the next stage of the business case.

Maintenance costs for the scheme are assumed to place a medium to long term ongoing maintenance liability on BCC following the adoption of the new roads e.g. resurfacing / renewal of the additional highway infrastructure, a net increase in additional drainage clearance, lighting operation, structural inspections etc. It could also be considered, however, that the scheme will reduce traffic volumes on existing roads which could have a positive impact upon the condition of those roads. At this stage, however, the cost implications of this are unknown, and have not been incorporated into a whole life VfM assessment.

The profile of budget provision is summarised in Table 8-4 below. Budget provision will be reviewed as the detailed design of the scheme progresses, with prospects for an accelerated delivery programme to be implemented which will bring forward capital expenditure to earlier years in the delivery programme. At this stage, the expenditure programme is considered to be deliverable but prudent, pending confirmation of detailed specifications, including ground conditions and the need for utilities diversions, which will inform the final delivery programme. The private funding budget provision outlined in Table 8-4 has been based upon calculations using an optimism bias of 15%.

Funding source	Total
LGF Award	£6.05m
BCC Leader Capital	£0.15m
Private (inc. Section 106/S278 agreements)	£1.21m
Total	**£7.41m**

Table 8-4 : Summary of Budget Provision (2015/16 to 2018/19)

Table 8-1 shows that using an optimism bias of 15%, the total cost of the Preferred Scheme ranges from £6.0m to £9.0m when taking into account the accuracy levels of the estimated costs. Table 8-4 shows that the total funding, from all the different sources, totals £7.4m which falls within the estimated cost range.

Full details regarding the Financial Case can be found in the report 'A355 Improvements (Gore Hill/Wilton Park) – Outline Business Case, March 2016'.

8.5.4 Commercial and Delivery Case

Outline Approach

BCC has a strong track record in the procurement and delivery of major schemes; three notable examples of recent projects that have been delivered or are nearing completion include Aylesbury Vale Parkway, Aylesbury Public Transport Hub and the Chapel Lane Improvement Scheme.

BCC are committed to delivering best value in the delivery of major highways schemes across the county and will continue to review options for procurement as the project develops through detailed design to commissioning of works on site.

As with all construction projects, there is a need for time, cost and quality issues to be managed and their inevitable tensions balanced. The process of contract selection and formulation will help to ensure scope of project and project-specific risks are controlled through procurement.

At this stage of business case development, the commercial case has been developed at a strategic level. Details on contract length, human resource issues and contract management will be finalised and updated subject to approval to proceed with the further development of the business case.

Procurement Strategy

The procurement of the business case development, scheme design, and associated services would be via the Transport for Buckinghamshire (TfB) Contract; an 'Alliance' model comprising BCC functions supported by the services of Ringway Jacobs Ltd and Amey.

The delivery plans for the scheme will be drawn up on the basis of BCC's preference to demonstrate value for money through a competitive environment[46], in accordance with The Public Contracts Regulations 2006.

Due to the different scales and emerging timescales of the Relief Road and junction improvement proposals, it is intended that they will be delivered as separate, distinct elements. As such, the possibility of further linking of project procurement is considered unlikely. However, the Council recognises that if multiple projects are approved – as part of the BTVLEP Local Growth Fund programme – there may be potential synergies between other projects that may yield increased value and faster overall delivery timetables by concatenating the procurement processes.

The final selection of procurement approach will be driven by, and the evaluation criteria will be set to reflect, the BCC Commercial Services Strategy[47], which includes the following requirements:

- To present new business opportunities to the market in a way that attracts the most capable suppliers and to stimulate competition and deliver best value;
- To comply with our legal obligations and standing orders relating to contracts;
- To incorporate social, economic, and environmental priorities into the evaluation criteria to the extent that they are relevant, proportionate, and do not compromise value for money;
- To ensure that decisions are based on whole life costs wherever possible; and
- To maximise the opportunity for small businesses, third sector, and voluntary organisations.

The main works for the A355 Relief Road will be in excess of the EU public procurement financial threshold £4.3m[48]. Publicly procured construction works greater than this value must be advertised within the Official Journal of the European Union (OJEU) under the European public contracts directive (2004/18/EC). Works will likely be procured using the New Engineering Contract (NEC) 3, Engineering and Construction Contract (ECC)[49], a published form of contract which:

- Stimulates good management of the relationship between the two parties to the contract and, hence, of the work involved in the contract
- Provides clarity, flexibility and simplicity
- Provides a rigorous approach to the evaluation of claims
- Has incentives available to complete on time and below budget by the use of contract options
- Widely used in the UK, especially in the public sector, and so contractors are experienced in its use
- Is endorsed by the Office of Government Commerce for use on public sector construction projects

[46] BCC, 2015. *Buckinghamshire County Council Constitution* http://www.buckscc.gov.uk/media/3041841/Constitution.pdf
[47] BCC, 2012. *Commercial Services Strategy 2012-2015*. https://democracy.buckscc.gov.uk/documents/s24925/R08.12%20Appendix.pdf
[48] OJEU, 2014. *EC Procurement Thresholds*. http://www.ojeu.eu/threshholds.aspx
[49] NEC® Contracts, 2014. *About NEC*. https://www.neccontract.com/About-NEC

At this stage, only modest improvements are proposed at the Gore Hill Roundabout and Ledborough Lane / Longbottom Lane Junctions.

The total value of these works will be less than EU thresholds. In line with the BCC Commercial Services Strategy[47] and Constitution[50], potential bidders will be identified using the most cost-effective and reasonable methods. This will most likely comprise delivery under the TfB contract; as the TfB contract is already in place, it should enable faster delivery of works on the ground by reducing timescales around tendering processes. Searching for registered suppliers via the e-Sourcing System, catalogues, business directories etc., however, could also be explored. For any competitive tendering activities and for quotations valued between £5k and EU tendering thresholds in line with contract management procedures, the Council will use its standard e-Sourcing system.

Risk

Throughout the development of the scheme to date, risks have been identified, recorded and actively managed. Where appropriate, risk owners have been allocated and tasked with eliminating risks, where possible, or identifying mitigation measures for residual risks. The same ethos will be taken through to the delivery stages of the scheme.

A project risk register will be prepared as part of the procurement process to collate and cost, as accurately as possibly construction related risk. This process will inform a more competitive tendering process.

The approach to risk transfer will be such that the management of a particular risk will rest with the party best placed to manage them.

Full details regarding the Management and Commercial Cases can be found in the accompanying report ‘A355 Improvements (Gore Hill/Wilton Park) – Outline Business Case, March 2016’.

[50] http://www.buckscc.gov.uk/media/3041841/Constitution.pdf

9. Conclusions

9.1 Background

Jacobs has been commissioned by BCC to deliver a Business Case for the A355 Improvements (Gore Hill / Wilton Park) in support of the Buckinghamshire Thames Valley Local Enterprise Partnership (BTVLEP) Strategic Economic Plan (SEP).

This Stage 2 OAR documents the Stage 2 scheme appraisal process which includes the reconfirmation of the strategic conclusions drawn in Stage 1, whilst focussing on a detailed assessment of a small number of better performing options, previously identified in the Stage 1 OAR.

9.2 Overview of Preferred Scheme

The identified Preferred Scheme comprises a new single carriageway relief road that is closely associated with a new vehicular access to the proposed strategic housing and employment site at Wilton Park, extending northwards from the site and meeting the A355 south of the railway line. The scheme includes a roundabout at the northern end of the Relief Road with no direct access to Maxwell Road. Maxwell Road would gain access to Amersham Road and to the Relief Road via the old Amersham Road and the new link from the southwest side of the roundabout.

At the Ledborough Lane Longbottom Lane junctions minor improvements are proposed which include signing and lining, along with a monitoring and evaluation exercise at this location.

At Gore Hill roundabout, the technical evidence and feedback from the stakeholders workshop suggests that the current proposals would not be sufficient to address the existing traffic concerns at this location and that a larger scale scheme would be required. Additional options for the Gore Hill roundabout will be explored in the next stage of the business case.

The wider strategic purpose of the scheme is to improve the resilience and performance of Buckinghamshire's local highway network, and improve strategic north/south connectivity for the county thereby supporting economic and residential growth.

On a local level, the Preferred Scheme will improve network performance, relieving existing congestion issues on key parts of the network (A355 and A40).

9.3 Contribution to BTVLEP Strategic Economic Plan

The Scheme has been demonstrated to align with and contribute to the strategic objectives drawn from BTVLEP's Manifesto for Growth, which are echoed throughout the SEP.

The overall strategic transport objective within the SEP is 'to create a smart, integrated, transport network which provides excellent multi-modal connectivity between key areas of housing and economic growth across the wider sub-region'. In order to deliver this objective, a number of key transport aims have been prioritised, which comprise amongst others:

- unblocking major commercial property investments which support the needs of business;
- improving connectivity between major settlements and key economic centres;
- supporting employment and housing enabling transport infrastructure;
- supporting the regeneration of our town centres;
- reducing congestion, improving journey times and journey time reliability; and
- delivering a more co-ordinated and commercial approach to transport infrastructure and land-use planning.

The scheme will improve the resilience and performance of Buckinghamshire's local highway network, and improve strategic north/south connectivity for the county.

Appendix A. Glossary

Term	Description
AADT	Average Annual Daily Traffic.
AM peak	Typically, 08:00-09:00
AMCB	Analysis of Monetised Costs and Benefits
ANPR	Automatic Number Plate Recognition Surveys
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
ASR	Appraisal Specification Report
ATC	Automated Traffic Count
BCC	Buckinghamshire County Council
BCP	Beaconsfield Cycle Paths Action Group
BCR	Benefit cost ratio. Calculated as the PVB divided by the PVC
BTVLEP	Buckinghamshire Thames Valley Local Enterprise Partnership
Capacity	With respect to a road, the maximum amount of vehicles that can be accommodated in an hour
CDC	Chiltern District Council
CIL	Community Infrastructure Levy
DDPD	Delivery Development Plan Document
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
Do Minimum	The modelled scenario which excludes the proposed intervention
Do Something	The modelled scenario which includes the proposed intervention
DSA	Delivery and Site Allocations Development Plan
EAST	Early Assessment and Sifting Tool
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product, a measure of economic output
GVA	Gross Value Added, a measure of economic output
HGV	Heavy Goods Vehicle

Term	Description
LEP	Local Enterprise Partnership
LGV	Light Goods Vehicle
LSTF	Local Sustainable Transport Fund
LTB	Local Transport Body
LTP3	Third issue of the Local Transport Plan, covering the period 2011-2016
MCC	Manual Classified Count
NPPF	National Planning Policy Framework
NPV	Net Present Value. Calculated as the difference between PVB and PVC
NTEM	National Trip End Model – provides a set of predictions of growth in car ownership and car traffic, with associated planning data projections, at any geographical level down to local authority districts. Version 6.2 has been used for this report.
OAR	Option Assessment Report
OBC	Outline Business Case
ONS	The Office for National Statistics
PA	Public Accounts (table)
PM peak	Typically 17:00-18:00
PROW	Public Right of Way
PVB	Present Value Benefit. The monetised benefit of a scheme expressed in real terms, typically given in 2010 prices and values
PVC	Present Value Cost. The costs of a scheme expressed in real terms, typically given in 2010 prices and values
RPI	Retail Prices Index
RTPI	Real Time Passenger Information
SBDC	South Bucks District Council
SCS	Sustainable Communities Strategy
SEP	Strategic Economic Plan
SOC	Strategic Outline Case
SPD	Supplementary Planning Document

Term	Description
SRN	Strategic road network – trunk roads owned by the Secretary of State for Transport and operated on his behalf by the HA
TAG	Transport Analysis Guidance, published by the Department for Transport (see also WebTAG)
TEE	Transport Economic Efficiency (table)
TEMPRO	Trip End Model Presentation Program – is a modelling tool designed to allow users to look at the growth in trip ends, using actual and forecast data supplied by the DfT through NTEM. The version used is TEMPRO v6.2.
TfB	Transport for Buckinghamshire
TUBA	Transport User Benefit Appraisal. A programme developed by the DfT for calculating benefits of a scheme to transport users.
VISSIM	A micro-simulation modelling package, developed by PTV
WebTAG	The Department for Transport guidance document on the conduct of transport studies (see also TAG)

Appendix B. Traffic Model Development and Validation Results

A355 Beaconsfield Model

AM Flow Validation Location/Movement	Obs. Flow	Mod. Flow	Diff. Mod-Obs	% Diff.	Flow Category	GEH	Criteria GEH <5	Criteria GEH <10	Criteria Flow
ATC1: Candlemas lane EB	174	142	-32	-18%	1	**2.55**	Pass	Pass	Pass
ATC1: Candlemas lane WB	127	144	17	13%	1	**1.46**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A40 East straight WB	358	352	-6	-2%	1	**0.31**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A40 East left turn	446	451	5	1%	1	**0.23**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A40 West straight EB	331	284	-47	-14%	1	**2.70**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A40 West right turn	993	939	-54	-5%	2	**1.75**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/A355 South right turn	406	426	20	5%	1	**0.99**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A355 South left turn	1204	1183	-21	-2%	2	**0.61**	Pass	Pass	Pass
2 MCC: A40-A355/ Park ln right turn	109	129	20	19%	1	**1.87**	Pass	Pass	Pass
2 MCC: A40-A355/ Park ln left turn (Minerva Way)	12	5	-7	-60%	1	**2.48**	Pass	Pass	Pass
2 MCC: A40-A355/ Park ln straight ahead (London Rd)	709	691	-18	-3%	2	**0.68**	Pass	Pass	Pass
2 MCC: A40-A355/ Minerva Way right turn	21	20	-1	-6%	1	**0.27**	Pass	Pass	Pass
2 MCC: A40-A355/ Minerva Way straight ahead	14	14	0	3%	1	**0.11**	Pass	Pass	Pass
2 MCC: A40-A355/ Minerva Way left turn	19	20	1	4%	1	**0.18**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd right turn (Minerva Way)	27	25	-2	-8%	1	**0.43**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd straight ahead (A355)	736	833	97	13%	2	**3.48**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd left turn (London End)	750	673	-77	-10%	2	**2.89**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd Uturn	112	58	-54	-48%	1	**5.81**	Fail	Pass	Pass
2 MCC: A40-A355/ London End left turn	194	202	8	4%	1	**0.57**	Pass	Pass	Pass
2 MCC: A40-A355/ London End straight ahead (Minerva Way)	34	28	-6	-18%	1	**1.12**	Pass	Pass	Pass
2 MCC: A40-A355/ London End right turn (London Rd)	490	455	-35	-7%	1	**1.59**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd check E EB	1330	1225	-105	-8%	2	**2.95**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd check E WB	1513	1540	27	2%	2	**0.69**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/ Maxwell Rd right turn	30	33	3	9%	1	**0.50**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/ Maxwell Rd left turn	112	107	-5	-5%	1	**0.50**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/ A355 S left turn	138	199	61	44%	1	**4.71**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/ A355 S straight ahead	1024	963	-61	-6%	2	**1.93**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd /A355 N right turn	264	227	-37	-14%	1	**2.33**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/A355 N straight ahead	706	638	-68	-10%	2	**2.62**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ Canlemas Ln right turn	92	91	-1	-1%	1	**0.08**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ Canlemas Ln left turn	51	50	-1	-2%	1	**0.14**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 S left turn	101	88	-13	-13%	1	**1.34**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 S straight ahead	924	965	41	4%	2	**1.35**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 N right turn	50	56	6	11%	1	**0.77**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 N straight ahead	803	731	-72	-9%	2	**2.59**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 check S NB	1025	1032	7	1%	2	**0.21**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 check S SB	895	817	-78	-9%	2	**2.67**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ Lakes Ln right turn (London Rd)	60	58	-2	-3%	1	**0.21**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ Lakes Ln left turn (London End)	8	8	0	-5%	1	**0.14**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ London Rd left turn (Lakes Ln)	20	20	0	-1%	1	**0.04**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ London Rd straight ahead (London End)	646	665	19	3%	1	**0.76**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ London End right turn (Lakes Ln)	0	0	0	n/a	1	n/a	n/a	n/a	Pass
5 MCC: A40-Lakes Ln/ London End straight ahead (London Rd)	442	455	13	3%	1	**0.63**	Pass	Pass	Pass
SUM	**17500**	**17043**	**-457**						

PM Flow Validation Location/Movement	Obs. Flow	Mod. Flow	Diff. Mod-Obs	% Diff.	Flow Category	GEH	Criteria GEH <5	Criteria GEH <10	Criteria Flow
ATC1: Candlemas lane EB	138	153	15	11%	1	**1.24**	Pass	Pass	Pass
ATC1: Candlemas lane WB	56	87	31	56%	1	**3.69**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A40 East straight WB	347	336	-11	-3%	1	**0.60**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A40 East left turn	334	343	9	3%	1	**0.50**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A40 West straight EB	266	264	-2	-1%	1	**0.14**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A40 West right turn	859	762	-97	-11%	2	**3.39**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/A355 South right turn	319	313	-6	-2%	1	**0.34**	Pass	Pass	Pass
1 MCC: Pyebush Rnd/ A355 South left turn	1296	1290	-6	0%	2	**0.16**	Pass	Pass	Pass
2 MCC: A40-A355/ Park ln right turn	191	199	8	4%	1	**0.54**	Pass	Pass	Pass
2 MCC: A40-A355/ Park ln left turn (Minerva Way)	4	6	2	50%	1	**0.89**	Pass	Pass	Pass
2 MCC: A40-A355/ Park ln straight ahead (London Rd)	580	566	-14	-2%	1	**0.59**	Pass	Pass	Pass
2 MCC: A40-A355/ Minerva Way right turn	8	9	1	8%	1	**0.21**	Pass	Pass	Pass
2 MCC: A40-A355/ Minerva Way straight ahead	8	7	-1	-13%	1	**0.37**	Pass	Pass	Pass
2 MCC: A40-A355/ Minerva Way left turn	16	17	1	5%	1	**0.20**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd right turn (Minerva Way)	16	13	-3	-16%	1	**0.68**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd straight ahead (A355)	896	893	-3	0%	2	**0.11**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd left turn (London End)	695	682	-13	-2%	1	**0.49**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd Uturn	52	54	2	4%	1	**0.27**	Pass	Pass	Pass
2 MCC: A40-A355/ London End left turn	276	332	56	20%	1	**3.21**	Pass	Pass	Pass
2 MCC: A40-A355/ London End straight ahead (Minerva Way)	28	28	0	-1%	1	**0.04**	Pass	Pass	Pass
2 MCC: A40-A355/ London End right turn (London Rd)	464	393	-71	-15%	1	**3.42**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd check E EB	1112	1029	-83	-7%	2	**2.53**	Pass	Pass	Pass
2 MCC: A40-A355/ London Rd check E WB	1607	1624	17	1%	2	**0.43**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/ Maxwell Rd right turn	55	93	38	70%	1	**4.46**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/ Maxwell Rd left turn	176	135	-41	-24%	1	**3.32**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/ A355 S left turn	103	102	-1	-1%	1	**0.08**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/ A355 S straight ahead	977	1057	80	8%	2	**2.51**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd /A355 N right turn	81	85	4	5%	1	**0.48**	Pass	Pass	Pass
3 MCC: A355-Maxwell Rd/A355 N straight ahead	717	708	-9	-1%	2	**0.34**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ Canlemas Ln right turn	77	73	-4	-5%	1	**0.49**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ Canlemas Ln left turn	77	79	2	3%	1	**0.25**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 S left turn	51	60	9	17%	1	**1.16**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 S straight ahead	1068	1171	103	10%	2	**3.09**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 N right turn	33	28	-5	-16%	1	**0.98**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 N straight ahead	665	699	34	5%	1	**1.29**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 check S NB	1119	1206	87	8%	2	**2.55**	Pass	Pass	Pass
4 MCC: A355-Candlemas Ln/ A355 check S SB	742	743	1	0%	2	**0.02**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ Lakes Ln right turn (London Rd)	55	54	-1	-2%	1	**0.14**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ Lakes Ln left turn (London End)	7	7	0	3%	1	**0.08**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ London Rd left turn (Lakes Ln)	31	35	4	14%	1	**0.73**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ London Rd straight ahead (London End)	601	675	74	12%	1	**2.94**	Pass	Pass	Pass
5 MCC: A40-Lakes Ln/ London End right turn (Lakes Ln)	0	0	0	n/a	1	n/a	n/a	n/a	Pass
5 MCC: A40-Lakes Ln/ London End straight ahead (London Rd)	378	393	15	4%	1	**0.77**	Pass	Pass	Pass
SUM	**16581**	**16804**	**223**						

AM Summary Flow Validation Statistics				PM Summary Flow Validation Statistics		
	Criteria GEH <5	Criteria GEH <10	Criteria Flow	Criteria GEH <5	Criteria GEH <10	Criteria Flow
Fail	1	0	0	0	0	0
Pass	41	42	43	42	46	43
Total	42	42	43	42	46	43
%	98%	100%	100%	100%	100%	100%
Correlation Co-efficient R			0.996			0.996
			Pass			Pass

AM Journey Time Calibration						
Route	**Description**	**Observed (s)**	**Modelled (s)**	**Difference**	**% Difference**	**Pass/Fail**
1 NB	Pyebush Rbt					
1 NB	Cricket Club 30 mph signs - Just after town gates	25	12	-13	-51%	Pass
1 NB	London Rd / Park Ln / London End Rbt	42	41	-1	-2%	Pass
1 NB	Candlemas Ln traffic island - just before junction	29	27	-2	-8%	Pass
1 NB	Ronald Rd 40 mph signs - just after junction	30	26	-4	-14%	Pass
1 NB	Railway Bridge	31	24	-7	-21%	Pass
1 NB	Ledborough Ln / Longbottom Ln Crossroads	33	41	8	24%	Pass
1 NB	**Total average journey time**	**190**	**171**	**-19**	**-10%**	**Pass**
1 SB	Ledborough Ln / Longbottom Ln Crossroads					
1 SB	Railway Bridge	98	95	-3	-3%	Pass
1 SB	Ronald Rd 40 mph signs - just after junction	99	83	-16	-17%	Pass
1 SB	Candlemas Ln traffic island - just before junction	75	88	13	18%	Pass
1 SB	London Rd / Park Ln / London End Rbt	72	93	21	29%	Pass
1 SB	Cricket Club 30 mph signs - Just after town gates	33	22	-11	-34%	Pass
1 SB	Pyebush Rbt	25	18	-7	-28%	Pass
1 SB	**Total average journey time**	**402**	**398**	**-4**	**-1%**	**Pass**
2 EB	London End / Aylesbury End / Wycombe End Rbt					
2 EB	Medical Centre Sign - Located on the left opposite Lloyds Pharmacy	45	80	35	78%	Pass
2 EB	London Rd / Park Ln / London End Rbt	122	136	14	12%	Pass
2 EB	Cricket Club 50 mph signs - Just before town gates	31	21	-10	-31%	Pass
2 EB	Pyebush Rbt	25	18	-7	-28%	Pass
2 EB	**Total average journey time**	**223**	**256**	**33**	**15%**	**Pass**
2 WB	Pyebush Rbt					
2 WB	Cricket Club 50 mph signs - Just before town gates	23	12	-11	-47%	Pass
2 WB	London Rd / Park Ln / London End Rbt	51	62	11	21%	Pass
2 WB	Medical Centre Sign - Located on the left opposite Lloyds Pharmacy	26	37	11	42%	Pass
2 WB	London End / Aylesbury End / Wycombe End Rbt	25	22	-3	-11%	Pass
2 WB	**Total average journey time**	**125**	**133**	**8**	**7%**	**Pass**

PM Journey Time Calibration						
Route	**Description**	**Observed (s)**	**Modelled (s)**	**Difference**	**% Difference**	**Pass/Fail**
1 NB	Pyebush Rbt					
1 NB	Cricket Club 30 mph signs - Just after town gates	20	14	-6	-30%	Pass
1 NB	London Rd / Park Ln / London End Rbt	54	48	-6	-11%	Pass
1 NB	Candlemas Ln traffic island - just before junction	33	27	-6	-19%	Pass
1 NB	Ronald Rd 40 mph signs - just after junction	28	26	-2	-6%	Pass
1 NB	Railway Bridge	31	29	-2	-5%	Pass
1 NB	Ledborough Ln / Longbottom Ln Crossroads	44	41	-3	-6%	Pass
1 NB	**Total average journey time**	**210**	**190**	**-20**	**-10%**	**Pass**
1 SB	Ledborough Ln / Longbottom Ln Crossroads					
1 SB	Railway Bridge	48	36	-12	-24%	Pass
1 SB	Ronald Rd 40 mph signs - just after junction	28	26	-2	-7%	Pass
1 SB	Candlemas Ln traffic island - just before junction	26	30	4	17%	Pass
1 SB	London Rd / Park Ln / London End Rbt	41	55	14	35%	Pass
1 SB	Cricket Club 30 mph signs - Just after town gates	37	22	-15	-42%	Pass
1 SB	Pyebush Rbt	29	16	-13	-46%	Pass
1 SB	**Total average journey time**	**209**	**189**	**-20**	**-9%**	**Pass**
2 EB	London End / Aylesbury End / Wycombe End Rbt					
2 EB	Medical Centre Sign - Located on the left opposite Lloyds Pharmacy	153	33	-120	-78%	Fail
2 EB	London Rd / Park Ln / London End Rbt	247	112	-135	-55%	Fail
2 EB	Cricket Club 50 mph signs - Just before town gates	28	21	-7	-24%	Pass
2 EB	Pyebush Rbt	22	16	-6	-29%	Pass
2 EB	**Total average journey time**	**450**	**180**	**-270**	**-60%**	**Fail**
2 WB	Pyebush Rbt					
2 WB	Cricket Club 50 mph signs - Just before town gates	17	14	-3	-17%	Pass
2 WB	London Rd / Park Ln / London End Rbt	33	48	15	46%	Pass
2 WB	Medical Centre Sign - Located on the left opposite Lloyds Pharmacy	30	28	-2	-6%	Pass
2 WB	London End / Aylesbury End / Wycombe End Rbt	28	19	-9	-32%	Pass
2 WB	**Total average journey time**	**108**	**118**	**10**	**10%**	**Pass**

Gore Hill Junction Model

AM Flow Validation Location/Movement	Obs. Flow	Mod. Flow	Diff. Mod-Obs	% Diff.	GEH	Criteria GEH <5	Criteria GEH <10	Criteria Flow
MCC-1-Left Turn (A355N to A413 EB)	12	12	0	0%	0.00	Pass	Pass	Pass
MCC-1-Straight (A355 N to Gore Hill South)	378	359	-19	-5%	0.99	Pass	Pass	Pass
MCC-1-Right Turn (A355N to A413 WB)	215	213	-2	-1%	0.14	Pass	Pass	Pass
MCC-1-Right turn (A413E to Gore Hill North)	10	9	-1	-10%	0.32	Pass	Pass	Pass
MCC-1-Left Turn (A413E to Gore Hill South)	152	159	7	5%	0.56	Pass	Pass	Pass
MCC-1-Straight (A413E to A413 WB)	479	490	11	2%	0.50	Pass	Pass	Pass
MCC-1-Straight (A355S to Gore Hill North)	422	401	-21	-5%	1.04	Pass	Pass	Pass
MCC-1-Right Turn (A355S to A413 EB)	267	254	-13	-5%	0.81	Pass	Pass	Pass
MCC-1-Left Turn (A355S to A413 WB)	270	255	-15	-6%	0.93	Pass	Pass	Pass
MCC-1-Left Turn (A413W to Gore Hill North)	340	318	-22	-6%	1.21	Pass	Pass	Pass
MCC-1-Straight (A413W to A413 EB)	904	903	-1	0%	0.03	Pass	Pass	Pass
MCC-1-Right Turn (A413W to Gore Hill SB)	426	409	-17	-4%	0.83	Pass	Pass	Pass

PM Flow Validation Location/Movement	Obs. Flow	Mod. Flow	Diff. Mod-Obs	% Diff.	GEH	Criteria GEH <5	Criteria GEH <10	Criteria Flow
MCC-1-Left Turn (A413 EB)	11	12	1	9%	0.29	Pass	Pass	Pass
MCC-1-Straight (Gore Hill South)	387	381	-6	-2%	0.31	Pass	Pass	Pass
MCC-1-Right Turn (A413 WB)	363	350	-13	-4%	0.69	Pass	Pass	Pass
MCC-1-Right turn (Gore Hill North)	10	13	3	30%	0.88	Pass	Pass	Pass
MCC-1-Left Turn (Gore Hill South)	187	164	-23	-12%	1.74	Pass	Pass	Pass
MCC-1-Straight (A413 WB)	827	730	-97	-12%	3.48	Pass	Pass	Pass
MCC-1-Straight (Gore Hill North)	454	453	-1	0%	0.05	Pass	Pass	Pass
MCC-1-Right Turn (A413 EB)	149	142	-7	-5%	0.58	Pass	Pass	Pass
MCC-1-Left Turn (A413 WB)	399	385	-14	-4%	0.71	Pass	Pass	Pass
MCC-1-Left Turn (Gore Hill North)	251	232	-19	-8%	1.22	Pass	Pass	Pass
MCC-1-Straight (A413 EB)	358	327	-31	-9%	1.68	Pass	Pass	Pass
MCC-1-Right Turn (Gore Hill SB)	222	208	-14	-6%	0.95	Pass	Pass	Pass

Ledborough Lane / Longbottom Lane Junction Model

AM Flow Validation Location/Movement	Obs. Flow	Mod. Flow	Diff. Mod-Obs	% Diff.	GEH	Criteria GEH <5	Criteria GEH <10	Criteria Flow
MCC-2-Left turn (Whipass Hill to Longbottom Lane)	46	47	1	2%	0.15	Pass	Pass	Pass
MCC-2-Straight ahead (Whipass Hill to Amersham road)	878	852	-26	-3%	0.88	Pass	Pass	Pass
MCC-2-Right Turn (Whipass Hill Road to Ledborough Lane)	79	71	-8	-10%	0.92	Pass	Pass	Pass
MCC-2-right Turn (Longbottom Road to whipass Hill road)	13	16	3	23%	0.79	Pass	Pass	Pass
MCC-2-Left turn & ahead (Longbottom Road to Amersham Road)	133	128	-5	-4%	0.44	Pass	Pass	Pass
MCC-2-Left turn Ahead & right Turn (Longbottom Road to Ledborough lane)	116	112	-4	-3%	0.37	Pass	Pass	Pass
MCC-2-Straight ahead (Amersham Road to Whipass Hill)	789	799	10	1%	0.35	Pass	Pass	Pass
MCC-2-Left Turn (Amersham Road to Ledborough Lane)	129	126	-3	-2%	0.27	Pass	Pass	Pass
MCC-2-Ahead & right turn (Amersham Road to Longbottom Lane)	135	138	3	2%	0.26	Pass	Pass	Pass
MCC-2-Left turn & ahead (Ledborough Road to Whipass hill Road)	94	86	-8	-9%	0.84	Pass	Pass	Pass
MCC-2-Left ahead & right turn (Ledborough Road to Longbottom Lane)	169	167	-2	-1%	0.15	Pass	Pass	Pass
MCC-2-Right Turn (Ledborough Road to Amersham road)	56	54	-2	-4%	0.27	Pass	Pass	Pass

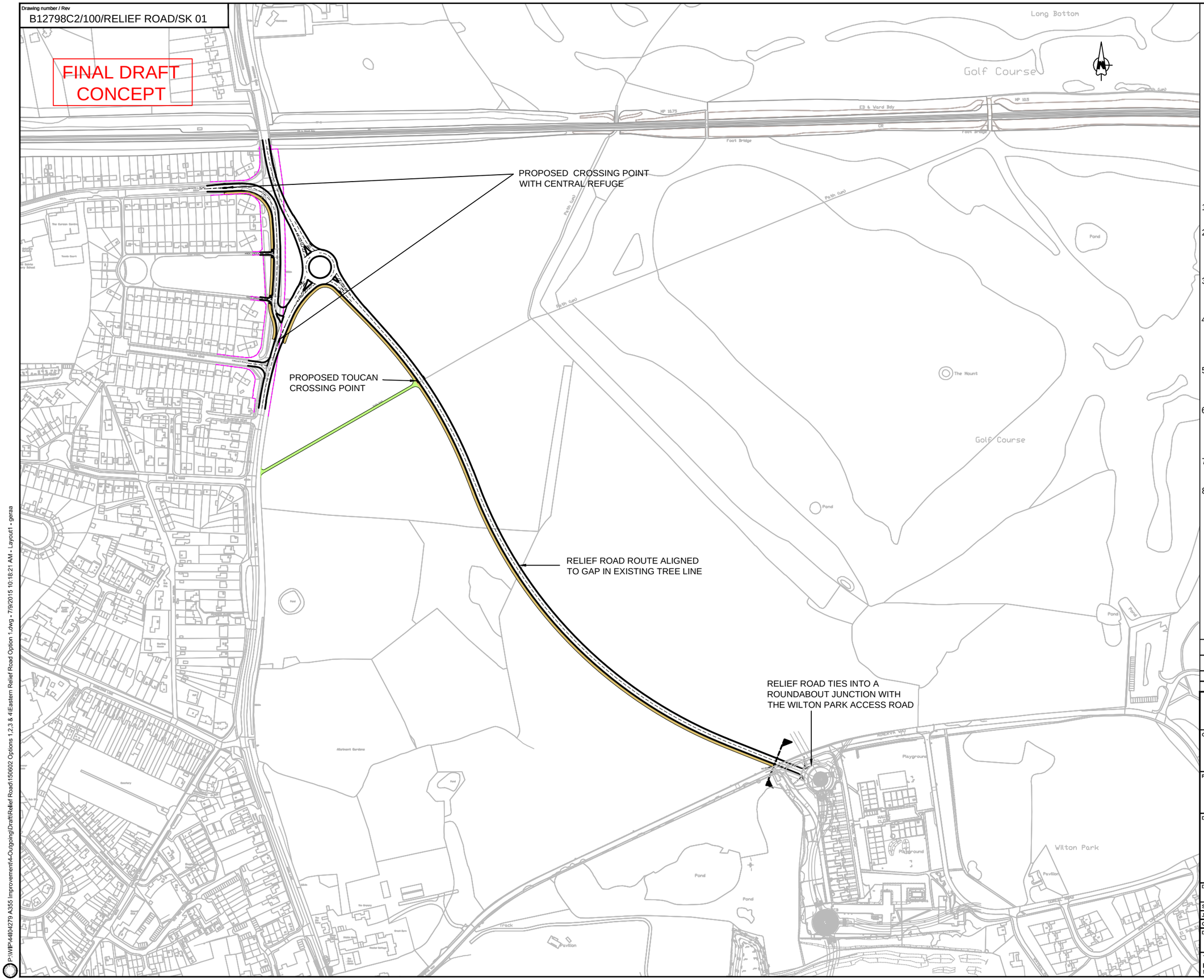
PM Flow Validation Location/Movement	Obs. Flow	Mod. Flow	Diff. Mod-Obs	% Diff.	GEH	Criteria GEH <5	Criteria GEH <10	Criteria Flow
MCC-2-Left turn (Whipass Hill to Longbottom Lane)	24	22	-2	-8%	0.42	Pass	Pass	Pass
MCC-2-Straight ahead (Whipass Hill to Amersham road)	684	688	4	1%	0.15	Pass	Pass	Pass
MCC-2-Right Turn (Whipass Hill Road to Ledborough Lane)	70	69	-1	-1%	0.12	Pass	Pass	Pass
MCC-2-right Turn (Longbottom Road to whipass Hill road)	8	12	4	50%	1.26	Pass	Pass	Pass
MCC-2-Left turn & ahead (Longbottom Road to Amersham Road)	96	109	13	14%	1.28	Pass	Pass	Pass
MCC-2-Left turn Ahead & right Turn (Longbottom Road to Ledborough lane)	66	73	7	11%	0.84	Pass	Pass	Pass
MCC-2-Straight ahead (Amersham Road to Whipass Hill)	912	869	-43	-5%	1.44	Pass	Pass	Pass
MCC-2-Left Turn (Amersham Road to Ledborough Lane)	203	198	-5	-2%	0.35	Pass	Pass	Pass
MCC-2-Ahead & right turn (Amersham Road to Longbottom Lane)	130	124	-6	-5%	0.53	Pass	Pass	Pass
MCC-2-Left turn & ahead (Ledborough Road to Whipass hill Road)	102	102	0	0%	0.00	Pass	Pass	Pass
MCC-2-Left ahead & right turn (Ledborough Road to Longbottom Lane)	81	89	8	10%	0.87	Pass	Pass	Pass
MCC-2-Right Turn (Ledborough Road to Amersham road)	26	23	-3	-12%	0.61	Pass	Pass	Pass

Appendix C. Concept Scheme Drawings

Drawing number / Rev

B12798C2/100/RELIEF ROAD/SK 01

FINAL DRAFT CONCEPT



KEY:

- PROPOSED KERB
- PROPOSED SHARED PATH 3M WIDE WITH 0.5 M HARD STRIP
- EXISTING FOOTPATH CONVERTED TO SHARED CYCLE TRACK
- HIGHWAY BOUNDARY

Notes:

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6. SCREENING OPTIONS FOR RELIEF ROAD USING FENCING / PLANTING TO BE CONSIDERED AT NEXT STAGE OF DESIGN PROCESS.
7. THE BOUNDARY SHOWN ON THIS DRAWING IS INDICATIVE ONLY.
8. DESIGN PROPOSALS SOUTH OF DASHED LINE ARE ASSOCIATED WITH THE WILTON PARK ACCESS ROAD, PRODUCED BY A THIRD PARTY.

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2	05.06.15	UPDATED TO ADDRESS BCC/TfB COMMENTS	JA	SR	RB	RS
1	26.05.15	UPDATED TO ADDRESS BCC/TfB COMMENTS	JA	SR	RB	RS
0	24.02.15	FIRST SUBMISSION	JA	SR	RB	RS

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Tel:+44(0)1296 395000

Project: A355 IMPROVEMENTS EASTERN RELIEF ROAD

Drawing title: EASTERN RELIEF ROAD OPTION 1 (SHEET 1 of 2)

Drawing status: FINAL DRAFT

Scale	1:4000 @ A3	DO NOT SCALE
Jacobs No.	B12798C2	
Client no.		

Drawing number: B12798C2/100/RELIEF ROAD/SK 01 Rev 2

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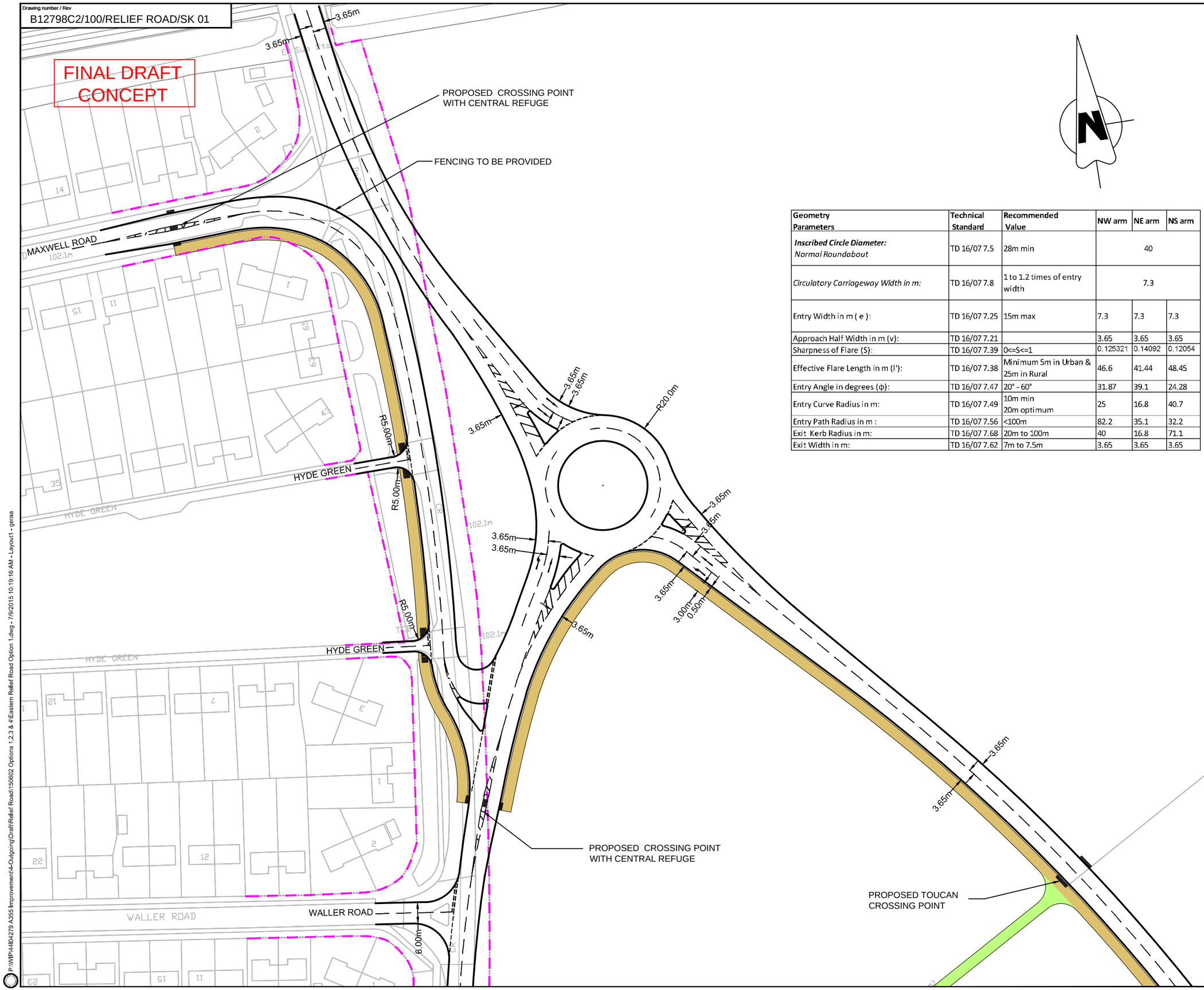
P:\WP\44\04279 A355 Improvement\4-Outgoing\Draft\Relief Road\150602 Options 1,2,3 & 4\Eastern Relief Road Option 1.dwg - 7/9/2015 10:18:21 AM - Layout1 - geraa

Drawing number / Rev

B12798C2/100/RELIEF ROAD/SK 01

FINAL DRAFT CONCEPT



Geometry Parameters	Technical Standard	Recommended Value	NW arm	NE arm	NS arm
Inscribed Circle Diameter: *Normal Roundabout*	TD 16/07 7.5	28m min	40		
Circulatory Carriageway Width in m:	TD 16/07 7.8	1 to 1.2 times of entry width	7.3		
Entry Width in m (e):	TD 16/07 7.25	15m max	7.3	7.3	7.3
Approach Half Width in m (v):	TD 16/07 7.21		3.65	3.65	3.65
Sharpness of Flare (S):	TD 16/07 7.39	0<=S<=1	0.125321	0.14092	0.12054
Effective Flare Length in m (l'):	TD 16/07 7.38	Minimum 5m in Urban & 25m in Rural	46.6	41.44	48.45
Entry Angle in degrees (ϕ):	TD 16/07 7.47	20° - 60°	31.87	39.1	24.28
Entry Curve Radius in m:	TD 16/07 7.49	10m min 20m optimum	25	16.8	40.7
Entry Path Radius in m :	TD 16/07 7.56	<100m	82.2	35.1	32.2
Exit Kerb Radius in m:	TD 16/07 7.68	20m to 100m	40	16.8	71.1
Exit Width in m:	TD 16/07 7.62	7m to 7.5m	3.65	3.65	3.65

KEY:

- PROPOSED KERB
- PROPOSED SHARED PATH 3M WIDE WITH 0.5 M HARD STRIP
- PROPOSED ROAD MARKINGS/ DIRECTIONAL ARROW
- HIGHWAY BOUNDARY

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0	24.02.15	FIRST SUBMISSION	JA	SR	RB	RS

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Project: A355 IMPROVEMENTS EASTERN RELIEF ROAD

Drawing title: EASTERN RELIEF ROAD OPTION 1 (SHEET 2 of 2)

Drawing status: FINAL DRAFT

Scale	1:1000 @ A3	DO NOT SCALE
Jacobs No.	B12798C2	
Client no.		
Drawing number	B12798C2/100/RELIEF ROAD/SK 01	Rev 2

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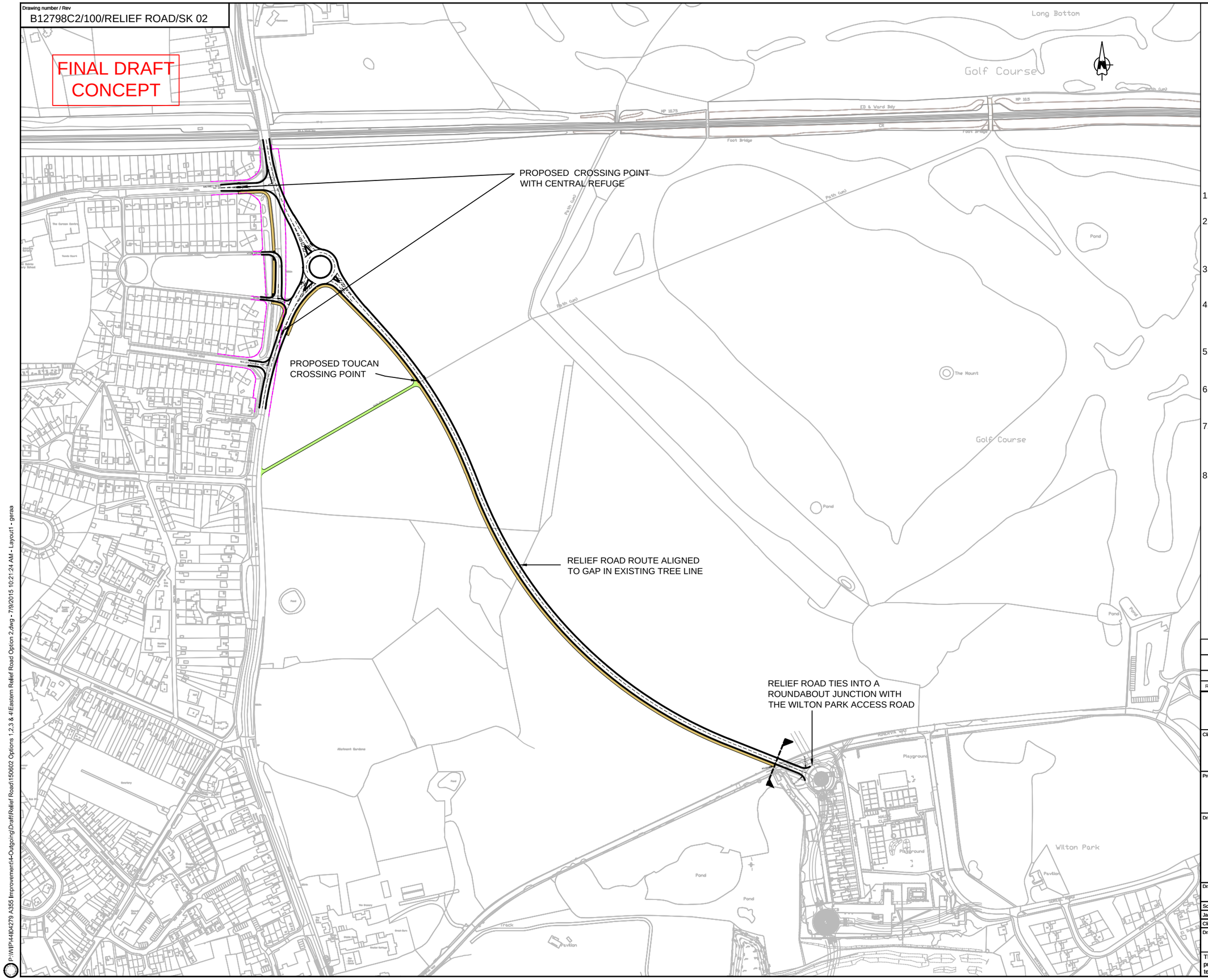
Drawing number / Rev

B12798C2/100/RELIEF ROAD/SK 02

FINAL DRAFT CONCEPT



KEY:

- PROPOSED KERB
- PROPOSED SHARED PATH 3M WIDE WITH 0.5 M HARD STRIP
- EXISTING FOOTPATH CONVERTED TO SHARED CYCLE TRACK
- HIGHWAY BOUNDARY

Notes:

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1	26.05.15	UPDATED TO ADDRESS BCC/TfB COMMENTS	JA	SR	RB	RS
0	24.02.15	FIRST SUBMISSION	JA	SR	RB	RS

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Project

A355 IMPROVEMENTS
EASTERN RELIEF ROAD

Drawing title

EASTERN RELIEF ROAD
OPTION 2

(SHEET 1 of 2)

Drawing status: FINAL DRAFT

Scale	1:4000 @ A3	DO NOT SCALE
Jacobs No.	B12798C2	
Client no.		

Drawing number: B12798C2/100/RELIEF ROAD/SK 02 — Rev: 2

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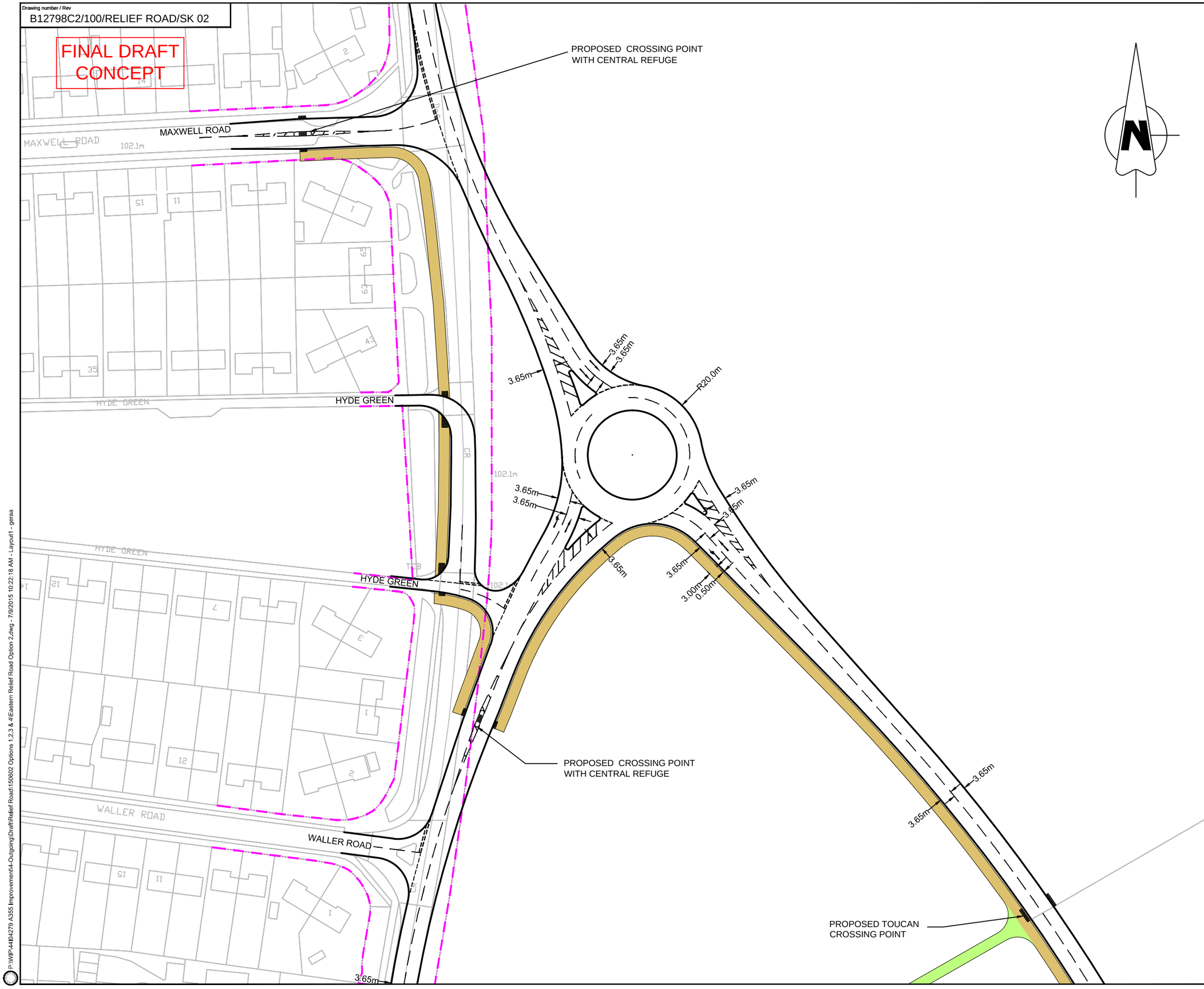
Drawing number / Rev

B12798C2/100/RELIEF ROAD/SK 02

FINAL DRAFT CONCEPT



KEY:

- PROPOSED KERB
- PROPOSED SHARED PATH 3M WIDE WITH 0.5 M HARD STRIP
- PROPOSED ROAD MARKINGS/ DIRECTIONAL ARROW
- EXISTING FOOTPATH CONVERTED TO SHARED CYCLE TRACK
- HIGHWAY BOUNDARY

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Project

A355 IMPROVEMENTS
EASTERN RELIEF ROAD

Drawing title

EASTERN RELIEF ROAD OPTION 2

(SHEET 2 of 2)

Drawing status: FINAL DRAFT

Scale	1:1000 @ A3	DO NOT SCALE
Jacobs No.	B12798C2	
Client no.		
Drawing number	B12798C2/100/RELIEF ROAD/SK 02	Rev 2

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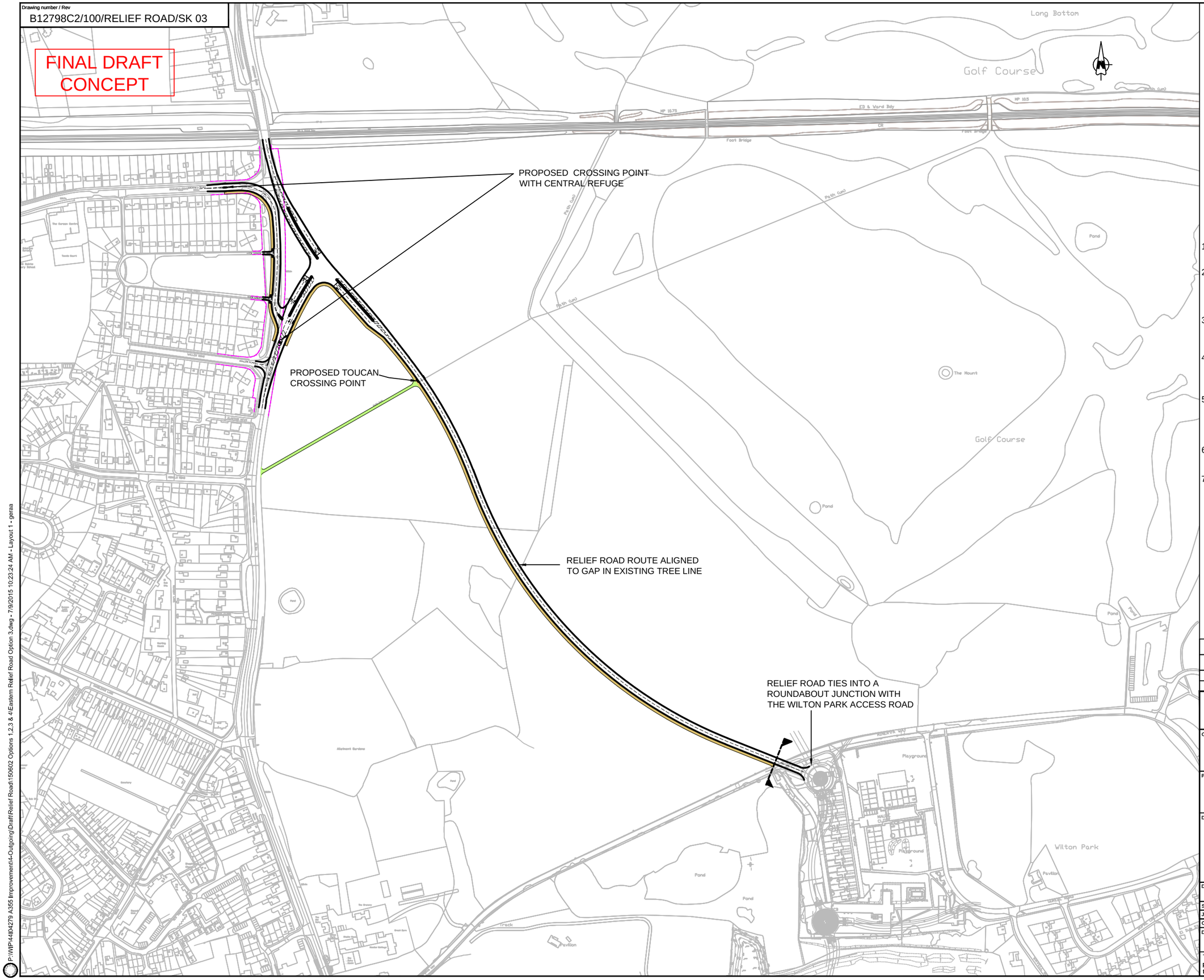
Drawing number / Rev

B12798C2/100/RELIEF ROAD/SK 03

FINAL DRAFT CONCEPT



KEY:

- PROPOSED KERB
- PROPOSED SHARED PATH 3M WIDE WITH 0.5 M HARD STRIP
- EXISTING FOOTPATH CONVERTED TO SHARED CYCLE TRACK
- HIGHWAY BOUNDARY

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Tel:+44(0)1296 395000

Project: A355 IMPROVEMENTS EASTERN RELIEF ROAD

Drawing title: EASTERN RELIEF ROAD OPTION 3 (SHEET 1 of 2)

Drawing status: FINAL DRAFT

Scale	1:4000 @ A3 — DO NOT SCALE
Jacobs No.	B12798C2
Client no.	

Drawing number: B12798C2/100/RELIEF ROAD/SK 03 — Rev 2

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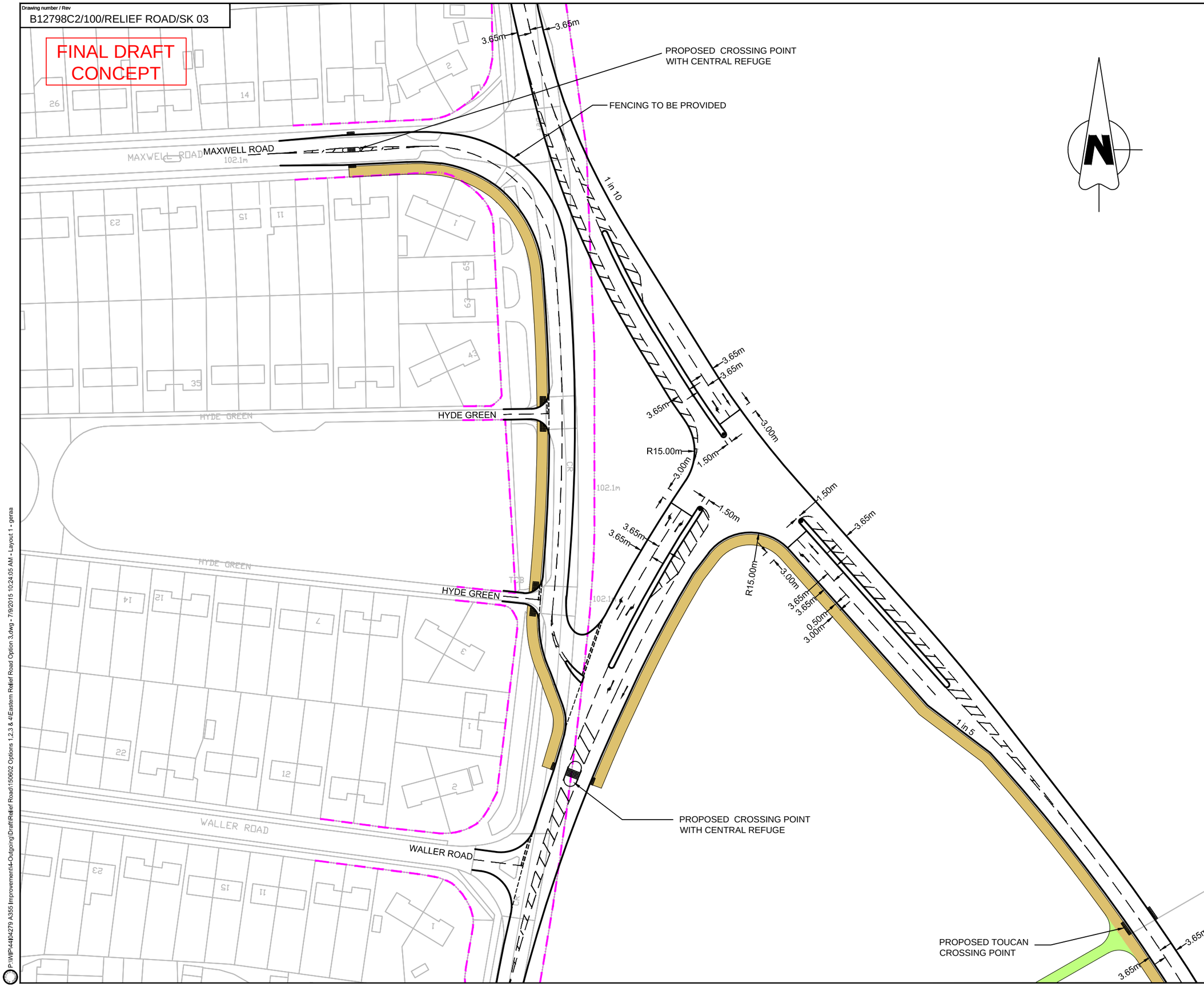
Drawing number / Rev
B12798C2/100/RELIEF ROAD/SK 03

FINAL DRAFT CONCEPT



KEY:

- PROPOSED KERB
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- PROPOSED ROAD MARKINGS/ DIRECTIONAL ARROW
- EXISTING FOOTPATH CONVERTED TO SHARED CYCLE TRACK
- HIGHWAY BOUNDARY

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Tel:+44(0)1296 395000

Project: A355 IMPROVEMENTS EASTERN RELIEF ROAD

Drawing title: EASTERN RELIEF ROAD OPTION 3 (SHEET 2 of 2)

Drawing status: FINAL DRAFT

Scale	1:1000 @ A3	DO NOT SCALE
Jacobs No.	B12798C2	
Client no.		
Drawing number	B12798C2/100/RELIEF ROAD/SK 03	Rev 2

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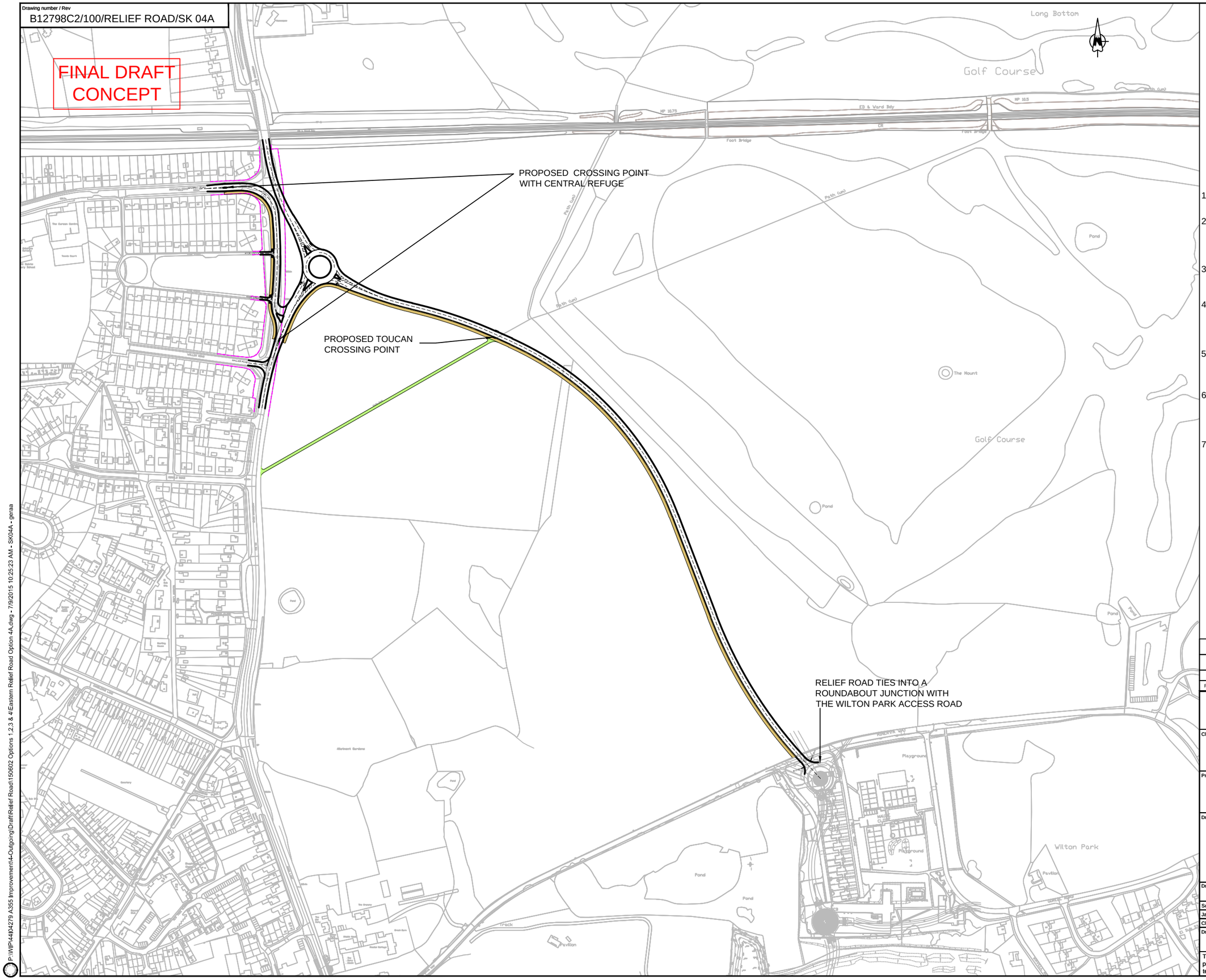
Drawing number / Rev

B12798C2/100/RELIEF ROAD/SK 04A

FINAL DRAFT CONCEPT



KEY:

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- PROPOSED SHARED PATH 3M WIDE WITH 0.5 M HARD STRIP
- EXISTING FOOTPATH CONVERTED TO SHARED CYCLE TRACK
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Project

A355 IMPROVEMENTS
EASTERN RELIEF ROAD

Drawing title

EASTERN RELIEF ROAD OPTION 4A

(SHEET 1 of 2)

Drawing status

FINAL DRAFT

Scale	1:4000 @ A3 — DO NOT SCALE
Jacobs No.	B12798C2
Client no.	
Drawing number	B12798C2/100/RELIEF ROAD/SK 04A
Rev	2

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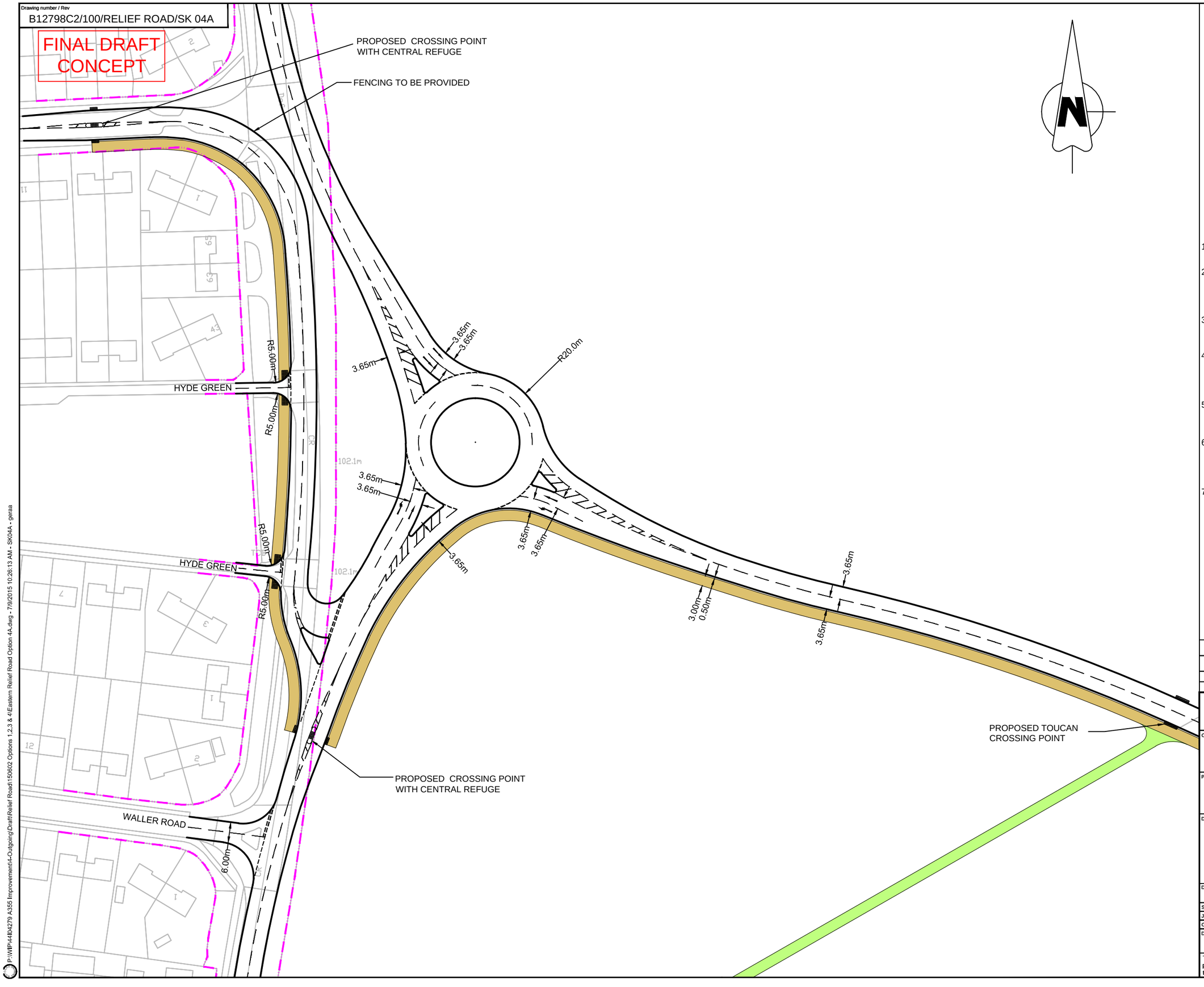
Drawing number / Rev

B12798C2/100/RELIEF ROAD/SK 04A

FINAL DRAFT CONCEPT



KEY:

- PROPOSED KERB
- PROPOSED SHARED PATH 3M WIDE WITH 0.5 M HARD STRIP
- PROPOSED ROAD MARKINGS/ DIRECTIONAL ARROW
- EXISTING FOOTPATH CONVERTED TO SHARED CYCLE TRACK
- HIGHWAY BOUNDARY

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING REPRESENTS A CONCEPT SCHEME DEVELOPED AS ONE OF A NUMBER OF OPTIONS BEING CONSIDERED FOR THE A355 LOCAL DEVOLVED MAJOR SCHEME.
3. THE PROPOSED WORKS SHOWN ON THIS DRAWING ARE INDICATIVE & SUBJECT TO CHANGE.
4. DETAILED DESIGN OF GIVE-MAY MARKINGS AND DIRECTIONAL ARROWS WILL BE UNDERTAKEN AS PART OF THE NEXT DESIGN STAGE.
5. RAISED CROSSINGS WOULD BE INTRODUCED AT THE SIDE ROAD JUNCTIONS.
6. SCREENING OPTIONS FOR RELIEF ROAD USING FENCING / PLANTING TO BE CONSIDERED AT NEXT STAGE OF DESIGN PROCESS.
7. THE BOUNDARY SHOWN ON THIS DRAWING IS INDICATIVE ONLY.

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Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
2	05.06.15	UPDATED TO ADDRESS BCC/TfB COMMENTS	JA	SR	RB	RS
1	26.05.15	UPDATED TO ADDRESS BCC/TfB COMMENTS	JA	SR	RB	RS
0	05.05.15	FIRST SUBMISSION	JA	SR	RB	RS

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Project: A355 IMPROVEMENTS EASTERN RELIEF ROAD

Drawing title: EASTERN RELIEF ROAD OPTION 4A (SHEET 2 of 2)

Drawing status: FINAL DRAFT

Scale	1:1000 @ A3	DO NOT SCALE
Jacobs No.	B12798C2	
Client no.		
Drawing number	B12798C2/100/RELIEF ROAD/SK 04A	Rev 2

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Appendix D. TEE, PA and AMCB Tables

Economic Efficiency of the Transport System (TEE)

Non-business: Commuting	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	7498		7498			
Vehicle operating costs	593		593			
User charges	0		0			
During Construction & Maintenance	0		0			
COMMUTING	8091	*(1a)*	8091			

Non-business: Other	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	14552		14552			
Vehicle operating costs	889		889			
User charges	0		0			
During Construction & Maintenance	0		0			
NET NON-BUSINESS BENEFITS: OTHER	15441	*(1b)*	15441			

Business							
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**
Travel time	16120		5909	10211			
Vehicle operating costs	1334		828	506			
User charges	0		0	0			
During Construction & Maintenance	0		0	0			
Subtotal	17454	*(2)*	6737	10717			
Private sector provider impacts						**Freight**	**Passengers**
Revenue	0					0	
Operating costs	0					0	
Investment costs	0					0	
Grant/subsidy	0					0	
Subtotal	0	*(3)*				0	
Other business impacts							
Developer contributions	-909	*(4)*				-909	
NET BUSINESS IMPACT	16545	*(5) = (2) + (3) + (4)*					

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	40077	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values

Public Accounts (PA) Table

	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Local Government Funding						
Revenue	0		0			
Operating Costs	0		0			
Investment Costs	168		168			
Developer and Other Contributions	-909		-909			
Grant/Subsidy Payments	0		0			
NET IMPACT	-742	*(7)*	-742			
Central Government Funding: Transport						
Revenue	0		0			
Operating costs	0		0			
Investment Costs	6257		6257			
Developer and Other Contributions	0		0			
Grant/Subsidy Payments	0		0			
NET IMPACT	6257	*(8)*	6257			
Central Government Funding: Non-Transport						
Indirect Tax Revenues	976	*(9)*	976			
TOTALS						
Broad Transport Budget	5516	*(10) = (7) + (8)*				
Wider Public Finances	976	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs and Benefits

Noise		*(12)*
Local Air Quality		*(13)*
Greenhouse Gases	384	*(14)*
Journey Quality		*(15)*
Physical Activity		*(16)*
Accidents		*(17)*
Economic Efficiency: Consumer Users (Commuting)	8091	*(1a)*
Economic Efficiency: Consumer Users (Other)	15441	*(1b)*
Economic Efficiency: Business Users and Providers	16545	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-976	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	39485	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	5516	*(10)*
Present Value of Costs (see notes) (PVC)	5516	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	33969	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	7.158	BCR=PVB/PVC

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

Appendix E. Appraisal Summary Table

Appraisal Summary Table

Date produced:	4 March 2016

Contact:	
Name	
Organisation	
Role	Promoter/Official

Name of scheme:	A355 Improvements Scheme - Preferred Option
Description of scheme:	Single carriageway relief road, closely associated with a new vehicular access to the proposed strategic housing and employment site at Wilton Park, extending northwards from the site and meeting the A355 south of the railway line. Maxwell Road re-joins to the south of the new junction.

Impacts		Summary of key impacts	Assessment		
			Quantitative	Qualitative	Monetary
Economy	Business users & transport providers	The scheme generates benefits for business users through addressing issues with the capacity and capability of the existing network. In the future, these issues are exacerbated by growth in Beaconsfield which generates serious issues for transport users. The Scheme generates reductions in travel time in all time periods and generates vehicle operating cost savings of £1.3m.	Value of journey time changes(£m): £16.1 Net journey time changes (£m) 0 to 2min: 16.1; 2 to 5min: 0.0; > 5min: 0.0		16.545
	Reliability impact on Business users	An improvement in journey reliability is anticipated due to the diversion of traffic flows away from the current A355 and built up area of Beaconsfield.	N/A	Large Beneficial	N/A
	Regeneration	Not assessed - scheme does not impact upon a designated regeneration area.	N/A	N/A	N/A
	Wider Impacts	Benefits anticipated through reduced north/south journey times, improving the accessibility between business in Amersham, Beaconsfield and Slough, as well as improving access to the M40, and thereby businesses further afield. Traffic reassigning on to the relief road will have knock on effects for other business in Beaconsfield, as existing junctions such as London End Roundabout will experience a reduction in traffic and delays, thereby improving accessibility for business in the Old Town. Output change in imperfectly competitive markets anticipated, equal to 10% of the business transport user benefit, derived using TUBA.	N/A	N/A	N/A
Environmental	Noise	Noise reductions anticipated at properties along the existing A355 Park Lane/Amersham Road, within the bypassed area, and on surrounding roads as traffic reassigns onto the relief road. These improvements will be offset by the disbenefit of the new road, however, there will be fewer noise receptors associated with the new route, and therefore an overall noise benefit would be expected.	Not quantified at this stage.	Slight to Moderate Beneficial	WebTAG noise analysis not carried out at this stage.
	Air Quality	The proposed scheme is anticipated to lead to an improvement in local air quality overall. The proposed scheme does not affect air quality within an AQMA (NO2 & PM10).	Not quantified at this stage.	Slight to Moderate Beneficial	WebTAG air quality analysis not carried out at this stage.
	Greenhouse gases	The Scheme reduces levels of carbon (CO2 equivalent tonnes) emitted. Values were calculated by the TUBA analysis using outputs from the traffic model.	Change in non-traded carbon over 60y (CO2e): -8179 Change in traded carbon over 60y (CO2e): -7		0.384
	Landscape	This proposed scheme would introduce a new road into open farmland which forms part of the Green Belt. This would affect the appearance and character of the area and with the addition of lighting, would result in landscape and visual effects in the construction and operational periods. Views from nearby PROW (BEA/15/1, BEA/15/2 and BEA/16/1) and residential properties along the A355 (Amersham Road) would be impacted in both the construction and operational periods.	N/A	Moderate Adverse	N/A
	Townscape	The scheme would reduce traffic volumes and allow street scene enhancements on existing roads within Beaconsfield.	N/A	Moderate Beneficial	N/A
	Historic Environment	Beneficial effect on the character of the Beaconsfield Old Town Conservation Area and the setting of many Listed Buildings near the existing A355 from reduced traffic flows as traffic reassigns on to the relief road. However, risk of unknown archaeology and impact on setting of cultural heritage features.	N/A	Slight Beneficial	N/A
	Biodiversity	There is potential for protected species within, or in close proximity to, the proposed working area. This option also has the potential to pass through or adjacent to broadleaved woodland and deciduous woodland BAP priority habitat. Mitigation measures will be developed as the project progresses to minimise environmental impacts and where possible, to provide environmental enhancements.	N/A	Moderate Adverse	N/A
	Water Environment	A Flood Risk Assessment would be required to evaluate the impact of surface water flooding. This option is within Groundwater SPZ 3, therefore, construction works would need to be properly managed to reduce the risk of a pollution incident.	N/A	Slight Adverse	N/A
Social	Commuting and Other users	The scheme generates benefits for users through addressing issues with the capacity and capability of the existing network. In the future, these issues are exacerbated by growth in Beaconsfield which generates serious issues for transport users. The Scheme generates reductions in travel time in all time periods and generates vehicle operating cost savings of £15.44m.	Value of journey time changes(£m): 22.0 Net journey time changes (£m) 0 to 2min: 22.0; 2 to 5min: 0.0; > 5min: 0.0		23.532
	Reliability impact on Commuting and Other users	An improvement in journey reliability is anticipated due to the diversion of traffic flows away from the current A355 and built up area of Beaconsfield.	N/A	Beneficial	N/A
	Physical activity		Unable to quantify at this stage	Slight to Moderate Beneficial	N/A
	Journey quality	Positive impact is achieved through provision of alternative north/south route and reduced traffic volumes. Further benefits arise from complementary package of sustainable transport measures and improved facilities available to public transport users and cyclists.	N/A	Beneficial	N/A
	Accidents	The reduction in traffic through those junctions as a result of traffic reassigning on to the new relief road will reduce those safety concerns.	Not quantified at this stage.	Slight to Moderate Beneficial	N/A
	Security	Slight improvement for pedestrians and cyclists. Relatively few cyclists and pedestrians using the A355 currently but provision of complementary sustainable transport measures in conjunction with reduced traffic volumes will improve pedestrian connectivity and facilities for cyclists.	N/A	Slight Beneficial	N/A
	Access to services	Slight improvement for pedestrians and cyclists. Benefits also offered in terms of public transport reliability and punctuality through reduced congestion.	N/A	Slight Beneficial	N/A
	Affordability	The scheme will have a neutral impact on affordability as it will not impact of user charges.	N/A	Neutral Impact	N/A
	Severance	Slight severance caused by the relief road to be offset by design and provision of complementary sustainable transport measures. Reduction in terms of current severance caused by the large volumes of traffic on existing roads. Alignment of relief road, however, will sever Footpath BEA/15/2.	N/A	Slight to Moderate Beneficial	N/A
	Option and non-use values	User of motor vehicles would experience improvement in conditions with less congestion.	Unable to quantify at this stage	Slight Beneficial	N/A
Public Accounts	Cost to Broad Transport Budget	PVC of total investment costs for all contributions at 15% OB. Central Government Funding: 6.257m. Local Government Funding: -0.742m. Broad Transport Budget: 5.516m.	N/A	N/A	PVC: 5.516m
	Indirect Tax Revenues	Wider Public Finances (Indirect Taxation Revenues): -0.976m (loss to the exchequer)	N/A	N/A	Indirect Tax Rev.: -0.976m