M11 Junction 11 Bus-Only Slip-Road Study: Strategic Outline Business Case
Commercial Case
City Deal Partners

23 November 2016
Notice

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Document history

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1. Introduction

1.1. Overview
This chapter sets out the Commercial Case for the M11 Junction 11 Bus-Only Slip-Road Scheme. The Commercial Case forms part of the Strategic Outline Business Case (SOBC), following DfT’s WebTAG guidance. The objective of the Commercial Case is to provide evidence of the commercial viability of the proposed scheme. This chapter also explores options for a range of potential procurement strategies that may be used to engage the market. It describes the financial implications of the proposed procurement strategies, including risk allocation and transfer, contract (and implementation) strategies and timescales, as well as summarising the capability and skills of the team delivering the project and any personnel implications arising from the proposal.

As identified at section 1.2 of the Strategic Case, there are currently no existing or planned local bus services exiting southbound at the M11 Junction 11 to Trumpington Park & Ride and the Biomedical Campus. As a result, there is no transport need and no strategic case for investment in a southbound bus-only slip-road as a stand-alone scheme, unless financially sustainable bus services use the junction in the future.

Such need may be provided by the Western Orbital bus scheme business case and Cambourne to Cambridge Better Bus Journeys business cases which are currently being considered separately to the M11 J11 scheme.

1.2. Purpose and objectives of this Commercial Case
The Commercial Case sets out options for the potential procurement strategies available to engage the market, setting out the financial implications of each potential procurement strategy and the commercial model which drives best Value for Money. It explains how the M11 Junction 11 Bus-Only Slip-Road Scheme is seeking to implement an innovative approach to deliver the objectives outlined in the Strategic Case.

At this stage of SOBC development, the Commercial Case has been prepared at a high level, to provide a strategic outline or overview. Details on contract length, human resource issues and contract management will be finalised and updated subject to approval to proceed with the development of the Full Business Case.

The Commercial Case would be developed following the steps in the approach outlined below:

- set the procurement objectives, define desired outcomes and identify potential constraints;
- identify potential procurement / purchasing options;
- assess the procurement options in terms of advantages and disadvantages, to develop a rationale for selecting the preferred sourcing option;
- confirm the preferred payment mechanism and pricing framework; and
- assess how different types of risk might be apportioned / shared, with risks allocated to the party best placed to manage them.

1.3. Compliance with DfT guidance for the Commercial Case
This Commercial Case follows the DfT WebTAG guidance for a Commercial Case. Table 1-1 demonstrates where the relevant information complying with those requirements is set out in this document.
### Table 1-1  Location checklist of requirements for the Commercial Case

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
<th>Location in report</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>Outline the approach taken to assess commercial viability.</td>
<td>1.2 Purpose and objectives of this Commercial Case</td>
</tr>
<tr>
<td><strong>Output based specification</strong></td>
<td>Summarise the requirement in terms of outcomes and outputs.</td>
<td>1.5 Output based specification</td>
</tr>
<tr>
<td><strong>Procurement strategy</strong></td>
<td>Detail procurement/purchasing options including how they will secure the economic, social and environmental factors outlined in the Economic Case.</td>
<td>2.1 Overall procurement strategy</td>
</tr>
<tr>
<td><strong>Sourcing options</strong></td>
<td>Explain the options for sources of provision of services to meet the business need e.g. partnerships, framework, and existing supplier arrangements, with rationale for selecting preferred sourcing option.</td>
<td>2.3 Capital works procurement options</td>
</tr>
<tr>
<td><strong>Payment mechanisms</strong></td>
<td>Set out the proposed payment mechanisms that will be negotiated with the providers e.g. linked to performance and availability, providing incentives for alternative revenue streams.</td>
<td>2.8 Payment mechanisms</td>
</tr>
<tr>
<td><strong>Pricing framework and charging mechanisms</strong></td>
<td>Including incentives, deductions and performance targets as well as outlining the pricing framework and charging mechanisms.</td>
<td>2.9 Pricing framework and charging mechanisms</td>
</tr>
<tr>
<td><strong>Risk allocation and transfer</strong></td>
<td>Present an assessment of how the types of risk might be apportioned or shared, with risks allocated to the party best placed to manage them subject to achieving Value for Money.</td>
<td>2.10 Risk allocation and transfer</td>
</tr>
<tr>
<td><strong>Contract length</strong></td>
<td>Set out scenarios for contract length (with rationale) and proposed key contractual clauses.</td>
<td>2.11 Contract length, defects, operation, maintenance, and compliance periods</td>
</tr>
<tr>
<td><strong>Human resource issues</strong></td>
<td>Consider personnel/people management/trade union implications, where applicable, including TUPE regulations.</td>
<td>2.12 Human resource issues</td>
</tr>
<tr>
<td><strong>Contract management</strong></td>
<td>Provide a high level view of implementation timescales. Detail additional support for in-service management during roll-out. Set out arrangements for managing contract through project / service delivery.</td>
<td>2.13 Contract management</td>
</tr>
</tbody>
</table>

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1 As set out in Table 5.1 – Contents of the Commercial Case – of *The Transport Business Cases* published by the Department for Transport (January 2013)

2 See the Office for Government Commerce’s *Achieving Excellence* briefing for advice on payment mechanisms for construction projects.
1.4. Summary of options – differing infrastructure outputs

Four options for the M11 Junction 11 Bus-Only Slip-Road Scheme (described and referred to in the Strategic Case at section 8.2.2 as Options A, B, C and D) have been considered within this Strategic Outline Commercial Case. In identifying an appropriate procurement strategy for the infrastructure (capital) outputs for these options, it is important to understand both the engineering and logistic complexity of each option. In terms of infrastructure, the key characteristics of the four options are as follows.

Two of the four schemes (Options C and D) stand out as being more complex than the other two as they both require bridge construction work. Option B is the only option which does not include any new segregated carriageway, instead it widens the existing motorway slip road to create a dedicated bus lane. Option A’s design, while including a new segregated carriageway immediately adjacent the M11, may prove not to be achievable from a design point of view as identified within Table 10.1 of the Strategic Case. Clearly this may be resolved as the design develops and it is assumed in this Commercial Case that the outline design as currently presented can be implemented generally as presented. For further details on the specific infrastructure proposed for each option, refer to the option descriptions presented in the Strategic Case.

Where options require carriageway widening or completely new infrastructure the delivery of which can only be secured by the use of additional land (‘land assembly’), such land assembly may need to be secured through the exercise of powers of compulsory acquisition; and compliance with local planning and highway legislative and regulatory requirements will also be necessary.

1.5. Output based specification

Section 7.2.2 of the Strategic Case distilled strategic high-level objectives for the scheme which it lists in Table 7-1 while clarifying that some of the objectives are themselves ‘outcomes’ while others relate to methods of achieving those outcomes.

As the Strategic Case has already taken the step of identifying the strategic methods required to achieve the outcomes, the Commercial Case can effectively concentrate on these for the purpose of highlighting the ability of different procurement methodologies to deliver the high-level objectives identified in the Strategic Case.

The high-level method objectives to deliver the Strategic Case as identified in Table 7-1 of the Strategic Case are reproduced below for ease of reference in Table 1-2;

<table>
<thead>
<tr>
<th>Type</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>To provide bus-based HQPT(^3) western orbital route along the M11 via M11 J11 to connect areas in the north and west of Cambridge with Trumpington and Addenbrooke’s (including the Hospital and Biomedical Campus).</td>
</tr>
<tr>
<td></td>
<td>To provide high quality segregated bus-only slip-road that enable attractive journey times and high reliability of future bus services, compared to the general traffic slip-roads.</td>
</tr>
<tr>
<td></td>
<td>To provide improved public transport links along the orbital route to the west of Cambridge in order to enhance economic growth opportunities and connectivity with local and regional destinations.</td>
</tr>
</tbody>
</table>

The Commercial Case will evaluate various procurement options available and propose methods most suitable for delivering the objectives as ‘outputs’ from the procurement. The Commercial Case will do this by reference to key delivery concepts in construction contracts; Cost and Quality, with Quality being understood more widely as covering not just the immediate passenger experience of ride quality but also ease and speed of undertaking a journey.

A third key delivery concept, Time is usefully added to Cost and Quality being important in its own right as an important element in the delivery of both Quality and Cost; a transport system delivered more quickly can be seen to directly increase both utility in use of the new transport scheme as well as increasing Value for

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\(^3\) ‘High Quality Public Transport’
Money derived from earlier income streams from the service provision. Time is also one of the key differentiating factors between possible procurement methodologies.

While ‘Cost’ is not the same as ‘Value for Money’, a change in scheme cost achieved with no change in quality results in a change in Value for Money obtained from the strategy. Cost is also an identifiable differentiating factor between possible procurement methodologies.

Developing a set of requirements for the outputs will be key to a successful procurement process, whether that process is traditional, Design and Build (D&B), Develop and Construct (D&C) or Develop and Operate (D&O).

In any project the three criteria of cost, time and quality are understood to be interdependent and decisions affecting one of the three criteria could affect one or both of the other two criteria. The appropriate procurement strategy recognises these interrelationships and balances scheme promoter needs and project characteristics. Incentivisation of cost and time is relatively straightforward and this is dealt with in sections 2.10.1 and 2.10.2 of this Commercial Case.

Within the general framework outlined above, a high level qualitative risk assessment of the key specific risks to Time, Cost and Quality arising from the outputs from the four options (as set out in the Strategic Case) is shown in Table 1-3. The assessment identifies in each case the derived risk following ‘occurrence’ in terms of High (‘H’), Medium (‘M’) or Low (‘L’), the categorisations being based upon professional judgement as proportionate for this stage of assessment. The likelihood of occurrence of the risks varies dependant on each individual Option scope. This is discussed further in section 2.3 of the Commercial Case “Capital works procurement options”.

Table 1-3 Qualitative risk assessment of output risks

<table>
<thead>
<tr>
<th>Risk</th>
<th>Assessed risk factor (‘H’, ‘M’, ‘L’)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TIME</td>
</tr>
<tr>
<td>Land Acquisition</td>
<td>L</td>
</tr>
<tr>
<td>Utilities works</td>
<td>M</td>
</tr>
<tr>
<td>New Bridge design</td>
<td>M</td>
</tr>
<tr>
<td>New Bridge construction</td>
<td>L</td>
</tr>
<tr>
<td>Traffic Management (‘TM’)</td>
<td>H</td>
</tr>
<tr>
<td>Segregated guideway design</td>
<td>M</td>
</tr>
<tr>
<td>Segregated guideway construction</td>
<td>M</td>
</tr>
<tr>
<td>Maintenance</td>
<td>L</td>
</tr>
</tbody>
</table>

The following sections of this report develop a suggested procurement and contracting strategy taking into account the particular risks arising from the required outputs of the potential options.

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4 If the scheme promoter obtains and exercises compulsory purchase powers for the land acquisitions this Time risk will be mitigated to a ‘Medium’ risk.
2. Procurement

2.1. Overall procurement strategy
A procurement strategy has been prepared based on the objectives of the project to ensure a successful outcome by addressing the output risks for the infrastructure options identified in the Strategic Case. The Partnership is expected to procure many of its professional services through frameworks with suppliers which have been pre-selected by virtue of their capabilities, experience, capacity and behaviours.

Risks to operational performance should sit with the scheme promoter and the outline designer whereas risk to time and costs, especially during implementation should sit with the contractor.

In the following sections the term ‘client’ is used as this is the title given by many standard form construction contracts. In the context of this Commercial Case the word ‘client’ is synonymous with ‘scheme promoter’ or the organisation through which the scheme enters into contract with construction organisations for the infrastructure works.

2.2. Capital works procurement strategy
The capital (infrastructure) works procurement strategy must acknowledge appropriate risk allocation and work with the design strategy and set the appropriate engagement of consultants and contractors for the detailed design and implementation. The capital works strategy is realised through the resulting project organisation, project management, contracting strategy and the consistency and co-ordination of the contract terms between the client and external organisations.

One of the most fundamental decisions when addressing the procurement strategy for infrastructure works is how to source the design elements of the work.

The design requirements of the infrastructure work vary between options. There may be elements in some of the options that are challenging and may present risk of delay either because of design complexity or because of necessary interface with third parties. Examples of risk accruing from relative technical complexity is the bridge work required for both Options C and D. Examples of risk accruing from design interfaces with third parties are the land assembly and design approvals from the respective statutory bodies for planning and highways amendment consents.

Infrastructure design is a process with distinct but related stages. Operational design, sometimes referred to as ‘Preliminary’, ‘Outline’ or ‘Reference’, defines the performance criteria of the scheme and what the actual outputs will be, whereas detailed design defines the construction of the project and how it is delivered on the ground.

Given that the key external constraints and risks on the project (land assembly and statutory utilities diversions) are largely defined during the initial phases of the design of the selected option, the procurement strategy can be effective in partially managing these risks before the delivery mechanism is set in train.

In terms of the construction phase of the project the key risks identified in the options include the planning and logistics involved with the construction of a new bridge (Options C and D only) and the sensitivity to the quality and reliability of the operational life of the infrastructure.

The section below on ‘Sourcing Options’ applies the risk assessment to decide on appropriate contracting strategies for the infrastructure.

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5 The term ‘Reference’ being applied often when an outline design is incorporated into a construction contract as part of the specification, being the design which a Design and Build contractor will need to develop with detailed design work before constructing.
2.3. Capital works procurement options

A number of procurement options are being considered; these mainly focus on procurement of key suppliers under direct contracts with the Partnership. Different procurement strategies provide different ways of allocating risk and responsibilities to the organisations contributing to the project, different structures for the project organisation and different relationships between those external organisations and the Partnership.

There are many procurement routes available including traditional, D&B, management contracts and private finance initiative / public-private partnership (PFI/PPP). With the exception of PFI/PPP there are a number of industry standard contract forms which provide terms and conditions to reflect and control the differing processes and priorities inherent in those basic contacting strategies discussed in further detail below.

The contract strategy will determine the level of integration of design, construction and maintenance for a project. This should support the objectives for outputs expressed in respect of time, cost, and quality which, subject to fine tuning, are understood to be generally stated as follows:

- **Cost** - a high degree of certainty that the scheme can be delivered within the available funding constraints;
- **Quality** - the provision of a high quality asset with minimal maintenance issues and interruptions to planned operation levels; and
- **Time** - bringing the new assets into operation quickly after funding is approved.

These objectives conflict to a certain degree and consequently the sourcing option will reflect an optimised balance between them. Mechanisms will be put in place in the chosen contract strategy to further incentivise the supply chain towards the objectives. The choice of strategy must ensure that control is concentrated where it is most needed and on the factors most important to the Partnership, with risk being allocated in a way that it is held by the party best able to manage it, consistent with the stated objectives.

The main types of procurement strategy for capital works are:

- **Traditional**: design by client-engaged consultants before tender and separate placement of a contract for the construction works;
- **D&B**: detailed design and construction are both undertaken by the same organisation;
- **D&C**: a hybrid of ‘traditional’ and D&B where part of the design is prepared before the contractor is appointed;
- **Construction management**: design by the client’s consultants and construction of the works overlap. A fee-earning construction manager defines and manages the work packages. All contracts are between a client and the trade contractors. The final cost of the project may only be accurately forecast when all packages have been let;
- **Management contracting**: design by the client’s consultant and construction overlap. A management contractor is appointed early to let elements of work progressively by trade or package contracts (‘works packages’). The contracts are between the management contractor and the works contractors. As with construction management, the final cost can only be forecast with reasonable certainty when the last package has been let; and
- **PFI/PPP**: This procurement route is typically where a public sector client buys services with defined outputs from the private sector on a long-term basis, typically for 25 years. This will typically involve constructing and maintaining the delivered asset, and consequently the supplier is incentivised in this model to have the highest regard to whole-life costing as it has the risk of future operation and maintenance costs for a substantial period of time.

Table 2-1 summarises and compares the options, presenting the advantages and disadvantages of each basic procurement route. Later on in this section we explain how the divisions between each separate route can be fine-tuned to obtain the optimum characteristics for the project contracting strategy.
## Table 2-1 Comparison of capital works procurement options

<table>
<thead>
<tr>
<th>Procurement type</th>
<th>Description</th>
<th>Risk transfer</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional approaches</td>
<td>Client completes a full detailed design followed by tendering for a contractor, who is passed the design to construct.</td>
<td>The contractor assumes responsibility and financial risks for the building works whilst the client takes the responsibility and risk for design team performance. Therefore, if the contractor's works are delayed by the failure of the design team to meet their obligations, the contractor may claim against the client for additional costs and/or time to complete the project.</td>
<td>• design-led, facilitating a higher level of client control over the design; • reasonable price certainty at contract award based upon market forces; • the strategy is satisfactory in terms of public accountability; • the procedure is well known; and • changes are easy to arrange and value.</td>
<td>• overall programme may be longer than for other strategies as there is no parallel working; • limited 'buildability' input by contractor; and • the strategy often results in adversarial relationships developing.</td>
</tr>
<tr>
<td>D&amp;B</td>
<td>Client goes to tender on the basis of performance criteria for the asset together with other design and logistical constraints possibly together with very limited design information. The successful contractor then becomes responsible for completing the design and construction in accordance with the stated requirements</td>
<td>Design risk is carried by the contractor. The client develops a detailed knowledge of risk, enabling a more informed negotiation of risk transfer at the tender stage.</td>
<td>• the client has only to deal with one firm; • more construction efficiency benefits ('buildability') are prioritised in the design; • price certainty is obtained before construction starts provided the client's requirements are adequately specified and changes are not introduced; and • reduced total project time through early completion is possible because of overlapping activities. Detailed Design is completed by the contractor to suit its own construction programme, the advanced site works being undertaken while the design for later activities is still in progress</td>
<td>• There are very few true D&amp;B construction organisations and what is usually being procured is a collaboration between a contractor and design organisation; • the client is required to commit itself before the detailed designs are completed; • there is no design overview unless separate consultants are appointed by the client for this purpose; • difficulties can be experienced by clients in preparing an adequate brief; • bids are difficult to compare since each design, programme and cost will vary; • client changes to project scope can significantly add to the scheme costs; and • Practical difficulties are possible if, despite contractual checks a contractor is intent on implementing a programme of cost savings</td>
</tr>
<tr>
<td>D&amp;C</td>
<td>The client submits for tender an outline design together with performance criteria for the asset together with other design and logistical constraints. The successful contractor then becomes generally as D&amp;B above but the contractor's design is constrained within certain parameters derived and defined by the outline design already undertaken by the client.</td>
<td>Generally as D&amp;B above but because of the pre-contract outline design work together with continuous checking of the developing detailed design the client has more control over the main characteristics of the asset as finally constructed.</td>
<td>• as D&amp;B above but because of the pre-contrast outline design work together with continuous checking of the developing detailed design the client has more control over the main characteristics of the asset as finally constructed.</td>
<td>• as D&amp;B above but the difficulties of and unpredictability of outcomes arising from representing the brief purely in words is mitigated by the client's 'pre-contract' partial design.</td>
</tr>
<tr>
<td>Procurement type</td>
<td>Description</td>
<td>Risk transfer</td>
<td>Advantages</td>
<td>Disadvantages</td>
</tr>
<tr>
<td>------------------</td>
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</tr>
<tr>
<td><strong>Management contracts</strong></td>
<td>Responsible for the outline design that it has inherited and completes the detailed design and construction in accordance with that outline design modified as necessary to comply with all the contract requirements. It is typical under this model for the client’s designer to be transferred to the contractor to maintain knowledge and continuity.</td>
<td>Under both regimes the work is let in separate work packages (generally by trade) which may include design responsibility). Under the construction management regime all work package contracts are placed directly by the client whereas under ‘management contracting’ the contractor places these contracts.</td>
<td>• the strategy offers time saving potential for overall project time due to the overlapping of procedures; • buildability advice potential is inherent; • breakdown of traditional adversarial barriers although a certain amount of contractor / client barriers remain under the ‘management contracting’ regime; • parallel working is an inherent feature; • clarity of roles, risks, and relationships for all participants; and • changes in design can be accommodated later than with some other strategies, without paying a premium, provided the relevant trade packages have not been let and earlier awarded packages are not too adversely affected.</td>
<td>• loss of contractor buildability input into the outline design stage however this can be mitigated by inviting alternative proposals with tenders; and • additional programme time spent before tender although limited net delay to achievement of the construction completion.</td>
</tr>
<tr>
<td><strong>PFI/PPP</strong></td>
<td>This procurement route is typically where a public sector Client buys services with defined outputs from the private sector on a long-term basis, typically for 25 years. This will involve maintaining or constructing and maintaining the asset, and the supplier is incentivised to consider whole-life costing as it will benefit directly from reduced spending on maintenance.</td>
<td>All risk is carried by the PFI Operator</td>
<td>• total cost of the scheme including maintenance and operation is effectively spread over the whole lifecycle of the project; and • long term interest in maintenance helps ensure quality driven approach to the design and construction of the scheme.</td>
<td>• increased procurement process duration will lead to significantly later start date of construction and therefore potential for increased cost to completion; • generally more expensive overall than self-funded procurement models; • very long ‘lock-in’ time with the contractor may be problematic if relationships are not satisfactory; and • strong differences of political opinion exist on the use of PFI models of procurement. This may</td>
</tr>
<tr>
<td>Procurement type</td>
<td>Description</td>
<td>Risk transfer</td>
<td>Advantages</td>
<td>Disadvantages</td>
</tr>
<tr>
<td>------------------</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>generate political difficulty in obtaining sanction for use.</em></td>
</tr>
</tbody>
</table>
As outlined above, while certain identified design and construction risks exist, only the scheme options under consideration which contain a requirement for bridge works could be considered to contain complex engineering design.

Currently, bus operator involvement in providing infrastructure is generally limited and there are very few precedents of bus operator involvement in any PPP/PFI infrastructure schemes in the UK or for infrastructure schemes specifically for bus services. This is distinct from operators contributing to the capital or revenue costs of infrastructure, of which examples include an access charge (Cambridgeshire Busway), contribution to capital cost (Leeds) or profit share mechanism (South Hampshire Eclipse). It is for this reason that the procurement strategy (in this SOBC) has considered parallel procurement routes for both capital works and bus services.

While identified within the Strategic Case in Table 10-1 as being ‘low risk’ for each of the four options, one of the key design risks (other than in the case of Option B in which the new route is created by widening the existing carriageway) will be the establishment of the precise route of the chosen option, and the source of the risk deriving from the time taken to undertake the necessary land assembly. The land transactions if concluded by negotiation/agreement, will potentially involve a large number of separate contracts with third party landowners. Consequently it will take a significant amount of time before the route can be finalised and the consequent time and cost risk removed. This argues for the D&C procurement process, where a relatively detailed outline design is developed at an earlier stage than under the D&B model (before the contractor is engaged) enabling the client to commence acquisition of land as early as possible. The extent of additional land required, and consequently the number of land transactions needed, varies between the four options and this issue should therefore be taken into consideration in the choice of the preferred option.

The problem of a large number of land transactions deriving from the chosen route may be mitigated significantly by the exercise of compulsory purchase powers (if such are authorised) through the general vesting declaration process, which would not require a large number of separate contracts with third party landowners.

In terms of the construction process, the main risk is in the works to be undertaken by statutory undertakers as a result of the number of alterations to utilities equipment. This work comes with a significant time and cost implication as the engagement process prescribed under the New Roads and Street Works Act 1991 (NRSWA) is capable of being extremely prolonged and costly. Early engagement with utilities companies is therefore vital to identify the necessary diversions and the cost and programme requirements of these works. Additionally, mostly being installed underground, the adaptation work is likely to be needed at a relatively early stage in the construction process. Notwithstanding that preparatory engagement with the utilities companies will reap dividends in time savings, final arrangements, detailed planning and implementation are more effectively managed by the contractor who should be required to contract with each utility company for the works.

The only caveat to the recommendation that contracting with the utility companies should be left to the contractor is that the discount given by utilities companies to public authority clients under the provisions of NRSWA may not accrue to the works contractor, although experience has suggested that if the contractor evidences that the works are being undertaken on behalf of a public authority then most utility companies will offer the same discount. This will be one of the issues to be checked during the early stages of client / utility company engagement; clearly if the discount will not be offered to a contractor then this aspect of the procurement strategy ought to be re-considered.

The work involved seems suited to transferring a significant amount of design to the construction supply chain; the quality aspects of most of the infrastructure being heavily prescribed by nationally codified highways standards rather than client preference. However it needs to be acknowledged that the operational performance standards required for the infrastructure (high ride quality being one of the strategic scheme objectives) need to be set out and the contractor’s designs to achieve that performance reviewed for compliance as highways standards may not address these aspects satisfactorily.

Although identified in the Strategic Case as being ‘low risk’, the risks accruing from negotiation of land purchases to allow the new infrastructure to be established within given boundary limitations is unsuitable to be transferred to a contractor and would almost inevitably lead to delay and cost escalation. However, other transportation schemes which have obtained compulsory purchase powers for contractors under a Transport Works Act (TWA) Order have adopted this approach. In the context of the four options being considered, such an approach would only be possible if a dedicated busway option is chosen (which excludes Option B),
but would not necessarily be preferable if the busway is not to be part of a longer term franchise or concession arrangement.

The time and cost risk accruing from the utilities works will attract significant risk premiums unless mitigated in some way. As discussed above this risk can be mitigated by early engagement with the utilities companies to identify and plan the necessary adaptions required by the chosen route option. This process is suitable for a contractor and is an argument in favour of Early Contractor Involvement (ECI) which is discussed in section 2.5.

2.4. Rationale for preferred sourcing option

The contract strategy should support the main project objectives in terms of risk allocation, delivery, and incentivisation.

As the only complex aspect of infrastructure design of any of the options, the bridgework, is not required to be technologically novel, and much of the rest of the construction is largely constrained by highways standards, the schemes are suitable to be designed by the construction supply chain.

However as identified previously there are time and cost risk factors that arise from the design process which if unmitigated at tender stage, will attract a tender premium if transferred to the supply chain. These primarily arise from the identification of the route of new carriageways and the related need for land assembly and utilities works. It will therefore be beneficial to the achievement of the required project outputs if these aspects can be mitigated before tendering the infrastructure work. The appropriate procurement solution for the construction of any of the current project options should therefore be one that incorporates aspects both of D&B and ‘traditional’ contracting such that the outline of the design would be developed prior to tender establishing a design framework within which the successful contractor could complete the remainder of the design.

The D&C model satisfies these criteria. A significant amount of outline design can be completed pre-tender to allow the new route location to be established, necessary land purchases transacted and utilities works to be provisionally identified and estimated before passing responsibility for completion of the detailed design to a contractor. The contractor will then complete the detailed route design (within contractually stated boundaries consistent with the land assembled), and engage with the statutory undertakers for delivery of the amendments to its equipment consistent with the final design.

As the design will not be completed at the time of tender, it will not be possible or, indeed, appropriate or good Value for Money to produce bills of quantities; instead the tendering contractors should be invited to break down their tenders in accordance with an activity schedule to an appropriate level of detail.

As a result of the client completing the outline design to this level, contractors can price the work without having to deal with the significant cost and time risk issues accruing from matters almost totally outside their control enabling keen pricing of the remaining work.

Within this model a number of ‘fine tuning’ adjustments can be made to tailor the risk transfer more accurately to the needs of the Partnership in respect of financial / commercial matters and to incentivise the contractor to deliver in a manner that reflects the client’s needs and objectives. This is discussed in detail later within section 2.10 (Risk allocation and transfer) before the final contract mechanisms are summarised at the end of this Commercial Case in section 3 (Preferred Procurement Route).

At this point consideration must be given to the requirements of the Public Contracts Regulations 2015. Current estimates of the capital works contracts as given in section 1.2.1 of the Financial Case suggest that the works contracts and related consultancy appointments under Options C and D of the scheme exceed the threshold sums specified in Article 4(a) of the Public Contracts Directive. As such, the work will be required to be tendered using a method compliant with the regulations if either of those options is selected to be taken forward.

2.5. Early Contractor Involvement (ECI)

ECI seeks to obtain the benefits of contractor expertise at an early stage of the design development during the ‘pre-contact’ stage under traditional contracting terminology. The potential benefits could include advice on planning and introduction of more cost / time efficient design options.
One drawback of such an arrangement is that it compromises the principles of tendering and in its pure form (as contained within the New Engineering Contract’s (NEC’s) published ECI agreement) obliges a client to contract on what is essentially a single-sourcing basis for the vast majority of the construction works.

On a more specific basis, because the design / construction issues involved in the options are relatively simple and largely constrained by published standards there is little justification for engaging in ECI on this project other than for the administration of the preliminary utilities’ quotations.

Cambridgeshire County Council (‘CCC’) has access to both design and construction framework consultants and contractors. Its framework highway works contractor has extensive and local expertise in liaising with utilities over diversions and new equipment associated with highways works and it is recommended that it could be quickly and efficiently engaged to undertake this aspect of the pre-tender design work.

Consequently formal ECI is not recommended as part of the procurement of any of these schemes.

2.6. Partnering

Partnering is a relative newcomer to the construction procurement toolkit. Generally requiring bespoke contract drafting, it typically works by binding together the client’s supply chain with a multi-party partnering arrangement where suppliers can be incentivised collectively to achieve project objectives. The NEC provides a standardised partnering model by the use of Option X12 of its form of contract. X12 is used as a secondary option common to each of the NEC contracts by which each party separately has obligations to its common client.

As even the bridge works in Options C and D do not necessarily involve innovative designs or materials, the work mitigates toward a simple supply chain amounting to a single D&C contractor.

There is therefore felt to be no need for formal partnering arrangements within the contracting strategy.

2.7. Framework contracts

Framework contracts are arrangements where all the procedures for the pricing and undertaking of construction works, design services and management services are tendered in competition without the promise of any work being actually undertaken under them with ‘call-off’ agreements set up for individual tasks. Framework contracts are typically placed with a number of successful tenderers covering a broad spectrum of work likely to be required; they establish commercial relationships between the client and each framework supplier for a period of years.

Call-off packages are then placed for each piece of work or service as and when it can be defined by the client.

Framework contracts can accommodate the setting up of specific call-off contacts to incorporate various contractual arrangements; build-only, D&B, lump sum, cost reimbursement or target cost to suit the circumstances of the call-off in question. Framework agreements can also be set up in less flexible ways.

In addition to the more limited use of CCC’s highways framework for ECI work mentioned above, it is understood that the Partnership has access to frameworks for both highways design services and construction work. One of these, the Eastern Highways Alliance Framework (and specifically ‘LOT2’ of that framework being for larger scale works), has the ability to place orders up to £20million in value by delegated authority. Importantly for the scheme options which will require construction contracts in excess of this sum, the Eastern Highways Alliance Framework has the ability under its governance rules to place orders in excess of this following approval of the framework governing body.

The framework is based upon the NEC form and allows for prices to be sought and orders placed under four of the main procurement options available with this suite of contracts: Options A, B, C and D. These comprise respectively;

- the lump sum options A and B; A the ‘Priced contract with activity schedule’ and B the ‘Priced contract with bill of quantities’; and
- the Target Cost options C and D; C the ‘Target contract with activity schedule’ and D the ‘Target contract with bill of quantities’.
Activity Schedules and Bills of Quantities are used as different ways of obtaining a breakdown of the contractor’s tender; the activity schedules typically demanding a less detailed breakdown than the bills of quantities. The bills of quantities are more prescriptive but require detailed knowledge of the completed design to compile the tender.

In respect of consultancy work the framework also uses the terms of the Professional Services Contact (PSC) which is also part of the NEC suite.

The framework encompasses three of the procurement options available with the PSC suite, Option A: Priced contract with activity schedule, Option C: Target based contract and Option E: Time based contract.

2.8. Payment mechanisms

Deciding on appropriate payment mechanisms for the contract strategy is about striking a balance between the risk to the client for paying for work undertaken in advance of it being completed and becoming a useful asset. The supply chain partner will need to borrow money to fund any outgoings and will include interest charges in any tender. As the client organisation will have access to cheaper funding than the supply chain partner it will be to the client’s economic advantage to provide regular interim payments to enable the supply chain to operate on the project with minimal need for borrowing.

By maintaining a frequent and transparent interim payment process for the contractor, as well as consultancies engaged on the project, the objective of open and collaborative working within the project team will be facilitated which should deliver Value for Money for the client as well as allowing the supply chain partners to make a reasonable return from its endeavours.

A range of mechanisms is available within the payment processes of most standard form contracts which allow the process to be adjusted so as to reflect the risk allocation profile of the project. These are described in more detail in section 2.10 (Risk allocation and transfer).

Advance payments in return for price savings could be considered but the interests of the client will need to be protected against loss of any cash advances through performance bonds or parent company guarantees which may prove more costly than the discount offered.

2.9. Pricing framework and charging mechanisms

The pricing framework embedded within the contract terms needs to be appropriate to the procurement model selected.

The procurement model appropriate to the current options has been identified earlier as D&C, a hybrid of the basic D&B model. Following this process the scheme design will only be completed to an outline level of detail and as such any detailed pricing model such as bills of quantities will be impossible. Consequently construction tenders will be invited to be broken down into sums set against a given list of activities reflecting the key elements of the project with particularly large elements broken down into sub-elements. The tenderers will be invited to add additional activities to suit their planned design development and proposal ideas as they may see the breakdown of costs slightly differently to the client's consulting team.

The tender activity schedules will be used by the client’s consulting team to compile a pre-tender cost check which can be used as a baseline to validate and challenge tenderers’ submissions by highlighting any non-optimal pricing strategies such as front-end pricing.

The priced schedule of the successful tenderer can be used to provide a quick and transparent means of interim payment assessment by applying the percentage completed of each schedule activity item to its respective value in the schedule and summing the individual amounts to give an assessment of the total value of work undertaken. Additional works undertaken as a result of change orders can be addressed in a similar way by applying the percentage complete to the costed change register.

At regular intervals more detailed assessments of actual cost expended should be undertaken to ensure the contractor’s cash flow is not being compromised by this shorthand methodology.

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6 Applicable for only Capital Works procurement
Key Performance Indicators (KPI)

KPIs can be introduced into contracts relatively simply (for example by engaging Option X20 on contacts within the NEC suite) for matters considered valuable to monitor. Examples include the number of defects, the rate of progress of certain works, whether client satisfaction levels were reached, whether the asset is cheaper to operate and maintain than expected, and so on.

Consistent with the objectives of the KPI system to improve results it is clear that the performance of the supplier and its supply chain is monitored and measured against KPIs regularly throughout the contract. It is important to identify and describe KPIs, including achievement criteria, at the outset and include this information within the tender documents.

The general approach with KPIs (and certainly that drafted into the NEC contract) is to promote the concept of continuous improvement. It needs to be emphasised that as drafted in standard form these indicators are therefore not intended to be punitive and no negative financial adjustment is provided for if the targets set are not achieved or bettered.

The basic payment structure of the NEC contract utilised in Eastern Highways Alliance Framework terms of contract already provides negative financial consequences where stipulated performance is not achieved. Dependant on the choice of specific form chosen, examples of such mechanisms can include; imposition of delay damages, inability of the contractor to recover the cost of correcting defects in the work undertaken after completion, the burden of pain share for the contractor incurring costs over the contract cost target as well as non-payment of costs for failure by the contactor to comply with a number of identified commercial processes such as a required procurement procedure for sub-contract packages as described in earlier sections.

In our opinion KPI systems do not offer Value for Money. Additionally if contracts are amended to enable them to be punitive they often result in protracted and counter-productive disputes. We do not recommend their use as part of the more detailed procurement strategy.

2.10. Risk allocation and transfer

As commented above, the key to risk transfer is to allocate risk to the party best able to manage it. Within the basic procurement model and contract strategy identified above, using a D&C contracting strategy and transferring design responsibly to the contactor, the industry standard form contracts enable a significant fine tuning of the risk transfer. The preceding sections of this Commercial Case contain a high-level evaluation of the key risks accruing from the outputs of the current scheme options; the procurement and contracting strategy derived subsequently explains how these risks can be effectively managed, mitigated and transferred through the adoption of a D&C methodology.

Fine tuning of the D&C model is valuable to more accurately reflect the project objectives, constraints and risk allocation decisions. Many of these adjustments can be done with ‘standard’ options (such as weather events) offered by standard form contracts although some fine-tuning options involve more expensive bespoke amendment requiring legal drafting or review. The sub-sections immediately below address various fine tuning mechanisms available within most standard form contacts to allow cost and time risks to be apportioned appropriately between client and supplier.

A short discussion of the use of insurance to support the risk allocation of particularly onerous risks is provided later in this Commercial Case in section 2.10.3.

2.10.1. Cost risk sharing and financial incentivisation

There is a range of payment mechanism measures to optimise value for any particular project and its particular characteristics. The following list provides the main examples;

- Contractor bonus for early completion – in the Engineering and Construction Contract (ECC) there is provision for introducing a bonus for each day the contractor completes the works ahead of the contractual Completion Date;
- Target cost – the client can utilise target cost arrangements where, if the supplier delivers the out-turn cost below the level of the final target, the savings are shared according to a pre-agreed formula. A similar sharing arrangement of cost over-run reciprocates this arrangement;
Value Engineering – a contractor is rewarded for suggesting alternative solutions to one stipulated in the contact that would offer an operational performance, cost and/or time benefit to the project; and

Cost reimbursement – construction works, if considered difficult to estimate at the time of contracting may be let on the basis of minimal cost risk for a contractor.

Following the D&C methodology, for any of the current options for this project fine-tuned with any or all of the incentivisation mechanisms described above will mitigate the key time and cost risks arising. A cost reimbursement payment model is wholly unjustified and would almost certainly lead to unnecessary expenditure and uncertainty.

Conversely the ability of a contractor experienced in highways infrastructure works on a similar scale as the scheme options should have no difficulty in managing the residual risks presented. There will be significant scope for mutually beneficial commercial risk transfer mechanisms such as either lump-sum or target cost contracting.

While administratively marginally more complex than lump sum contracting arrangements, target cost contracting enables both parties to share the risks and benefits of the outturn cost of the works and is justifiably popular on many types of construction projects. The concept of scope changes / variations is common to both approaches, however being linked to a transfer of design responsibility following a pre-contract client’s outline design, the scope for significant post-contract change is reduced.

The various percentages and cost ranges for the calculation of a contractor's 'pain' or 'gain', together with the mechanism for their application to contractor payments will be set at a level to incentivise rather than punish.

Unfortunately the drafting of most standard forms of contract does not allow pain-share (or gain-share) to be applied before completion of the works and this has led to a number of inequitable situations. One specific and extremely important example of this problem occurred to a member of Partnership while building the Cambridgeshire Guided Busway project and was highlighted as part of the lessons learned process following completion of that project. As a direct result of this weakness in the drafting of many standard construction contact forms, CCC was obliged to source additional funding to pay an overspending contractor until completion as well as additional expenditure required to obtain recovery of the pain-share funds from the recalcitrant contractor.

We recommend that bespoke amendments be made to the terms of standard contract used to address these significant problems making it possible to apply painshare as soon as expenditure reaches the Target Cost or possibly when totals of individual elements of the Target Cost breakdown are reached.

Additionally most standard contracts include 'value engineering' mechanisms which operate to incentivise contractors to propose changes which save money and/or time. Should such a proposal be acceptable to the client the technical, commercial and programme consequences of the change are agreed and the change formalised, with the client and contractor sharing the benefit at a pre-agreed rate (50/50 or otherwise).

2.10.2. Time risk sharing, transfer of the financial consequences of late completion

This is not so much a formal option under standard forms but more the application of judgement by a client in deciding whether or not to fully transfer the cost of late completion of the project onto the contactor via the liquidated damages mechanism in the contract.

Our view is that most large contractors are familiar with working under the risk of very significant daily or weekly liquidated rates for delay damages payable on default. While strategies for the avoidance of such damages are also well developed by contractors in the form of extension of time claims, opportunities for significant successful claims are limited due to the reduction in the need and opportunity for scope charge as a result of the D&C design risk transfer model.

Conversely a contractor’s bonus for early completion can be incorporated providing positive incentivisation for early completion. Clearly in conjunction with delay damages for late completion the combined effect provides a mechanism to incentivise efficient time management which mirrors (although not exactly) the cost incentivisation provided by the pain/gain mechanism recommended above.
2.10.3. Insurance and risk
The occurrence of certain catastrophic risks are capable of frustrating a project and possibly even causing the liquidation or bankruptcy of one of the supply chain or indeed a client. Such risks include destruction of the contract works or adjacent property by fire caused as a result of the construction works, or personal injury to an individual from similar circumstances. While it is wholly appropriate for the risk of such occurrence to be transferred to a contractor as it is they who are most able to manage the circumstances on site that may lead to the occurrence of such a risk, it is wholly impractical to imagine that a contractor would have the funds to re-build a destroyed project or adjacent property from its own funds.

For this reason it is standard practice to require that the contractor takes out insurances for such risks when undertaking such work, for amounts stated in the contract, and that the contractor delivers evidence proving the existence of such policies before commencement of the works.

2.11. Contract length, defects, operation, maintenance, and compliance periods
On most projects of this kind clients will require that, for a period after completion, the contractor is responsible for the compliance of the physical work supplied to the contract specification, and that the asset has been designed to meet the required standards. This obligation is incorporated into the terms of most standard form contacts and set at one year’s duration from completion. However, on this kind of infrastructure the client may wish to prescribe a longer period, such as ten years. Clearly there is a risk of contractor default over this extended period and in this case the use of additional financial products such as performance bonds may offer valuable management of this risk at a cost.

It may additionally be seen as advantageous to involve the contractor far more positively in the asset following the completion of construction by requiring the constructor to manage the asset in use for a period after completion. These periods are typically termed “operation periods” and are usually specified to be in place for a number of years. The contract strategy to achieve a contractor managed operating period can be achieved by either applying the ‘sectional completion’ provisions under ECC if the operation period is not too long, or by using an entirely separate contract (such as the Term Service Contract from the NEC suite) to operate if this is for an extended period.

Experience has suggested that contractors and bus operating companies are not ideally compatible and consequently this kind of operational linkage is not recommended. As CCC has a framework highways contractor, and the majority of the new infrastructure being created would be highway, it is recommended that use of this framework contractor for on-going maintenance of the asset is appropriate and the most economic option.

2.12. Human resource issues
The recommended project governance structure is identified within section 1.3 (Governance, Organisational Structure and Roles) of the ‘Delivery Case’ section of this SOBC.

It is recommended a dedicated Project Management Office (PMO) be established and staffed with the appropriate range of specialists. If Option B is selected its more limited scope will not require the same level of staffing as the other schemes. The PMO role will be the day to day management of the project and will include liaising with, and regularly reporting to, the programme manager and project board as well as other stakeholders, to engage design consultants and bring together the outline design consistent with the TWA Order (should this be the necessary consenting method for the project) and the budget and any associated planning conditions before tendering the works.

Post-contract the same project office would administer the management of the construction works.

2.13. Contract management
A standard contract that ensures that the contractual / commercial arrangements are well defined should be used. A form of contract that is well understood throughout the supply chain and relies on a pre-defined risk register to allocate and manage anticipated risk is preferred. The NEC3 ECC contract is such a contract. During contract negotiations, risk will be allocated to the party best able to manage it in the most cost-effective manner.
effective way. The NEC3 ECC has a specified change management procedure that will be followed to formalise and control any required alterations to the contracted works.

Project Management resource can be engaged from external consultancies to support in house resource seconded into the PMO. Similarly the required design skills should be engaged on NEC PSC terms through the framework contract to undertake the outline design of the works and to support the creation and submission of the draft TWA Order for the project and subsequent land acquisition.

Depending on the perceived technical complexity of the remaining detailed design, the PMO may feel it beneficial to novate all or some of the design consultants to the successful contractor. This however is not always appropriate. For example, for Options A and B which do not have any bridge work, it may be better to leave the selection of detailed designer to the successful contactor. The incumbent ‘client designer’ could then be usefully retained by the PMO to undertake reviews of the contractor’s submitted detailed designs.
3. Preferred Procurement Route

We recommend that the contract works be competitively tendered and let using the framework on NEC Option C (Target Cost) terms with complete responsibility for completion of the detailed design and direct engagement of all statutory undertakers for all utilities works that are necessary.

This was the contractual arrangement used to procure the Cambridgeshire Guided Busway by CCC. Subject to the serious consequences of the mis-functioning of the pain-gain clauses of the contract highlighted earlier in section 2.10.1 the contractual model would appear suitable for this work which is not dissimilar.

The SOBC Commercial Case, at this stage of assessment, considers all options procurable. As identified in section 2.4 of the Commercial Case (Rationale for preferred sourcing) it is considered that the D&C model of procurement (as described earlier in the report) is appropriate for all the options. The risk mitigation facilities available within the NEC standard form should be adjusted to suit the specific risk profiles that emerge as the preferred option is selected and the outline design for that option is developed further before tendering.
M11 Junction 11 Bus-Only Slip-Road Study: Strategic Outline Business Case
Financial Case
City Deal Partnership

23 November 2016
Notice

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1. The Financial Case

1.1. Introduction

1.1.1. Overview
This chapter presents the Financial Case for the M11 Junction 11 Bus-Only Slip-Road Study, and provides a high level assessment of the four options considered for the scheme. The total outturn costs and expenditure profiles of each of the options are presented, along with an assessment of the impact of construction of each option on the City Deal budgets and accounts.

On-going maintenance and renewals that will be generated over the lifecycle of the scheme are considered within the Economic Case, as this Financial Case only considers up-front costs.

1.1.2. Guidance and Compliance
The DfT guidance document ‘The Transport Business Case: Financial Case’ summarises the areas of a Financial Case that should be considered within an SOBC. It states that the contents of the Financial Case should include:

- Introduction – outline the approach taken to assess affordability;
- Costs – provide details of:
  - the expected whole life costs (covered in detail in the Economic Case);
  - when they will occur;
  - breakdown and profile of costs by those parties on whom they fall; and
  - any risk allowance that may be needed
- Budgets/ funding cover – provide analysis of the budget/ funding cover for the project; and
- Describe the expected impact on the sponsor organisation's balance sheet. For an SOBC this is considered ‘optional’ where evidence should be provided if relevant.

1.1.3. Outline Approach
The investment costs of each of the options have been estimated, and internally reviewed by a number of technical specialists and are based on high level information on the potential alignment of the options, taking account of the potential infrastructure requirements. Capital construction estimates, including spend profiles, have been provided by Faithful + Gould. Changes to bus service operating costs are assumed to be negligible.

The cost estimates are based on a scheme opening year of 2021. It should be recognised that any delay to scheme opening is likely to result in an increase in costs from those forecast here.

1.2. Capital Costs by Option

1.2.1. Derivation of Base Costs
Construction cost estimates for each of the options are derived from high level preliminary designs of each option alignment. For further details on the specific infrastructure proposed for each option, refer to the option descriptions presented in the Strategic Case. Construction costs were provided by Faithful+Gould with a Q4 2015 price base. The base costs exclude allowances for VAT, inflation, risk and optimism bias.

The capital cost estimates include the following key assumptions:

- Consideration of land ownership and indicative land acquisition costs have not been included.
- Consideration of utilities diversions has not been included.
- Quantitative Risk Assessment (QRA) modelling has not been included.
- Faithful+Gould have assumed that the rates are inclusive of main contractor’s preliminaries, overheads and profit, and traffic management.
- Faithful+Gould have assumed and it has been confirmed that the rates are exclusive of any contingencies, VAT, land acquisition costs, utilities diversions and professional fees.
No allowances have been included for reconfiguring Trumpington Park and Ride.

Faithful+Gould have reviewed the cost elements included in the M11 Junction 11 Bus-Only Slip-Roads Outline Summary of Scheme Report dated 18th November 2015. The rates originally used in November 2015 did not include sufficient allowances for preliminaries, overheads & profit, and traffic management. The design has changed as well resulting in increased quantities of new build bus-only routes. The tables below summarise the original and revised costs for each option.

**Table 1-1** Comparison of Original and Revised Base Capex for Option A (Q4 2015 Prices)

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<th>Item</th>
<th>Original Costs (000's)</th>
<th>Revised Costs (000's)</th>
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<td>New Carriageway Construction</td>
<td>£584</td>
<td>£1,258</td>
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<td>Carriageway Widening</td>
<td>£0</td>
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<td>Earthworks (Infill)</td>
<td>£518</td>
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<td>Earthworks (Cutting)</td>
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<td>Footway</td>
<td>£51</td>
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<td>Central Islands</td>
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<tr>
<td>New Highway Structure</td>
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<td>£0</td>
</tr>
<tr>
<td>Road Markings</td>
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<td>£2</td>
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<tr>
<td>Junction Improvements</td>
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<td>£200</td>
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<td><strong>TOTAL</strong></td>
<td><strong>£1,155</strong></td>
<td><strong>£2,296</strong></td>
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Faithful+Gould

The estimated cost for option A has almost doubled, an increase of 99%.

**Table 1-2** Comparison of Original and Revised Base Capex for Option B (Q4 2015 Prices)

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<th>Item</th>
<th>Original Costs (000's)</th>
<th>Revised Costs (000's)</th>
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<td>Road Markings</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>£780</strong></td>
<td><strong>£869</strong></td>
</tr>
</tbody>
</table>

Faithful+Gould

The estimated cost for option B has increased by 12%.

**Table 1-3** Comparison of Original and Revised Base Capex for Option C (Q4 2015 Prices)

<table>
<thead>
<tr>
<th>Item</th>
<th>Original Costs (000's)</th>
<th>Revised Costs (000's)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Carriageway Construction</td>
<td>£2,224</td>
<td>£3,135</td>
</tr>
<tr>
<td>Carriageway Widening</td>
<td>£0</td>
<td>£805</td>
</tr>
<tr>
<td>Earthworks (Infill)</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>Earthworks (Cutting)</td>
<td>£1,464</td>
<td>£1,555</td>
</tr>
</tbody>
</table>
Table 1-4  Comparison of Original and Revised Base Capex for Option D (Q4 2015 Prices)

<table>
<thead>
<tr>
<th>Item</th>
<th>Original Costs (000’s)</th>
<th>Revised Costs (000’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Carrigeway Construction</td>
<td>£1,640</td>
<td>£2,369</td>
</tr>
<tr>
<td>Carriageway Widening</td>
<td>£0</td>
<td>£284</td>
</tr>
<tr>
<td>Earthworks (Infill)</td>
<td>£871</td>
<td>£1,045</td>
</tr>
<tr>
<td>Earthworks (Cutting)</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>Footway</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>Central Islands</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>New Highway Structure</td>
<td>£2,000</td>
<td>£2,430</td>
</tr>
<tr>
<td>Road Markings</td>
<td>£6</td>
<td>£6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>£4,517</strong></td>
<td><strong>£6,134</strong></td>
</tr>
</tbody>
</table>

The estimated cost for option D has increased by 36%.

The table below summarises the revised base capital cost for each option.

Table 1-5  Revised Base Capex for each Option (Q4 2015 Prices)

<table>
<thead>
<tr>
<th>Option</th>
<th>Base Capex (000’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A</td>
<td>£2,296</td>
</tr>
<tr>
<td>Option B</td>
<td>£869</td>
</tr>
<tr>
<td>Option C</td>
<td>£8,130</td>
</tr>
<tr>
<td>Option D</td>
<td>£6,134</td>
</tr>
</tbody>
</table>

1.2.2. Allowance for Preparatory Costs

The construction costs for each option do not include preparatory costs that would be incurred to enable construction to take place. These include detailed design work, future business case analysis, auditing, statutory planning preparation costs, consultation, procurement, project management, and monitoring and evaluation. An allowance of 12% on the capital construction costs is deemed appropriate at this stage as advised by Faithful+Gould.

The table below presents the construction and preparatory costs for each option.

Table 1-6  Construction and Preparatory Costs for each Option (Q4 2015 Prices)
1.2.3. Allowance for Risk

A risk allowance has been assumed for the preparatory and construction costs. Due to the number of options being considered at this stage of the project, and the early conception stage of the scheme design, an overall weighted risk allowance of 20% is deemed appropriate at this stage. This is consistent with the Cambourne to Cambridge Better Bus Journeys Financial Case.

The table below presents the risk allowance for each option.

Table 1-7 Risk Allowance for each Option (Q4 2015 Prices)

<table>
<thead>
<tr>
<th>Item</th>
<th>Option A Cost (000’s)</th>
<th>Option B Cost (000’s)</th>
<th>Option C Cost (000’s)</th>
<th>Option D Cost (000’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparatory Costs</td>
<td>£275</td>
<td>£104</td>
<td>£976</td>
<td>£736</td>
</tr>
<tr>
<td>Construction Costs</td>
<td>£2,296</td>
<td>£869</td>
<td>£8,130</td>
<td>£6,134</td>
</tr>
<tr>
<td>Risk</td>
<td>£514</td>
<td>£195</td>
<td>£1,821</td>
<td>£1,374</td>
</tr>
<tr>
<td>TOTAL</td>
<td>£3,085</td>
<td>£1,169</td>
<td>£10,927</td>
<td>£8,244</td>
</tr>
</tbody>
</table>

1.2.4. Derivation of Inflation/Deflation

Construction, capital renewal and infrastructure maintenance costs have all been estimated with a Q4 2015 price base, and inflated to the point of expenditure based on either the All-in Tender Price Index (TPI) or the Retail Price Index (RPI), depending on the cost item.

For the purposes of economic appraisal only real inflation (i.e. the rate of inflation of costs above the rate of background inflation) has been considered. However for the Financial Case, the full rate of inflation has been included within the cost forecasts, so the results are provided in cash prices at the time of expenditure.

The rates used in the assessment indicate that construction related costs over the course of the construction period will rise by 5.10% per annum up to 2018. Beyond 2018, there are no forecasts available and therefore the forecast rate of inflation between 2017 and 2018 has been assumed to continue year on year up until completion of construction in 2021.

1.2.5. Out-turn Capital Costs

Out-turn cost estimates (i.e. the costs which will actually be incurred at the time of expenditure, taking into account the full impacts of construction inflation, with no discounting, market price adjustment or removal of background inflation as has been applied in the Economic Case) have been produced for each of the options, excluding VAT. The risk allowance is also included within the out-turn cost totals.

The table below provides a breakdown of out-turn costs for each option.

Table 1-8 Breakdown of Out-turn Costs for each Option

<table>
<thead>
<tr>
<th>Item</th>
<th>Option A Cost (000’s)</th>
<th>Option B Cost (000’s)</th>
<th>Option C Cost (000’s)</th>
<th>Option D Cost (000’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparatory Costs</td>
<td>£287</td>
<td>£109</td>
<td>£1,017</td>
<td>£767</td>
</tr>
<tr>
<td>Construction Costs</td>
<td>£2,830</td>
<td>£1,072</td>
<td>£10,022</td>
<td>£7,561</td>
</tr>
<tr>
<td>Risk</td>
<td>£634</td>
<td>£240</td>
<td>£2,245</td>
<td>£1,694</td>
</tr>
</tbody>
</table>
1.3. Funding Sources

1.3.1. Funding Package
Funding for the M11 Junction 11 scheme is intended to be sourced through the Greater Cambridge City Deal (GCCD). City Deals provide a funding framework for central government and local partners to agree investment programmes, centred on the promotion of local economic growth and development. The GCCD has created an investment fund for the five year period 2015/16 to 2019/20 - which consists of £100 million from the government (£20 million per year). In addition, Greater Cambridge partners have pledged to invest over £500 million from a range of sources. Achieving City Deal funding is dependent upon the satisfactory completion of a Business Case, which will inform the funding decision to be taken by the GCCD Project Board.

Funding for the M11 Junction 11 scheme is intended to be delivered through this investment fund. However the overall City Deal funding package covers a wide range of schemes and it is unlikely that all of the schemes will fit into the package. Therefore the schemes will need to be prioritised and so funding for the M11 Junction 11 scheme is not guaranteed from the City Deal fund.

To meet the funding requirements, Cambridge City Council will be seeking to recover a proportion of the cost from local developer contributions, secured through the planning process. The local developer contributions are dependent upon on-going negotiations, and may vary between options. However at the time of this appraisal being undertaken the recovery values are unknown and therefore, for the purposes of the appraisal only, the recovery value has been set as zero.

1.3.2. Phasing of Total Capital
The table below shows the estimated phasing of the funding requirements for the M11 Junction 11 scheme, based on the estimated construction programme provided by Faithful + Gould.

<table>
<thead>
<tr>
<th>Option</th>
<th>Cost Element</th>
<th>2016 Cost (000’s)</th>
<th>2017 Cost (000’s)</th>
<th>2018 Cost (000’s)</th>
<th>2019 Cost (000’s)</th>
<th>2020 Cost (000’s)</th>
<th>2021 Cost (000’s)</th>
<th>Total (000’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Preparatory</td>
<td>£171</td>
<td>£116</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£287</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>£193</td>
<td>£1,718</td>
<td>£872</td>
<td>£46</td>
<td>£2,830</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk</td>
<td>£43</td>
<td>£385</td>
<td>£195</td>
<td>£10</td>
<td>£634</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>£171</td>
<td>£353</td>
<td>£2,102</td>
<td>£1,068</td>
<td>£57</td>
<td>£3,750</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Preparatory</td>
<td>£65</td>
<td>£44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£109</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>£73</td>
<td>£651</td>
<td>£330</td>
<td>£18</td>
<td>£1,072</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk</td>
<td>£16</td>
<td>£146</td>
<td>£74</td>
<td>£4</td>
<td>£240</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>£65</td>
<td>£134</td>
<td>£796</td>
<td>£404</td>
<td>£21</td>
<td>£1,421</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Preparatory</td>
<td>£605</td>
<td>£411</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£1,017</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>£685</td>
<td>£6,083</td>
<td>£3,090</td>
<td>£164</td>
<td>£10,022</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk</td>
<td>£153</td>
<td>£1,363</td>
<td>£692</td>
<td>£37</td>
<td>£2,245</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>£605</td>
<td>£1,250</td>
<td>£7,446</td>
<td>£3,782</td>
<td>£201</td>
<td>£13,283</td>
<td></td>
</tr>
<tr>
<td>Option</td>
<td>Cost Element</td>
<td>2016 Cost (000’s)</td>
<td>2017 Cost (000’s)</td>
<td>2018 Cost (000’s)</td>
<td>2019 Cost (000’s)</td>
<td>2020 Cost (000’s)</td>
<td>2021 Cost (000’s)</td>
<td>Total (000’s)</td>
</tr>
<tr>
<td>--------</td>
<td>---------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Option D</td>
<td>Preparatory</td>
<td>£457</td>
<td>£310</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>£767</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>£517</td>
<td>£4,590</td>
<td>£2,331</td>
<td>£124</td>
<td>£7,561</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk</td>
<td>£116</td>
<td>£1,028</td>
<td>£522</td>
<td>£28</td>
<td>£1,694</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>£457</td>
<td>£943</td>
<td>£5,618</td>
<td>£2,853</td>
<td>£151</td>
<td>£10,022</td>
<td></td>
</tr>
</tbody>
</table>

1.4. Conclusions

The chapter has presented the Financial Case for the M11 Junction 11 Transport Study, presenting the high level assessment of the four scheme options. The Financial Case has considered the up-front costs of the scheme, with reference to capital expenditure including construction infrastructure costs. Whole life costs (maintenance and capital renewal) are discussed within the Economic Case.

The chapter has presented how there is a range of between £1.4 million and £13.3 million in out-turn costs (including allowance for risk) between the options. This variation can be attributed to the proportion of each option which requires off-line infrastructure, and the differences in route alignment. Option B is shown to be the lowest cost option, with an out-turn cost of approximately £1.4 million. The highest-cost option is indicated as option C, with an out-turn cost of approximately £13.3 million.
M11 Junction 11 Bus-Only Slip-Road Study: Strategic Outline Business Case
Management Case
City Deal Partnership

23 November 2016
Notice

This document and its contents have been prepared and are intended solely for City Deal Partnership’s information and use in relation to the M11 Junction 11 Bus-Only Slip-Road Study.

Atkins assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 23 pages including the cover.

Document history

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1. The Management Case

1.1. Introduction

1.1.1. Overview

This chapter presents the Management Case supporting the M11 Junction 11 Bus-Only Slip-Road Strategic Outline Business Case (SOBC). The M11 Junction 11 scheme is a proposal to provide a form of dedicated access for buses only from the M11 southbound, connecting to Hauxton Road at M11 Junction 11. Full descriptions of the M11 Junction 11 scheme options are presented in Strategic Case of this SOBC.

The purpose of the Management Case is to assess whether a proposal is deliverable, with consideration given to the management and governance arrangements to be adopted to enable delivery of a scheme.

The M11 Junction 11 scheme forms part of a wider suite of city deal schemes which include the Cambourne to Cambridge Better Bus Journey Scheme and the Western Orbital Public Transport Priority Infrastructure – M11: Junction 11-13 Scheme. Therefore the Management Case for M11 Junction 11 has been prepared with reference to the management and governance arrangements expected to be adopted for the delivery of these schemes.

This Management Case has been informed by the following documents prepared by Cambridge City Council (CCC):

- The Western Orbital Public Transport Priority Infrastructure – M11: Junction 11-13 Project Inception Document (PID); and
- A428, A1303, Madingley Road Project Western Orbital Summary Joint Project Management Plan (PMP).

1.1.2. Guidance and Compliance

The Department for Transport (DfT) document ‘The Transport Business Cases: The Management Case’ summarises the areas of a Management Case that should be considered within an SOBC.

It states that the Management Case should present 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. In accordance with DfT guidance, the contents of the Management Case should include as a minimum:

- Introduction – outline approach taken to assess the deliverability of the proposal;
- Evidence of similar projects – if possible, provide evidence of similar projects that have been successful, to support the recommended project approach;
- Programme/project dependencies – set out deliverables and decisions that are provided/received from other projects;
- Governance, organisational structure and roles – describe key roles and lines of accountability;
- Programme/project plan – plan key milestones and the critical path;
- Assurances and approvals plan – plan with key assurance and milestones plan;
- Communication and stakeholder management – develop communications strategy;
- Programme/project reporting – describe reporting arrangements;
- Risk management strategy – arranges for risk management; and
- Options – summarise overall approach for project management at this stage of the project.

Accordingly, this chapter had been structured to follow this contents list, so that the key elements of the Management Case can be easily identified.

1.2. Evidence of Similar Projects

The promoters of the scheme (CCC) are informed by the experience gained in delivering a number of schemes which are comparable in terms of the scale and complexity, including the Cambridge Core Traffic...
Scheme, Addenbrooke’s Access Road and the Cambridgeshire Guided Busway, as well as the emergent Ely Southern Bypass.

The Cambridge Core Traffic Scheme sought to improve access for pedestrians, cyclists and public transport through traffic management and priority measures in the area bounded by the inner ring road. This demonstrates an ability of the promoters to think about the full impacts of a bus scheme. The measures were implemented in phases from 1997, promoting sustainable travel modes to improve the city centre environment. Between 1993 and 2003 the number of private vehicles in the city centre fell by 15%. Bus patronage on routes into Cambridge also increased.

The Addenbrooke’s Access Road is a £24m scheme between Hauxton Road in Trumpington and Addenbrooke’s Hospital, which was completed in October 2010. This enabled expansion of the hospital and access to Southern Fringe developments and relieved traffic in Trumpington village and the Long Road and Hills Road areas of Cambridge. Funding for the project was sourced from developers and the Growth Area Fund.

The Cambridgeshire Guided Busway is a 42km open access route with high segregation that provides a HQPT connection between Huntingdon and St Ives, to the north west of Cambridge, and Addenbrooke’s Hospital and Trumpington to the south of Cambridge, with direct access to Cambridge City Centre.

The route comprises 25km of guided busway and 17km of on-street provision, incorporating bus priority. Benefits of the scheme have included travel time savings and road decongestion, modal shift in an area where the car is dominant, improved journey time reliability and increased interchange opportunities. The scheme has also improved access to key services in rural areas, generated both construction and operational jobs, and has enabled development that was identified in the Regional Spatial Strategy and Structure Plan.

Construction began in March 2007 and the busway opened on 7th August 2011 with 2.5 million journeys in the first year of operation. Whilst there were challenges encountered during construction, the system has delivered the desired outcomes in terms of service levels, service quality, mode shift and passengers carried. The challenges encountered during construction have also allowed the sponsors to learn important lessons regarding the delivery of a scheme of this nature. The commercial response by operators has also been very positive with very high frequency services being operated and additional destinations such as Peterborough being served.

The Ely Southern Bypass is a £25m scheme that will connect the A142 at Angel Drove to Stuntney Causeway. This will include bridges over the railway line and the River Great Ouse and its floodplains. It is intended that the bypass will relieve heavy traffic around Ely station.

1.3. Governance, Organisational Structure and Roles

The project approach is the proposed way of achieving the project objectives and this is set out in the PID prepared by CCC.

The project process and resources are set out in the PMP, agreed by the city deal Project Board, and are based on 2 key parameters:

- PRINCE 2 approach to good project governance and management; and
- DfT major scheme development methodology.

This means the following key aspects:

- The overall scope of the project is set by the City Deal Executive Board;
- The project is governed by a Project Board that will receive reports on project activity including spend, quality and risks;
- The Project Board can request from the Project Manager all information required for it to perform its governing role;
The Project Manager must present all information to the Project Board that he/she considers is required for the Board to perform their governing role;
- The 2 key project governance documents are the PMP and Project Initiation Document (PID). One sets the need and aims for the project and the other sets out the method of achieving the outcomes; and
- The Project Manager has full day to day responsibility for delivery of technical work streams and is employed by CCC.

The overall project management structure is set out hierarchically in the table below:

<table>
<thead>
<tr>
<th>Body</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCCD Executive Board</td>
<td>Overall Strategic Direction of City Deal Programme.</td>
</tr>
<tr>
<td>GCCD Assembly</td>
<td>Strategic and local advisory body for City Deal Executive Board.</td>
</tr>
<tr>
<td>Infrastructure Steering Group</td>
<td>GCCD officer level programme board.</td>
</tr>
<tr>
<td>Individual Project Boards</td>
<td>‘Within scope’ overall control of each project.</td>
</tr>
<tr>
<td>Programme Manager</td>
<td>Technical and procedural oversight of projects and programme level benefit management.</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Day to day management of each project.</td>
</tr>
</tbody>
</table>

At the City Deal level the GCCD Executive Board consists of the Leader or equivalent of each of the partner organisations, as the key decision-making group. There is also be a 17-person Assembly with appropriate representation from the Local Authorities and other stakeholders, which play an advisory and scrutiny role.

A key role of the Executive Board is to agree and oversee the delivery of a programme of major schemes that will help to achieve the GCCD aims and support the sustainable growth and continued prosperity of the Greater Cambridge city-region, in line with national and local policy objectives and the LEP’s overarching economic strategy for the area. In particular the Executive Board:
- Takes responsibility for ensuring Value for Money is achieved;
- Identifies prioritised list of investments within the available budget;
- Makes decisions on individual scheme approval, investment decision making and release of funding, including scrutiny of individual scheme Business Cases;
- Monitors the progress of scheme delivery and spend; and
- Actively manages the budget and programme to respond to changed circumstances (scheme slippage, scheme alteration, cost increases, etc.).

CCC, CaCC and SCDC have three representatives on the Assembly, with political balance in each Authority’s membership reflecting the balance of the political parties on the relevant Council. The other three places on the Assembly are filled by members representing various stakeholder groups.

The GCCD is focused on both programme and project level governance with the principle that issues of key important at both the programme and project level are addressed at the highest levels of governance but that for other issues of a more technical nature, officer level structures at the project and programme level are empowered to guide development.
At the Programme Level an officer technical group (Programme Board) made up of key officers and stakeholders develops the overall scheme prioritisation and seeks to manage programme level risks and capture shared benefits. This Board in consultation with Chief Executives raise programme level issues with the GCCD Executive Board and Joint Assembly as required.

At the project level a Project Team, works up scheme details and reports to a Project Board which will guide the overall development of the project at the technical level. At the project gateways reports are made to the City Deal Executive Board on progress and seek decisions on key matters which are project related.

The following figures set out the City Deal Project Structure and Governance Structure:

**Figure 1-1  City Deal Project Structure**
1.3.1. Project Board

Each City Deal project has a Project Board with consistent terms of reference and has full decision making powers within the scope of the project, except for ‘key decisions’, which are defined in section 1.3.3 below.

The Project Board will consist as a minimum of the following representatives:

- Senior representatives from CCC;
- Senior representative from SCDC;
- Senior representative from CaCC;
- Senior representative from UoC; and
- Senior representative from LEP.

The Project Board can add to its membership as it sees fit to discharge its function.

1.3.2. Local Liaison Forum (LLF)

To support the project board in discharging its role a LLF of local elected Members and stakeholders has been formed. The LLF is a formalised process for capturing local views and delivering locally acceptable designs. While not able to work outside of the scope of the key decision made by the GCCD Executive Board, the LLF can form technical working parties to consider project specific issues in more detail and agree resolutions which form part of the Project Boards considerations.
1.3.3. Decision Making and Change Control

The Project Manager determines which category a decision falls under. There are 4 types of Project Decision:

- **Key Decision**: these decisions are as defined in the GCCD paper agreed in January 2015 which are the major ‘gateway’ decisions to allow the overall project to progress. These key decisions form the outer scope of the project and define the ‘project parameters’; Key decisions are the sole responsibility of the GCCD Executive Board with advice from the City Deal Assembly and Chief Executives.

- **Scope Change Decisions**: these decisions are those which will take the project out of scope of the project parameters agreed at the key decision making stage. These decisions will impact cost/quality or time. As such these decisions are the sole responsibility of the City Deal Executive Board with advice from the City Deal Assembly and Chief Executives.

- **Major decisions within Scope**: These decisions are within the agreed project parameters but are still considered ‘major decisions’ because they have an impact on cost/quality/time and/or will require a change of the PID. A major decision is the sole responsibility of the Project Board.

- **Project Management Decisions**: These are decisions which do not impact cost/quality or time (an example may be technical decisions on detailed options). These decisions include moving budget between work streams. These are the responsibility of the Project Manager.

1.3.4. Project Managers Report

The fundamental process of capturing change in the project is through the Project Managers Report. The Project Managers Report is presented at the regular meetings of the Project Board and if necessary can be submitted separately between Project Boards at the Project Managers discretion. The Project Managers Report is the main business of the Project Board. The Project Managers Report summarises progress and change on the project.

The following is the format of the Project Managers Report:

- Activity Report – progress of work streams;
- Key activities in the forthcoming period;
- Budget update;
- Review of strategic risks/ issues;
- Decisions under the 4 project decision headings.

1.3.5. Project Review

Following construction of the project a review of delivery process will be undertaken in accordance with a GCCD Project Review Protocol which will be agreed by the GCCD Executive Board. The Project Manager will facilitate the review to produce a review report for consideration by the Project Board, ahead of scrutiny by the Assembly and sign off by the Executive Board.

1.4. Programme/Project Plan

This section sets out the project plan with key milestones and progress, including the critical path. It also includes project dependencies as well as decision and reporting milestones.

The project will be governed using the PRINCE 2 project method. It will pass through a number of gateways to ensure that progress is approved which are as a minimum the GCCD key decision points. The Project Board may at its discretion create additional gateways if it considers this necessary for the effective governance and delivery of the project.
As such the project is divided into 6 phases that broadly approximate to the 5 Key Decisions and the construction phase which are as follows:

- Phase 1 - Work needed to establish project (leading to Key Decision 1);
- Phase 2 – Work needed to identify outline concepts (leading to Key decision 2);
- Phase 3 – Work needed to identify a preferred option (leading to Key Decision 3);
- Phase 4 – Work needed to achieve FBC and Statutory Approvals (leading to Key Decision 4);
- Phase 5 – Work needed to achieve final design scheme for approval (leading to Key Decision 5); and
- Phase 6 – Work needed to construct the scheme and hand over to a final operator.

Phases 2, 3, 4 and 5 are the main technical stages of the project and these are being taken forward using the DfT WebTAG major scheme development methodology. WebTAG sets out the scope of the 2 main assessments – Outline Business Case (OBC) and Full Business Case (FBC). There may also be the need for a Strategic Outline Business Case (SOBC) in advance of the OBC. As such phases 2, 3, 4 and 5 are themselves divided into the following WebTAG related stages:

- Stage A – High level option assessment – identify feasible options;
- Stage B – Identify preferred option on the basis of SOBC/OBC;
- Stage C – FBC on preferred option; and
- Stage D – Approval of preferred option.

The relationship can be best described in Table 1-2 below.

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>WebTAG Stage</td>
<td>A</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>Key Technical Outputs</td>
<td>Early economic assessment of benefits of ‘a scheme’</td>
<td>High level feasibility report recommending specific range of feasible concepts for further work</td>
<td>OBC for feasible concepts with recommended preferred option</td>
<td>FBC for preferred option</td>
<td>Detailed scheme design</td>
</tr>
</tbody>
</table>

The following is the high level summary of all project work streams (known as the Work Breakdown Structure or WBS). No activities or spend of project resources will take place outside of the defined work streams as together they define the entirety of the scope of the project. Under some work streams there are likely to be further sub work streams which are set out in the full detailed work stream breakdown structure. Each work stream has a name to define it, a reference which assists in the organisation of project files etc., a link to one or more phases of work, a summary description and a current responsible delivery body or named role.
## Table 1-3 Work Breakdown Structure

<table>
<thead>
<tr>
<th>Phase</th>
<th>ID</th>
<th>1.1</th>
<th>1.2</th>
<th>2.1</th>
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</table>

### Project Management 1.1
All activities related to the management of technical work streams throughout the project and general day to day communication and engagement.

### Early Option Identification 1.2
The identification of all concepts which could meet the objectives of the schemes.

### Shortlisting Options 2.1
Reducing concepts to a limited number of feasible options.

### Consultation 3.1
The formal consultation processes on high level options during Phase 3, Preferred Option during Phase 4 and consultation linked to statutory processes.

### OBC 3.2
The processes of identifying a Preferred Option using technical assessment methods.

### Legal Compliance 3.3
All necessary legal activities necessary for supporting delivery of the scheme.

### Modelling 3.4
All necessary strategic and traffic modelling necessary for supporting delivery of the scheme.
<table>
<thead>
<tr>
<th>Category</th>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred Option Assessment</td>
<td>4.1</td>
<td>The identification of a Preferred Option FBC.</td>
</tr>
<tr>
<td>Bus Operations</td>
<td>4.2</td>
<td>All necessary bus planning and operational considerations to support the planning of bus priority infrastructure.</td>
</tr>
<tr>
<td>Procurement</td>
<td>4.3</td>
<td>All necessary procurement activities to support the delivery of the scheme.</td>
</tr>
<tr>
<td>Statutory Processes</td>
<td>5.1</td>
<td>All activities related to securing the necessary statutory processes.</td>
</tr>
<tr>
<td>Traffic Management Planning</td>
<td>5.2</td>
<td>The planning of temporary traffic management throughout the course of the Project.</td>
</tr>
<tr>
<td>Construction Design</td>
<td>5.3</td>
<td>The design of the scheme suitable for construction purposes.</td>
</tr>
<tr>
<td>Property</td>
<td>5.4</td>
<td>All property related activities and purchases.</td>
</tr>
<tr>
<td>Mitigation Planning</td>
<td>5.5</td>
<td>Design of measures necessary to mitigate the environmental impact of the scheme.</td>
</tr>
<tr>
<td>Main Works</td>
<td>6.1</td>
<td>Construction of the scheme.</td>
</tr>
<tr>
<td>Snagging</td>
<td>6.2</td>
<td>Rectifications of defects prior to completions.</td>
</tr>
<tr>
<td>Demobilisation</td>
<td>6.3</td>
<td>All activities related to clearing the site and mothballing as required.</td>
</tr>
<tr>
<td>Handover</td>
<td>6.4</td>
<td>All activities related to handing over infrastructure to operators.</td>
</tr>
<tr>
<td>Rectifications</td>
<td>6.5</td>
<td>Rectification of defects after completion under warranty or otherwise.</td>
</tr>
<tr>
<td>Legacy</td>
<td>6.6</td>
<td>All activities associated with managing information from the project for future reference e.g. as built drawings, lessons learned, discharge of outstanding issues.</td>
</tr>
</tbody>
</table>
The project programme is a baseline. Because the details of the final scheme have not emerged, the first programme is for a ‘reference case’ – that is a project which requires limited off highway powers and reflects the timescales in the PID. However the Project Board must note that the programme could change as a result of major non highway powers being needed. If that is the case then the Project Managers Report will detail these impacts. Should the programme move out of the scope in the PID then this would be a matter for the GCCD Executive Board.

The M11 J11 is currently in the very early stages of development and the conceptual stage work is currently funded as part of an allocation of £9m to develop projects ready for any second tranche of monies, within the Western Orbital scheme. As such, the programme is assumed to be commensurate with that of the Western Orbital. The overall scheme programme including indicative timescales is set out below:

Table 1-4  Overall Scheme Programme

<table>
<thead>
<tr>
<th>Description</th>
<th>Duration (in working days i.e. 5 days per week)</th>
<th>Target Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree the scope of project</td>
<td>25 days (5 weeks)</td>
<td>July 2015</td>
</tr>
<tr>
<td>The details of the fundamental aims, objectives and expectation of the project</td>
<td></td>
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<tr>
<td>Report presented to GCCD Board</td>
<td>30 days (6 weeks)</td>
<td>November 2015</td>
</tr>
<tr>
<td>Consultants review high level options</td>
<td>140 days (28 weeks)</td>
<td>December 2015</td>
</tr>
<tr>
<td>This will involve initial option identification followed by using assessment criteria to gradually refine proposals down to a manageable number of feasible options. This process may involve some site visits, workshops and early engagement with key stakeholders. The idea being is that the most realistic options are put forward.</td>
<td></td>
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<tr>
<td>Report presented to GCCD board on high level options</td>
<td>30 days (6 weeks)</td>
<td>January 2016</td>
</tr>
<tr>
<td>Further detailed work on options prior to consultation</td>
<td>40 days (8 weeks)</td>
<td>February 2016</td>
</tr>
<tr>
<td>At this stage a consultation on the early shortlist will identify the broad direction of travel of the project and identify key risks. In practice it is necessary to bring forward some technical work to help inform the general public on the choices before them.</td>
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<tr>
<td>Consult on high level options</td>
<td>110 days (22 weeks)</td>
<td>March 2016</td>
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<tr>
<td>This will be the process of consultation in terms of the logistics of engagement (e.g. leaflets/roadshows etc)</td>
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<tr>
<td>Analyse results on consultation</td>
<td>35 days (7 weeks)</td>
<td>April 2016</td>
</tr>
<tr>
<td>This is the analysis work. This work is not just reporting on crude outcomes but also analysis of responses in more detail. Work may include innovative approaches to reporting results e.g. heat maps</td>
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<tr>
<td>Report presented to GCCD Board on consultation outcomes</td>
<td>40 days (8 weeks)</td>
<td>May 2016</td>
</tr>
<tr>
<td>Further refinement of options</td>
<td>100 days (20 weeks)</td>
<td>July/August 2016</td>
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<tr>
<td>This work will be a process of feeding consultation results and ideas back into the earlier assessment framework and also assessing any new ideas. The extent of this work will be contingent on the consultation outcomes</td>
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<tr>
<td>Report to GCCD Board on preferred option</td>
<td>40 days (8 weeks)</td>
<td>October 2016</td>
</tr>
<tr>
<td>Undertake Further consultation</td>
<td>60 days (12 weeks)</td>
<td>May 2017</td>
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</table>
Develop FBC for Preferred Option
This is producing the final business case for a preferred option which is compliant with the standard methodologies and robust enough to pass detailed cross examination. This is outputted as a report

<table>
<thead>
<tr>
<th>Activity</th>
<th>Timeframe</th>
<th>Date</th>
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<tbody>
<tr>
<td>200 days (40 weeks) September 2017</td>
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Report to GCCD Board on detailed option
This will be the process of pre application discussions, obtaining legal guidance, preparing applications and then preparing for hearings

<table>
<thead>
<tr>
<th>Activity</th>
<th>Timeframe</th>
<th>Date</th>
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<tbody>
<tr>
<td>40 days (8 weeks) October 2017</td>
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</table>

Seek statutory approvals for detailed option
This will be the process of pre application discussions, obtaining legal guidance, preparing applications and then preparing for hearings

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<thead>
<tr>
<th>Activity</th>
<th>Timeframe</th>
<th>Date</th>
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<tbody>
<tr>
<td>400 days (80 weeks) June 2019</td>
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Report to GCCD Board for authority to construct scheme

<table>
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<tr>
<th>Activity</th>
<th>Timeframe</th>
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<tbody>
<tr>
<td>40 days (8 weeks) September 2019</td>
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Procure a contractor
This is issuing a contract for the works

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<tr>
<th>Activity</th>
<th>Timeframe</th>
<th>Date</th>
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<tr>
<td>100 days (20 weeks) End 2019</td>
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</table>

Period of mobilisation
This is the period between the contractor being appointed and the start of works

<table>
<thead>
<tr>
<th>Activity</th>
<th>Timeframe</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 days (14 weeks) February 2020</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Construct Scheme

<table>
<thead>
<tr>
<th>Activity</th>
<th>Timeframe</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>660 days* (110 weeks) August 2023</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Clear site and hand over
This is the process of the contractor leaving sites

<table>
<thead>
<tr>
<th>Activity</th>
<th>Timeframe</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 days (8 weeks) November 2023</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Depending on the preferred option, the construction works may involve (but may not be limited to) the following operations:

- Traffic management;
- Construction of BRT busway on widened slip-road;
- Construction of bridges and other structures;
- Construction of on road bus priority features;
- Signal and junction upgrades/ changes; and
- Landscaping.

It is possible that the scheme may require a Transport and Works Act (TWA) Order. Consents to enable delivery of the scheme would likely include compulsory purchase of land, planning permission, traffic regulation orders and public right of way orders.

1.5. Assurance and Approvals Plan

There are a number of key milestones in the Project Plan where internal and/or external approvals will be required in order for the project to progress. As noted above, the project will pass through a number of gateways to ensure that progress is approved.

There is also a GCCD Draft Assurance Framework, which sets out the role of the Assembly in scrutinising Executive Board decisions. The varied membership of the Assembly will help to ensure that it is both independent and sufficiently representative of a variety of viewpoints and stakeholder groups to allow effective scrutiny. Independent local audits will be carried out and these will be reported to the Executive Board, Assembly and the constituent member organisations as appropriate. The aim of each audit will be to verify that the Combined Authority is operating effectively within the terms of its agreed remit and Assurance Framework.

An independent advisor may be appointed to ensure independent scrutiny of transport scheme assessments and to provide oversight on the prioritisation process and the recommended programme. This will ensure that there is no conflict of interest between scheme promoter and assessor, and ensure robust and independent scrutiny in line with DfT requirements. Under the direction of the technical group, they will be responsible for scrutinising the scheme appraisal and Value for Money case. They will quality assure the work of the technical group and provide external advice. The role includes providing advice and skills to the scheme promoters and Executive Board and manage the review and authorisation of individual scheme assessments of the schemes going forward. Advice on the requirements for proportionate assessment for
individual schemes will also be provided. The Executive Board will need to approve the promoter’s Business Case submission before the next stage of work can be commenced.

1.6. Communications and Stakeholder Management

This section sets out the strategy for developing communications and stakeholder management on the project. Effective communication is critical to the success of the project. All communication activities will be signed off by the Project Manager. The Communications Plan is guided by the principle of the City Deal wide communication strategy. The strategy outlines how the project will ensure that all internal and external stakeholders are informed of relevant project information. The purpose of the strategy is to ensure that accurate and timely messages about the project are disseminated to a range of identified stakeholder groups. Project communication is governed through the Communications Plan as follows:

<table>
<thead>
<tr>
<th>Audience</th>
<th>Types of communication</th>
<th>Frequency</th>
<th>Process/Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>General public</td>
<td>Formal consultation</td>
<td>At least 2 formal consultations</td>
<td>Communication Team</td>
</tr>
<tr>
<td></td>
<td>Regular website updates on project progress</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>Technical officers CCC</td>
<td>Project Team meetings</td>
<td>Regular meetings</td>
<td>Project Manager</td>
</tr>
<tr>
<td></td>
<td>Ad Hoc technical meetings</td>
<td>As required</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Other key stakeholders</td>
<td>Ad hoc meetings</td>
<td>At least quarterly</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Members</td>
<td>Reports</td>
<td></td>
<td>Project Manager</td>
</tr>
<tr>
<td></td>
<td>Briefing sessions</td>
<td></td>
<td>Project Manager</td>
</tr>
<tr>
<td></td>
<td>Single issue workshops</td>
<td></td>
<td>Project Manager</td>
</tr>
<tr>
<td>General correspondence</td>
<td>Letter, email in standard format</td>
<td>As required</td>
<td>Project Manager</td>
</tr>
</tbody>
</table>

The Project Manager will maintain a Communications Log for the lifetime of the project. The Communications Log will include the following headings:

- Date;
- Attendees;
- Subject matter/Title of meeting; and
- Organisations represented.

Key stakeholders will be identified and involved in the delivery of the project in a number of ways. Public and stakeholder engagement is an important means of overcoming challenges and making decisions that directly impact upon living, working, using services and doing business in the local area. Such engagement may include informing, consulting with, involving, collaborating with and empowering stakeholders to understand the issues to enable them to make informed choices.

The key objectives of the scheme’s stakeholder management are to:

- Keep stakeholders aware of the schemes progression and give an opportunity for feedback to help gain scheme approval;
• Give an opportunity for stakeholders to provide views and recommendations for improvements so that the scheme meets stakeholder requirements as far as is practical;
• Meet statutory requirements;
• Increase public and stakeholder awareness of the scheme;
• Provide consistent, clear and regular information to those affected by the scheme, including the nature of any scheme-related impacts and when and how it will affect people of groups both during delivery and once operational; and
• Address perceptions of the scheme where these are inconsistent with the scheme objectives and forecast outcomes.

1.7. Risk Management Strategy

This section sets out the arrangements for risk management and the effectiveness of the strategy so far. Risks are events that have not happened but may happen whereas issues are known to have happened. There are two types of risks, which are organised as follows:

• Strategic Risks – these are presented in the Project Managers report and are those risks which impact the overall delivery of the project scope; and
• Technical Risks – these are associated with specific work streams and are managed by the Project Manager.

The risk register sets out the following:

• Details of the risk;
• The status of the risk at the time of writing this Management Case;
• Who the risk has been raised by;
• The risk owner;
• The cause of the risk;
• The effect of the risk;
• The probably of the risk occurring;
• The impact of the risk; and
• A Probably X Impact score.

• An overall assessment of the current status of the risk or issue which will be one of the following categories:
  • Red – significant and live risk/issue with high potential to occur and to impact project delivery either at the strategic or technical level;
  • Amber – risk and issue that has lower potential to occur and lower impact;
  • Green – risk is unlikely to occur and or has no major impact.

Risk management processes will be employed and recorded throughout the project lifecycle. The risk register will be monitored and, if necessary, updated at regular workshops and meetings. The Project Manager has responsibility for overseeing the Risk Management process. DfT Major Scheme guidance will be followed in order to identify, assess and mitigate risks. A Quantified Risk Assessment (QRA) identifies the appropriate level of contingency to add to base scheme costs. Roles, responsibilities and reporting lines for risk management should be clearly defined within the project team.

A key strategic project level risk will be the appointment of a contractor prior to full completion of statutory processes and formal approval. Mitigating this risk will be a key issue within the contractual arrangements. The GCCD schemes are very ‘time sensitive’ with programme level issues around the timely delivery of successful schemes. In that context it is essential that the appointment of main contractor is well considered and planned and that an effective form of engagement is put in place and managed.

Potential key risks would include (but are not limited to):

• Lack of well-considered procurement strategy;
• Failure to put in place a good quality contractor at the right time;
• Need to manage the interface between ‘design’ and build;
• Failure to identify best practice in the field;
Inappropriate contractual arrangements between client and provider;
Lack of robust delivery performance framework;
Failure to identify economies of scale at the project and programme level;
Poor client provider relationships;
Lack of quality control in implementation stage;
Lack of clear lines of responsibility;

These risks could present potential cause for project failure including:

- Loss of project credibility;
- Loss of political/ stakeholder support;
- Financial, time and quality scope impacts.

The current project risk register, which is also applicable to the Western Orbital project, is set out in Table 1-6:
### Table 1-6 M11 J11 Project Risk Register (provided by CCC)

<table>
<thead>
<tr>
<th>Risk</th>
<th>Status</th>
<th>Raised By</th>
<th>Owner</th>
<th>Cause</th>
<th>Effect</th>
<th>Prob</th>
<th>Impact</th>
<th>Pxl</th>
<th>Chosen Action</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder management</td>
<td>Open</td>
<td>Team</td>
<td>CCC</td>
<td>Stakeholders may not agree with the proposed options</td>
<td>Options do not obtain buy-in, DCO application rejected due to insufficient consultation</td>
<td>3 - Moderate</td>
<td>4 - Critical</td>
<td>12</td>
<td>Prepare consultation plan, with timescales and actions</td>
<td>Stakeholder management</td>
</tr>
<tr>
<td>CSRM - space for runs</td>
<td>Open</td>
<td>Team</td>
<td>CCC</td>
<td>CSRM model installed at CCC but not enough space to do more than a few runs</td>
<td>Delays to programme and increased costs</td>
<td>3 - Moderate</td>
<td>2 - Marginal</td>
<td>6</td>
<td>Actions being undertaken by CCC. New server to be installed, Atkins to retain access.</td>
<td>CSRM - space for runs</td>
</tr>
<tr>
<td>Compliance with other schemes, to 'mirror' WebTag</td>
<td>Open</td>
<td>Team</td>
<td>CCC</td>
<td>Currently schemes are expected to follow WebTag, but full compliance is not required</td>
<td>If WebTag compliance becomes mandatory, more work will be required</td>
<td>1 - Very Low</td>
<td>3 - Significant</td>
<td>3</td>
<td>Monitor CCC has expressed interest in standardising requirements for all City Deal schemes.</td>
<td>Compliance with other schemes, to 'mirror' WebTag</td>
</tr>
<tr>
<td>Political/governance issues</td>
<td>Open</td>
<td>Team</td>
<td>Atkins</td>
<td>Unknown timings for Client's key decision points</td>
<td>Our delivery programme may not match the client's requirements</td>
<td>3 - Moderate</td>
<td>3 - Significant</td>
<td>9</td>
<td>Communicate with client to understand requirements before project start</td>
<td>Political/governance issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Development of processes and procedures related to City Deal funding and governance introduces 'new' decision points and reporting requirements</td>
<td>These requirements for information format and provision will cause delays to delivery, may result in scope creep.</td>
<td>4 - High</td>
<td>3 - Significant</td>
<td>12</td>
<td>Continued communication with client, client to 'standardise' approach to City Deal projects to gain consistency. Lessons learnt from A428. Establishing a project board for day-to-day decision making.</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Status</td>
<td>Raised By</td>
<td>Owner</td>
<td>Cause</td>
<td>Effect</td>
<td>Prob</td>
<td>Impact</td>
<td>Pxi</td>
<td>Chosen Action</td>
<td>Risk</td>
</tr>
<tr>
<td>-------------------------------------------</td>
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<td>-----------</td>
<td>-------</td>
<td>-----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------</td>
<td>--------</td>
<td>----</td>
<td>--------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Workshop availability</td>
<td>Closed</td>
<td>Team</td>
<td>CCC</td>
<td>Stakeholders may not be available</td>
<td>Delays to programme</td>
<td>3 - Moderate</td>
<td>3 - Significant</td>
<td>9</td>
<td>Communicate with client regarding timings; client organising stakeholder workshop</td>
<td>Workshop availability</td>
</tr>
<tr>
<td>Operational modelling</td>
<td>Closed</td>
<td>Team</td>
<td>Atkins</td>
<td>Opportunity to undertake operational modelling to inform engineering options</td>
<td>Options can be designed and evaluated more thoroughly, less rework in future</td>
<td>1 - Very Low</td>
<td>1 - Negligible</td>
<td>1</td>
<td>Chosen not to carry out in Phase 1, as considering high level options. May be appropriate for phase 2.</td>
<td>Operational modelling</td>
</tr>
<tr>
<td>Information sharing between disciplines</td>
<td>Open</td>
<td>Team</td>
<td>Atkins</td>
<td>Multi-disciplinary project where teams rely on other team's outputs for their work</td>
<td>Delays in sharing of information, lack of clarity on what is required</td>
<td>4 - High</td>
<td>3 - Significant</td>
<td>12</td>
<td>Hold weekly meetings with all teams</td>
<td>Information sharing between disciplines</td>
</tr>
<tr>
<td>Changes to brief/scope</td>
<td>Open</td>
<td>Team</td>
<td>Atkins</td>
<td>Brief and objectives may have changed since start of project due to increased levels of governance and new staffing from client perspective</td>
<td>Atkins fails to deliver due to confusion over 'final' brief</td>
<td>3 - Moderate</td>
<td>3 - Significant</td>
<td>9</td>
<td>Clarify using notes and continue to engage with client</td>
<td>Changes to brief/scope</td>
</tr>
<tr>
<td>Lack of buy-in to modelling results due to approach being &quot;black box&quot;</td>
<td>Open</td>
<td>Team</td>
<td>Atkins</td>
<td>Modelling is sensitive to inputs and stakeholders may not agree with results</td>
<td>Lack of buy-in, challenge to the benefits and OBC</td>
<td>3 - Moderate</td>
<td>4 - Critical</td>
<td>12</td>
<td>Use existing CSRM runs to inform Ph1, document assumptions and decisions.</td>
<td>Lack of buy-in to modelling results due to approach being &quot;black box&quot;</td>
</tr>
<tr>
<td>Consultation timescales</td>
<td>Closed</td>
<td>Team</td>
<td>CCC</td>
<td>Consultation to be approved by CCC board</td>
<td>Consultation and project may be delayed</td>
<td>2 - Low</td>
<td>3 - Significant</td>
<td>6</td>
<td>Ensure Phase 1 deliverables are in a format suitable for inclusion in an interim report (phase 2)</td>
<td>Consultation timescales</td>
</tr>
</tbody>
</table>
### Risk Management Case

**Risk**
- Interaction with A428

**Status**
- Open

**Raised By**
- Team

**Owner**
- Joint

**Cause**
- Some of the benefits of this scheme will be derived from users from the A428

**Effect**
- Need to make sure the scheme is compatible with A428, but also delivers sufficient benefits on its own

**Prob**
- 4 - High

**Impact**
- 3 - Significant

**PxI**
- 12

**Chosen Action**
- Monitor, and consider compatibility (quantitatively) through the assessment process.

**Risk**
- Interaction with A428
1.8. Monitoring and Evaluation

This section summarises the outline arrangements for monitoring and evaluating the intervention, reflecting DfT guidance. Monitoring and evaluation of benefits is required to establish the extent to which the scheme meets the objectives. To be fully effective, plans for monitoring and evaluation should form part of the early development of - and be a continuous process within – the scheme Business Case.

The key project outputs will be monitored at a programme wide and project specific level. The GCCD Monitoring Framework sets out the approach to programme wide monitoring. Project specific monitoring, as set out in the PID, will include the following activities:

<table>
<thead>
<tr>
<th>Output</th>
<th>Monitoring mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>• More reliable bus journey times</td>
<td>• Data from the RTPI system</td>
</tr>
<tr>
<td>• Safer conditions for cycling</td>
<td>• Strategic modelling</td>
</tr>
<tr>
<td>• Reduced risk of road casualties</td>
<td>• Micro simulation modelling</td>
</tr>
<tr>
<td>• Addional capacity for sustainable trips to support future planned developments</td>
<td>• Police road casualty reports</td>
</tr>
<tr>
<td>• Maintained or reduced general traffic levels</td>
<td>• Transport assessments for planning applications for planned developments</td>
</tr>
<tr>
<td>• Strategic modelling</td>
<td>• Traffic surveys</td>
</tr>
<tr>
<td>• Micro simulation modelling</td>
<td></td>
</tr>
<tr>
<td>• Positive impact on air quality</td>
<td>• Strategic modelling</td>
</tr>
<tr>
<td>• Part of ongoing pollution monitoring for the Greater Cambridge area</td>
<td>• Traffic surveys</td>
</tr>
<tr>
<td>• Improved streetscape &amp; public realm</td>
<td>• Strategic modelling</td>
</tr>
<tr>
<td>• Safer environment for road users</td>
<td>• Micro simulation modelling</td>
</tr>
<tr>
<td>• User perception surveys</td>
<td></td>
</tr>
</tbody>
</table>

The programme focuses on measuring performance, understanding scheme impacts and disseminating this to Government and wider stakeholders to ensure that any potential issues post implementation are identified and addressed.

As the Monitoring and Evaluation Plan evolves, it will expand to detail data requirements and sources, the approach to collecting and collating data, and define the audience, programme and governance structure for monitoring and evaluation.

The Executive Board and the independent advisor will need to agree this plan as part of the ‘sign-off’ process, and ensure that subsequent evaluation is undertaken in line with guidance, and will have a role in the scrutiny and review of findings.

The expectation is that the scheme promoter will be required to publish an initial report based on data collected at least one year post scheme opening, and a final report based on both one-year-after data and further data collected approximately five years after scheme opening published. The results of the evaluation will be independently reviewed and will be made available including publication on the relevant website.

The Executive Board will prepare and publish a periodic programme evaluation update that will summarise the evaluation of individual schemes. As part of this the Executive Board will consider the performance of schemes, identify key scheme issues and review the success of the evaluation process. Through this the Executive Board will identify and share best practice to ensure ongoing monitoring and evaluation is efficient and effective, and that key lessons are used to inform scheme development and assessment.
1.9. Conclusions

Arrangements that will ensure successful delivery of the scheme have been initiated by the promoters, with a number of plans and strategies emerging. The promoters are informed by the experience gained in delivering a number of schemes which are comparable in terms of the scale and complexity, including the Cambridge Core Traffic Scheme, Addenbrooke’s Access Road and the Cambridgeshire Guided Busway, as well as the emergent Ely Southern Bypass.

Governance arrangements are being put in place that will enable efficient decision making and change control to take place throughout the phases of the project from feasibility and optioneering to approval, construction and operation.

There are a number of key milestones in the Project Plan where internal and/or external approvals will be required in order for the project to progress. The project will pass through a number of gateways to ensure that progress is approved. The role of the Assembly will be to scrutinise Executive Board decisions. Independent local audits will be carried out and these will be reported to the Executive Board, Assembly and the constituent member organisations as appropriate.

Effective communication is critical to the success of the project. Key stakeholders will be identified and involved in the delivery of the project. All internal and external stakeholders will need to be informed of relevant project information in a timely manner. Public and stakeholder engagement is an important means of solving problems and making decisions. The cooperation of the bus operator(s) will be essential so that high quality, reliable and frequent services can be planned and delivered.

Risk management processes will be employed and recorded throughout the project lifecycle. A risk register will be monitored and, if necessary, updated at regular workshops and meetings. Risks to delivery will be identified, assessed and mitigated. A key strategic project level risk will be the appointment of a contractor prior to full completion of statutory processes and formal approval. Mitigating this risk will be a key issue within the contractual arrangements.

Monitoring and evaluation of benefits is required to establish the extent to which the scheme meets the objectives. To be fully effective, plans for monitoring and evaluation should form part of the early development of - and be a continuous process within – the scheme Business Case. The programme focuses on measuring performance, understanding scheme impacts and disseminating this to Government and wider stakeholders to ensure that any potential issues post implementation are identified and addressed.
M11 Junction 11 Bus-Only Slip-Road Study: Strategic Outline Business Case
Economic Case
City Deal Partnership

23 November 2016
Notice

This document and its contents have been prepared and are intended solely for City Deal Partnership’s information and use in relation to the M11 Junction 11 Bus-Only Slip-Road Study.

Atkins assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 43 pages including the cover.

Document history

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<th>Purpose description</th>
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<th>Checked</th>
<th>Reviewed</th>
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<td>AL</td>
<td>JD</td>
<td>JD</td>
<td>20/10/16</td>
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Client signoff

<table>
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<td>Table 1.11</td>
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<td>Real Cost Inflation to be added (Q4 2015 Price Base, Undiscounted Resource Prices)</td>
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<td>Optimism Bias to be added (Q4 2015 Price Base, Undiscounted Resource Prices)</td>
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</tr>
<tr>
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<td>Breakdown of Investment Costs for Each Option with Real Cost Inflation and Optimism Bias (Q4 2015 Price Base, Undiscounted Resource Prices)</td>
<td>21</td>
</tr>
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1. The Economic Case

1.1. Introduction

1.1.1. Overview

The purpose of a major scheme appraisal is to provide a balanced and evidence-based assessment of the costs and benefits of a project so that decision makers can understand how best to proceed. The scheme appraisal presents a range of evidence as to the costs and benefits, whilst all the time maintaining a focus on addressing key problems and meeting strategic objectives.

A Strategic Outline Business Case (SOBC) appraisal has five components:

- Strategic;
- Economic;
- Financial;
- Commercial; and
- Management.

The economic case section of the SOBC presents the appraisal of the transport, environmental, wider economic and social and distributional impacts of the proposed options for the M11 Junction 11 Bus-Only Slip-Road Study.

At the SOBC stage a key outcome is to make a case for change and outline options that could tackle the identified problem. This Economic Case follows the methodology set out in Department for Transport’s transport appraisal guidance (DfT WebTAG) requirements for an Economic Case for options at this stage of design development.

In accordance with WebTAG, the Value for Money Statement is outlined with initial findings and will be completed with a full assessment at the Outline Business Case stage (OBC).

The economic case is structured as follows:

- Section 1.2 presents the shortlisted options selected for testing;
- Section 1.3 describes the transport modelling methodology;
- Section 1.4 shows the costs included in the appraisal;
- Section 1.5 describes the appraisal methodology; and
- Section 1.6 provides the value for money assessment of each option.

1.1.2. Purpose and Objectives of this Economic Case

The M11 Junction 11 Bus-Only Slip-Road Study is concerned with new infrastructure linking the M11 southbound and Trumpington Park & Ride at Junction 11. The scheme options will improve the attractiveness of bus travel on journeys that route through the junction, which is congested during peak periods. The full problem description, vision, objectives, options and rationale for investment are described in detail in the Strategic Case. There are currently no existing or planned local bus services exiting southbound at the M11 Junction 11 to Trumpington Park & Ride and the Biomedical Campus. As a result, there is no strategic case for investment in a southbound bus-only slip-road as a stand-alone scheme, unless future bus demand is identified and met by financially sustainable bus services.

Without sufficient demand for bus services, a bus-only slip-road would be redundant infrastructure and would not enhance public transport provision or connectivity in line with City Deal goals and wider policy objectives. Any strategic case for investment will therefore be reliant on future demand which may come from services being proposed as part of the Western Orbital and Cambourne to Cambridge Better Bus Journeys schemes. If these schemes and services were progressed to implementation, then the M11 Junction 11 Bus-Only Slip-Road could provide a direct, fast and reliable route connecting the orbital scheme on the M11 to Trumpington Park & Ride and the Biomedical Campus.

Atkins Economic Case | Version 2.0 | 23 November 2016 | 5150598
The purpose of the Economic Case is to identify the monetised and non-monetised impacts as well as the costs for each option appraised and to report the Value for Money presented by each option.

The City Deal Assurance Framework sets out the requirements of Value for Money in which it states that, “Schemes with a BCR of less than 2:1 will not normally be funded, unless wider appraisal evidence provides a compelling case for investment.”

The document goes on to state that a compelling case may be, “where a scheme is required to unlock a barrier to growth, deliver wider economic benefits, environmental and or social/distributional impacts. Where this occurs, scheme promoters will be required to justify the investment through provision of an evidence base and a proportionate quantitative analysis of benefits not included in the central benefit-cost analysis, and to demonstrate how these help deliver the policy objectives, to enable a comparative assessment of the economic case and comparison of the value for money with other schemes in the programme”¹.

At this stage of assessment for the SOBC, the key requirements are to establish the strategic case for investment, to demonstrate how this investment will further City Deal’s aims and objectives and to secure approval to proceed with further development of option specifications and designs. Further detailed assessment is required in future stages of assessment to fully inform a preferred option in the Outline Business Case (OBC) and “to continually align the progress of the project towards achieving...objectives”². In that regard it could be expected that through option optimisation and improving the methods used to capture and assess scheme impacts that benefit-cost ratios could be developed in further stages of assessment.

1.1.3. Costs

Section 1.4 of this Economic Case outlines the cost and risk estimation for each option. The infrastructure delivery capital cost estimates include the investment capital required for new infrastructure. The whole life cost estimates present the costs of maintenance, operation and renewals that will also need to be considered over the appraisal period.

Private sector bus service operating costs and revenues are expected to be unaffected by the scheme and so have not been considered.

1.1.4. Benefits and Impacts

The Economic Case assesses a number of monetised and non-monetised benefits and impacts related to each option to allow for an objective comparison to take place. The monetised impacts captured using the transport modelling and appraisal methodology outlined in Section 1.5 are:

- Journey time.

The non-monetised impacts captured or discussed in this appraisal include:

- Air quality and greenhouse gas emissions;
- Biodiversity;
- Historic environment;
- Landscape;
- Noise; and
- Water environment.

Any mode shift towards bus travel is dependent upon future demand which may come from services being proposed as part of the Western Orbital and Cambourne to Cambridge Better Bus Journeys schemes. As a stand-alone scheme the M11 Junction 11 Bus-Only Slip-Road is not expected to generate any mode shift. As such mode shift benefits are not assessed as part of this SOBC. Generated demand for bus travel is also expected to be negligible.

¹ City Deal Assurance Framework
A bespoke LinSig model was developed to determine the transport economic impacts of each option. The LinSig modelling does not capture mode shift. The impact assessment of monetised economic benefits was undertaken in a bespoke spreadsheet model.

### 1.1.5. Value for Money

The Benefit to Cost Ratio (BCR) is an indication of the return on public sector investment in a scheme. The BCR is the ratio of the Present Value of Benefits (PVB)\(^3\) over the Present Value of Costs (PVC)\(^4\), and indicates how much benefit is obtained for each unit of cost. A BCR greater than 1 indicates that the benefits outweigh the costs.

Based on an assessment of the benefits and costs of each option an assessment of value for money is presented in Section 1.6 of this document comprising the BCR and the DfT Value for Money category for each of the options considered.

### 1.2. Shortlisted Options Selected for Testing

#### 1.2.1. Background

Four options to provide a bus-only slip-road at the M11 Junction 11 have been shortlisted for testing as part of this SOBC. These options have been selected through an option assessment process carried out in previous phases of the work and described in detail in the Strategic Case.

As described in the Strategic Case, it should be noted that subsequent to the analysis outlined in this Economic Case, and in particular the high-level desk-based environmental assessment, some of the option alignments have been refined and developed. However these refinements and developments are not captured in this Economic Case in terms of a formal assessment of costs, traffic impacts and benefits.

#### 1.2.2. Existing Highway Infrastructure

The M11 is a key strategic motorway located to the west of Cambridge running north to south and providing connectivity with the A14 and A428 to the north and the A120 and M25 to the south. The M11 at this location comprises of two lanes with a hard shoulder in both directions separated by a central reservation.

The M11 Junction 11 provides connectivity with the A10 Hauxton Road heading northeast and the A10 heading southwest. The M11 Junction 11 is a signal controlled grade separated junction.

The A10 Hauxton Road provides connectivity between the M11 and Cambridge City centre. Hauxton Road also provides access to Addenbrooke’s Road and the Trumpington Road Park & Ride site. At this location Hauxton Road is a dual carriageway with a central median. Between the M11 junction and Addenbrooke’s Road a third lane is added to provide dedicated access to the Park & Ride site.

The Hauxton Road junction with Addenbrooke’s Road is a signal controlled junction and provides a dedicated access into the Park & Ride site; this is currently in use by all vehicles. In addition, an access into the proposed Trumpington Meadows development to the west has also been provided. However, this may need to be amended by the developer dependent upon predicted trips generated by the proposed development site.

Addenbrooke’s Road commences from Hauxton Road and heads east towards Addenbrooke’s Hospital. Addenbrooke’s Road provides two lanes of traffic in both directions.

#### 1.2.3. Do Minimum Scenario

The four options being assessed as part of this SOBC have been compared against a Do Minimum future scenario. In order to provide a realistic comparison between two possible futures, the Do Something cases

\(^3\) PVB is the present value of the future stream of estimated benefits of an option over 60 years discounted to the DfT’s base year of 2010

\(^4\) PVC is the present value of the future stream of estimated costs of an option over 60 years discounted to the DfT’s base year of 2010
are compared to a Do Minimum case. The Do Minimum scenario includes exogenous and endogenous growth but assumes that there are no junction improvements and the existing road network is retained. The Do Minimum scenario therefore forms the expected future situation without the proposed bus scheme.

1.2.4. Do Something Scenarios

Four options have been assessed in this SOBC. Summary descriptions are provided for reference below. Full details of each scheme are provided in the Strategic Case. It should be noted that all alignments, including offline sections on greenfield and privately held land, would need significant stakeholder agreement and associated permissions and as such routes shown on the maps are indicative and subject to further design development. It is expected that as these option specifications and designs are optimised, environmental highway impacts can be minimised and public transport benefits maximised to enhance the value for money of options and fully inform the decision making process for a preferred option.

Option A provides a bus-only access road running off-line but adjacent to the existing general traffic slip-road from the M11 towards Trumpington Park & Ride. This option also provides a fully segregated bus-only access to the Park & Ride site. Under this option, the current layout and operation of the roundabout for general traffic is maintained. It is assumed that the segregated bus lane would be bus-only and would provide access directly to the Park & Ride site. Appropriate signage would need to be put in place to indicate the bus-only lane.

Option B provides a bus-only access route parallel to the existing off-slip and bypasses the existing traffic signals at the end of the slip-road. The existing slip-road would be widened to accommodate the extra lane. The bus-only access route then continues onto the dedicated Park & Ride traffic lane beyond the junction. It is assumed that the segregated bus lane would be bus-only and would provide access to the dedicated Park & Ride traffic lane. There is, however, potential for this to be made an all-traffic lane to the Park & Ride. Appropriate signage would need to be put in place to indicate the bus-only lane.

Option C provides a bus-only slip-road leaving the M11 prior to the existing agricultural bridge for buses travelling southbound on the M11. The segregated bus-only lane could continue to the Park & Ride site. The design of Option C has followed an iterative process with review of the relevant design standards. The design extends the off-slip at Junction 11 for all traffic to the north of the agricultural bridge, with a bus-only slip-road branching from the extended off-slip. As the bus-only lane travels adjacent to the off-slip the need for an escape lane is removed. Further assessment would be required on the widening of the agricultural bridge and a new structure to accommodate a two lane slip-road at the location of the existing agricultural bridge. Further work would need to consider appropriate signage to indicate the bus-only lane.

Option D involves provision of a bus-only slip-road which follows the alignment of the disused railway line to the east of the M11. The bus-only slip-road leaves the M11 close to the location of the disused railway line and then follows the railway line alignment to meet the northern boundary of the existing Trumpington Park & Ride site. The proposed design for Option D was reviewed against the relevant design standards to reduce the tightness of the turn on the slip-road where possible. This design would need to be discussed further with Highways England were this option to be progressed in terms of layout and signage. The four options provide a variety of solutions, each with the flexibility to accommodate minor alterations or realignment as required. Based upon information available, each option provides a solution to the client brief. It should be noted that the designs of the proposed route alignments now extend to the Park & Ride boundary as additional information is now available, which has resulted in a more informed design. The cost estimates also now reflect extended alignments to the Park & Ride site. However, the traffic modelling does not assess the full design. Only the junction has been modelled and so access to the Park & Ride site has not been captured.

1.3. Traffic Modelling

To assess and compare the impact on journey times and delays as a result of each option, traffic modelling for the Do Minimum scenario and for the four bus-only slip-road options was undertaken. This section of the Economic Case explains the traffic modelling approach taken and the results of the traffic modelling exercise.
1.3.1. Methodology
Traffic modelling was undertaken to assess the journey time and delay impacts of the four bus-only slip-road options in a 2031 forecast year. In order to fully assess the impacts of each option the results were compared to a Do Minimum scenario, where no junction improvements are assumed to be made.

While VISSIM software would be able to simulate each individual vehicle, there is no future year traffic signal data available so we have opted to model the options using LinSig, which is a more appropriate application to model the traffic network.

LinSig V3 is a computer software package for the assessment and design of traffic signal junctions either individually or as a network comprising of a number of junctions and is able to specify the length of each lane and evaluate the journey time and delay for specific routes in the network. This functionality was used to assess the impacts of the bus-only slip-road options on buses as well as on general traffic.

1.3.2. Model Network
The design options for the bus-only slip-roads cover the area from the M11 Junction 11 to Trumpington Park & Ride. As the bus-only slip-roads in all the options are free-flow into the Trumpington Park & Ride, the network modelled only includes the M11 Junction 11. Some key points of the model network are:

- All four arms of the M11 Junction 11 are modelled;
- The M11 north arm of Junction 11 will be extended to cover early leaving of the bus-only slip-road for Option D; and
- The Hauxton Road arm of Junction 11 will be extended to the Trumpington Park & Ride, as Options C and D go directly to the Trumpington Park & Ride.

The model network is shown in Figure 1.1.

Figure 1.1 Model Network Overview
### 1.3.3. Modelled Scenarios

In order to compare the performance of the M11 Junction 11 improvement options, the following scenarios were modelled:

- **Do-Minimum (Future Base)** – 2031 flows with existing road network, no M11 Junction 11 improvements;
- **Option A** – 2031 flows and additional arm from M11 North to Hauxton Rd with shorter lane length to represent the offline segregated lane;
- **Option B** – 2031 flows and additional bus-only lane for M11 North entry and Hauxton Rd exit;
- **Option C** – 2031 flows and additional arm linking M11 to the Trumpington Park & Ride to represent the designed diversion of buses to the Trumpington Park & Ride crossing agricultural land; and
- **Option D** – 2031 flows and additional arm linking M11 to the Trumpington Park & Ride via the new bus-only route going directly to the Trumpington Park & Ride along the disused railway line.

Lane lengths for the new bus-only route in each option were set up according to the measured distance from the design drawings. This is to ensure the journey time differences are reflected in each option so that journey time and delay impacts can be assessed.

### 1.3.4. Model Input Data

In order to build the LinSig model for all scenarios, four main model inputs were required: Traffic Flow Data, Bus Service Assumptions, Signal Timing Data, and Network Layout Data.

#### Traffic Flow Data

AM and PM traffic flow data for M11 Junction 11 was available from a Manual Classified Count (MCC) traffic survey undertaken on Tuesday 24th of March 2015. The traffic survey was undertaken for the AM Peak (07:00 to 10:00) and the PM Peak (15:00 to 19:00) in 15-minute intervals, and these 2015 flows were used in the traffic modelling as the base year flows. To assess the worst case scenarios, the hour with the highest traffic flow was modelled for each peak period.

To assess the impacts of the four improvement options in 2031 (the modelled future year), traffic flow data for the M11 Junction 11 for the AM and PM peaks was extrapolated. Flow growth factors were derived for the M11 Junction 11 corridor from CSRM model runs, capturing exogenous and endogenous growth. However, as only 2016 rather than 2015 model runs were available in CSRM, we have assumed linear annual growth in flows and calculated the growth factor for 2015-2031 from the growth factor for 2016-2031. The calculation method is shown in Figure 1.2 below.

#### Bus Service Assumptions

The M11 Junction 11 bus-only slip-road options were designed to accommodate entirely new bus services as there are currently no bus services using the junction. A bus service of 6 buses per hour was assumed for the AM and PM peaks, for the Do Minimum and all four options, in 2031. The origin and the destination of the new bus service is shown in Figure 1.3, and the bus service utilises the bus-only slip-road in each design option.
Signal Timing Data
The M11 Junction 11 is a partially signalised junction. Traffic from the M11 northbound off-slip, the A10 eastbound and the M11 southbound off-slip are controlled by traffic signals. Current signal timing data was received from Cambridgeshire County Council. With no signal timing data available in 2031, LinSig was used to optimise signal timings to reduce overall junction delay in 2031 for all modelled options.

Network Layout Data
Network layout data is required to build the traffic network in LinSig. Design drawings for the four options were used to build the traffic network. However, the design drawings only covered the details of the M11 North arm and Hauxton Road arm. OS Base mapping and Google maps are used in this case to build the A10 arm and M11 South arm.

1.3.5. Traffic Flows and Growth Factors
For input to LinSig, the flow data was converted into PCUs per hour according to the PCU factors from WebTAG. The hour with the highest traffic flow for each peak period was modelled, which is 07:15 to 08:15 for the AM peak and 17:00 to 18:00 for the PM peak. The 2015 traffic flows for the AM and PM peak hours are shown in Table 1.1.
Table 1.1  Flow Matrices for the AM and PM Peak Hours in 2015 (PCUs/hour)

<table>
<thead>
<tr>
<th></th>
<th>AM (07:15-08:15)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hauxton Road</td>
<td>M11 South</td>
<td>A10</td>
<td>M11 North</td>
<td>Total</td>
</tr>
<tr>
<td>Hauxton Road</td>
<td>0</td>
<td>138</td>
<td>299</td>
<td>454</td>
<td>892</td>
</tr>
<tr>
<td>M11 South</td>
<td>435</td>
<td>0</td>
<td>35</td>
<td>0</td>
<td>470</td>
</tr>
<tr>
<td>A10</td>
<td>702</td>
<td>5</td>
<td>3</td>
<td>438</td>
<td>1,147</td>
</tr>
<tr>
<td>M11 North</td>
<td>1,134</td>
<td>1</td>
<td>470</td>
<td>6</td>
<td>1,610</td>
</tr>
<tr>
<td>Total</td>
<td>2,270</td>
<td>144</td>
<td>807</td>
<td>897</td>
<td>4,118</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>PM (17:00-18:00)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hauxton Road</td>
<td>M11 South</td>
<td>A10</td>
<td>M11 North</td>
<td>Total</td>
</tr>
<tr>
<td>Hauxton Road</td>
<td>4</td>
<td>280</td>
<td>601</td>
<td>937</td>
<td>1,822</td>
</tr>
<tr>
<td>M11 South</td>
<td>151</td>
<td>0</td>
<td>33</td>
<td>3</td>
<td>187</td>
</tr>
<tr>
<td>A10</td>
<td>395</td>
<td>30</td>
<td>1</td>
<td>396</td>
<td>822</td>
</tr>
<tr>
<td>M11 North</td>
<td>582</td>
<td>1</td>
<td>369</td>
<td>8</td>
<td>961</td>
</tr>
<tr>
<td>Total</td>
<td>1,133</td>
<td>311</td>
<td>1,004</td>
<td>1,344</td>
<td>3,792</td>
</tr>
</tbody>
</table>

Growth factors for each movement were assessed to consider both general traffic growth and traffic redistribution, by following the methodology as described in Section 1.3.4. The 2015 – 2031 growth factors are shown in Table 1.2.

Table 1.2  2015 - 2031 Growth Factors

<table>
<thead>
<tr>
<th></th>
<th>AM</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Hauxton Road</td>
<td>M11 South</td>
<td>A10</td>
<td>M11 North</td>
<td>Total</td>
</tr>
<tr>
<td>Hauxton Road</td>
<td>1.00</td>
<td>1.29</td>
<td>1.14</td>
<td>1.35</td>
<td>1.28</td>
</tr>
<tr>
<td>M11 South</td>
<td>0.94</td>
<td>1.00</td>
<td>1.20</td>
<td>1.00</td>
<td>0.97</td>
</tr>
<tr>
<td>A10</td>
<td>0.87</td>
<td>1.12</td>
<td>1.00</td>
<td>1.52</td>
<td>1.12</td>
</tr>
<tr>
<td>M11 North</td>
<td>0.90</td>
<td>1.00</td>
<td>0.95</td>
<td>1.00</td>
<td>0.92</td>
</tr>
<tr>
<td>Total</td>
<td>0.90</td>
<td>1.27</td>
<td>1.01</td>
<td>1.43</td>
<td>1.06</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>PM</th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hauxton Road</td>
<td>M11 South</td>
<td>A10</td>
<td>M11 North</td>
<td>Total</td>
</tr>
<tr>
<td>Hauxton Road</td>
<td>1.00</td>
<td>1.12</td>
<td>0.91</td>
<td>1.05</td>
<td>1.02</td>
</tr>
<tr>
<td>M11 South</td>
<td>1.27</td>
<td>1.00</td>
<td>1.18</td>
<td>1.00</td>
<td>1.26</td>
</tr>
<tr>
<td>A10</td>
<td>1.15</td>
<td>1.10</td>
<td>1.00</td>
<td>1.20</td>
<td>1.18</td>
</tr>
<tr>
<td>M11 North</td>
<td>0.97</td>
<td>1.00</td>
<td>1.33</td>
<td>1.00</td>
<td>1.15</td>
</tr>
<tr>
<td>Total</td>
<td>1.11</td>
<td>1.12</td>
<td>1.12</td>
<td>1.10</td>
<td>1.11</td>
</tr>
</tbody>
</table>

With growth factors calculated, 2031 traffic flows were calculated from the 2015 traffic flows and the 2015 – 2031 growth factors. The calculated 2031 traffic flows for the AM and PM peak hours are shown in Table 1.3.
### Table 1.3 Flow Matrices for the AM and PM Peak Hours in 2031 (PCUs/hour)

<table>
<thead>
<tr>
<th></th>
<th>Hauxton Road</th>
<th>M11 South</th>
<th>A10</th>
<th>M11 North</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Road</td>
<td>0</td>
<td>177</td>
<td>340</td>
<td>615</td>
<td>1,133</td>
</tr>
<tr>
<td>M11 South</td>
<td>410</td>
<td>0</td>
<td>42</td>
<td>0</td>
<td>452</td>
</tr>
<tr>
<td>A10</td>
<td>614</td>
<td>6</td>
<td>3</td>
<td>664</td>
<td>1,286</td>
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<tr>
<td>M11 North</td>
<td>1,023</td>
<td>1</td>
<td>444</td>
<td>6</td>
<td>1,474</td>
</tr>
<tr>
<td>Total</td>
<td>2,047</td>
<td>184</td>
<td>829</td>
<td>1,285</td>
<td>4,344</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Hauxton Road</th>
<th>M11 South</th>
<th>A10</th>
<th>M11 North</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Road</td>
<td>4</td>
<td>313</td>
<td>546</td>
<td>984</td>
<td>1,846</td>
</tr>
<tr>
<td>M11 South</td>
<td>193</td>
<td>0</td>
<td>38</td>
<td>3</td>
<td>234</td>
</tr>
<tr>
<td>A10</td>
<td>454</td>
<td>33</td>
<td>1</td>
<td>476</td>
<td>964</td>
</tr>
<tr>
<td>M11 North</td>
<td>566</td>
<td>1</td>
<td>490</td>
<td>8</td>
<td>1,065</td>
</tr>
<tr>
<td>Total</td>
<td>1,217</td>
<td>347</td>
<td>1,075</td>
<td>1,471</td>
<td>4,109</td>
</tr>
</tbody>
</table>

#### 1.3.6. LinSig Model Network

The LinSig models for the Do-Minimum and the four M11 Junction 11 improvement options are summarised below, with key model features for each model identified.

**Do-Minimum**

The Do-Minimum model is created with the existing traffic network of M11 Junction 11 and no change to infrastructure. Key model features for the Do-Minimum scenario are:

- Model includes only Junction 11 of M11, and extends approximately 1.4km to M11 North to compare journey time with Option C and Option D;
- The extended lanes are separated into several parts to account for the speed differences on motorway, the ramp and junction entry;
- Short lane at M11 SB off-slip is modelled as long lane, as two short lanes are not allowed in LinSig model (for the widening design in Option A and Option B);
- Model year assumed to be 2031 and 2031 traffic flow matrices are used; and
- Bus zones (E and F) are added, which are used by the assumed 6 bus services from M11 North to the Trumpington Park & Ride.

**Option A**

Option A provides a segregated bus-only option by widening the existing slip road from M11 North to Hauxton Rd, and the bus-only route continues onto the dedicated Trumpington Park & Ride traffic lane. Key model features for Option A:

- Option A is built upon the Do-Minimum LinSig model;
- M11 SB off-slip entry is widened to four lanes, with extra lane as bus-only slip-road;
- An additional bus-only lane is added to Hauxton Rd exit and all the way to Zone F, and the lane only connects with the bus-only slip-road from M11 SB off-slip; and
- The assumed bus services from M11 to the Trumpington Park & Ride will route to the additional bus lane and stay in nearside dedicated Park & Ride traffic lane to Zone F.

**Option B**

Option B provides a segregated bus-only slip-road by widening the existing slip-road from M11 North to Hauxton Rd. Key model features for Option B:

- Option B is built upon the Do-Minimum LinSig model;
- M11 SB off-slip entry is widened to four lanes, with extra lane as bus-only slip-road;
An additional lane is added to Hauxton Rd exit and only connects with the bus-only slip-road from M11 SB off-slip;
- Bus service re-joins the main carriageway on the nearside lane with general traffic; and
- The assumed bus services from M11 to the Trumpington Park & Ride will route to the additional bus lane.

**Option C**

Option C provides a bus-only slip-road leaving the M11 before reaching Junction 11, and the bus-only slip-road goes directly to the Trumpington Park & Ride. Key model features for Option C:

- Option C is built upon the Do-Minimum LinSig model;
- A new arm that links M11 directly to Zone F is added;
- Distance for the bus-only slip-road via the existing agricultural lane is measured from the design drawing to calculate the bus journey time; and
- The assumed bus services from M11 to the Trumpington Park & Ride will route to the new arm to Zone F.

**Option D**

Option D provides a bus-only slip-road leaving the M11 earlier than Option C and following the alignment of the disused railway line to the Trumpington Park & Ride. Key model features for Option D:

- Option D is built upon the Do-Minimum LinSig model;
- A new arm that links M11 directly to Zone F is added;
- Distance for the bus-only slip-road via the disused railway line is measured from drawing to calculate the bus journey time; and
- The assumed bus services from M11 to the Trumpington Park & Ride will route to the new arm to Zone F.

### 1.3.7. Junction Performance Comparisons

The traffic modelling was used to assess the journey time and delay saving for the four design options when compared with the Do Minimum. LinSig was used to calculate the average journey time and average delay per Passenger Car Unit (PCU) for each route in the traffic network.

The junction performance results in terms of Degree of Saturation (DoS) and delay per PCU for each approach are shown and compared in this section. DoS and delay are measurements of junction performance. DoS measures how much demand the lane is experiencing compared to its total capability, and it is defined as the ratio of Flow to Capacity for the lane. Delay measures the additional travel time as a result of congestion, and it is defined as the difference between a vehicle’s free-flow journey time and the actual journey time.

Table 1.4 shows the junction performance comparison in the AM peak.

#### Table 1.4 2031 AM Peak Junction Performance Comparison

<table>
<thead>
<tr>
<th>Approach</th>
<th>DoS (%)</th>
<th>Delay (s/PCU)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do Minimum</td>
<td>Option A</td>
</tr>
<tr>
<td>Hauxton Rd Ahead / Left</td>
<td>58.6%</td>
<td>58.6%</td>
</tr>
<tr>
<td>Hauxton Rd Ahead</td>
<td>72.5%</td>
<td>72.5%</td>
</tr>
<tr>
<td>M11 NB off-slip Ahead / Left</td>
<td>65.1%</td>
<td>65.1%</td>
</tr>
<tr>
<td>M11 NB off-slip Ahead</td>
<td>44.3%</td>
<td>44.3%</td>
</tr>
</tbody>
</table>
The differences between the Do Minimum scenario and the M11 Junction 11 improvement options are highlighted. The operation of Junction 11 changes as bus services are removed from the overall traffic demand, instead using the designated bus-only slip-road. Benefits from directing bus services to the bus-only slip-road in terms of DoS and delay savings when compared to the Do Minimum are the same for all the scheme options. There is no differentiation in junction performance by option. Traffic operation at the junction sees a small benefit, which is consistent across the improvement options.

Table 1.5 shows the junction performance comparison in the PM peak.

<table>
<thead>
<tr>
<th>Approach</th>
<th>DoS (%)</th>
<th>Delay (s/PCU)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do Minimum</td>
<td>Option A</td>
</tr>
<tr>
<td>A10 Ahead / Left</td>
<td>102.4%</td>
<td>102.4%</td>
</tr>
<tr>
<td>A10 Ahead</td>
<td>48.7%</td>
<td>48.7%</td>
</tr>
<tr>
<td>M11 SB off-slip nearside</td>
<td>65.7%</td>
<td>64.8%</td>
</tr>
<tr>
<td>M11 SB off-slip offside</td>
<td>59.9%</td>
<td>58.9%</td>
</tr>
<tr>
<td>M11 SB off-slip Ahead</td>
<td>54.5%</td>
<td>54.5%</td>
</tr>
</tbody>
</table>

As with the AM peak, the differences between the Do Minimum scenario and the M11 Junction 11 improvement options are highlighted. The operation of Junction 11 changes as bus services are removed from the overall traffic demand, instead using the designated bus-only slip-road. Benefits from directing bus
services to the bus-only slip-road in terms of DoS and delay savings when compared to the Do Minimum are the same for all the scheme options. There is no differentiation in junction performance by option. Traffic operation at the junction sees a small benefit, which is consistent across the improvement options.

1.3.8. Bus Journey Time and Delay Comparisons

In order to determine the benefits to buses, bus journey time and delay results are produced for each model and compared. In the Do Minimum scenario, the bus services were assumed to be mixed in with general traffic. For each M11 Junction 11 improvement option, the bus services will go via the bus-only slip-road.

Table 1.6 shows the bus journey time results of each model in the AM and PM peak.

Table 1.6 Bus Journey Time Comparison

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Do Minimum</th>
<th>Option A</th>
<th>Option B</th>
<th>Option C</th>
<th>Option D</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>187</td>
<td>165</td>
<td>168</td>
<td>138</td>
<td>115</td>
</tr>
<tr>
<td>PM</td>
<td>174</td>
<td>161</td>
<td>163</td>
<td>136</td>
<td>114</td>
</tr>
</tbody>
</table>

Option A provides a segregated bus lane at the junction, and the bus lane is not controlled by the traffic signal at the junction. Bus journey times in Option A decrease compared with the Do Minimum, by approximately 22s and 13s in the AM and PM peak respectively.

Option B is similar to Option A, with a segregated bus lane at the junction to avoid delay due to the traffic signal. However, as bus only lane re-joins the main carriageway and continues for both bus and P&R vehicles as a nearside lane on Hauxton Rd, the bus journey times in Option B are slightly higher than in Option A, being 19s and 11s lower than the Do Minimum in the AM and PM peak respectively.

Option C provides a segregated bus-only route from the M11 to the Trumpington Park & Ride which routes offline from the M11 North arm of Junction 11. There are bus journey time savings when compared to the Do Minimum of 49s in the AM peak and 38s in the PM peak.

Option D provides a segregated bus-only route from the M11 directly to the north of the Trumpington Park & Ride, with a shorter journey distance than other options. This option provides a much shorter journey time than the Do Minimum scenario, saving 72s in the AM peak and 60s in the PM peak.

Table 1.7 shows the bus delay results of each model in the AM and PM peak.

Table 1.7 Bus Delay Comparison

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Do Minimum</th>
<th>Option A</th>
<th>Option B</th>
<th>Option C</th>
<th>Option D</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>35</td>
<td>13</td>
<td>16</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>PM</td>
<td>22</td>
<td>9</td>
<td>11</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

All of the options reduce delay compared with the Do Minimum in both the AM and PM peaks. Option B has the highest bus delay and is the poorest performing option. This is because the bus-only slip-road terminates at Hauxton Road and the bus service then re-joins the main carriageway with general traffic. Option D has the lowest bus delay and is the best performing option, reducing bus delay by 32s in the AM peak and 19s in the PM peak. The delay benefits of each option are greater in the AM peak than the PM peak because there is more traffic congestion in the AM peak than the PM peak.
1.4. Estimation of Cost per Option

This chapter sets out the costs of the options that are captured in the appraisal and explains the costs included and how they are manipulated following WebTAG guidance to provide a Present Value of Costs (PVC) for each option. First the capital cost is presented for all options and then the whole life costs (maintenance and renewals) associated with the proposed schemes. The risk allowance for each scheme is presented and then the inflation and optimism bias assumptions are explained. The costs are brought together, adjusted and discounted for inclusion in the cost benefit analysis.

These costs vary to those previously presented predominantly as a result of changes to the proposed route alignments (now extending to the Park & Ride boundary), the additional level of information available (resulting in a more informed design), and the addition of preliminaries, overheads and traffic management costs. The costs presented do not include land acquisition, utility diversions and professional fees.

A robust approach to cost estimation, including spend profiles, has been undertaken using expert input from quantity surveying experts from Faithful+Gould. A further breakdown of construction cost estimation is presented in the Financial Case.

The cost estimates for each option are derived from high level preliminary designs of each option alignment. Costs were provided with a Q4 2015 price base and are based on a scheme opening year of 2021. It should be recognised that any delay to scheme opening is likely to result in an increase in costs from those forecast here.

Construction costs
High level design drawings showing the potential alignment of each of the options, provided by Atkins, were used by Faithful+Gould to estimate the appropriate infrastructure requirements and subsequent costs, based on historic data. The construction costs for each option do not include preparatory costs that would be incurred to enable construction to take place. These include detailed design work, future business case analysis, auditing, statutory planning preparation costs, consultation, procurement, project management, and monitoring and evaluation. An allowance of 12% on the capital construction costs is deemed appropriate at this stage as advised by Faithful+Gould.

Operating costs
Changes to bus service operating costs due to using the bus-only slip-road rather than the existing junction are assumed to be negligible.

Renewals
For the purposes of this appraisal indicative life cycle renewal cost estimates have been prepared by Faithful+Gould. Life cycle renewal costs are costs associated with the renewal of infrastructure component(s), following the final disposal of the initial asset on completion of its life cycle. The estimates are based on high-level cost planning techniques and construction capital costs. The life cycle renewal costs do not include for planned and reactive maintenance, operation or end of life costs. The life cycle renewal costs utilise the descriptions, quantities and unit rates provided within the capital construction cost estimates, also provided by Faithful+Gould. A percentage scale of renewal has been applied to the assets considered to require life cycle renewal.

Maintenance costs
Highway maintenance costs, required for both general operation and repairs, are expected to be minimal due to the scale of the scheme. For the purposes of this appraisal, highway maintenance costs have been derived from construction costs using proportions from the Cambourne to Cambridge Better Bus Journeys Economic Case. They are assumed to have a flat spend profile, thereby providing a consistent annual maintenance cost.

Risk allowance
Due to the number of options being considered, and the early conception stage of the scheme design, an overall weighted allowance of 20% on the preparatory and capital construction costs is deemed appropriate at this stage. A 20% risk allowance has also been applied to the annual maintenance costs and lifecycle renewals estimates. This is consistent with the Cambourne to Cambridge Better Bus Journeys Economic Case.
Inflation
Details on the application of inflation onto the base costs to produce out-turn costs are provided in the Financial Case. Construction, capital renewal and infrastructure maintenance costs have all been estimated with a Q4 2015 price base, and inflated to the point of expenditure based on either the All-in Tender Price Index (TPI) or the Retail Price Index (RPI), depending on the cost item.

For the purposes of appraisal only real inflation (i.e. the rate of inflation costs above the rate of background inflation) has been considered. The background inflation, based on the GDP deflator from the July 2016 WebTAG Data Book, has been deducted from the total rates of inflation derived from the TPI/RPI.

The rates used in the assessment indicate that construction related costs over the course of the construction period will rise by 5.10% per annum up to 2018. Beyond 2018, there are no forecasts available and therefore the forecast rate of inflation between 2017 and 2018 has been assumed to continue year on year up until completion of construction in 2021.

Optimism Bias
Optimism bias is a factor added to scheme costs to account for the demonstrated systematic tendency for appraisers to be overly optimistic about the outcome of planned actions. This includes over-estimating the likelihood of positive elements of a scheme and/or under-estimating the likelihood of negative elements of a scheme. Reference has been made to Table 8 in WebTAG unit A1.2, to determine the category, type and stage of the project. The M11 Junction 11 Bus-Only Slip-Road Study is considered to fall under Stage 1 of a road scheme, with the project type being a bus lane scheme. Accordingly, a 44% optimism bias has been applied to risk-adjusted investment costs.

WebTAG is not prescriptive in providing guidance on a suitable level of optimism bias for capital renewals (traffic-related maintenance). Based on experience from comparable schemes (bus based road schemes) across the UK, a 15% optimism bias has been applied for capital renewals expenditure. In line with standard practice, no optimism bias uplift has been applied to the non-traffic related maintenance costs.

1.4.1. Infrastructure Delivery Capital Cost Estimates by Option
The base construction cost estimates are presented in Table 1.8. The base costs have been provided in resource prices, and exclude allowances for VAT, inflation, risk and optimism bias. Further detail on the derivation of base costs are provided in the Financial Case.

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Option A cost (000s)</th>
<th>Option B cost (000s)</th>
<th>Option C cost (000s)</th>
<th>Option D cost (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparatory</td>
<td>£275</td>
<td>£104</td>
<td>£976</td>
<td>£736</td>
</tr>
<tr>
<td>Construction</td>
<td>£2,295</td>
<td>£869</td>
<td>£8,130</td>
<td>£6,134</td>
</tr>
<tr>
<td>Total</td>
<td>£2,570</td>
<td>£973</td>
<td>£9,106</td>
<td>£6,870</td>
</tr>
</tbody>
</table>

1.4.2. Option Infrastructure Whole Life Cost Estimates

Renewals
Renewals estimates for the 60-year appraisal period have been provided by Faithful+Gould based on high-level cost planning techniques and construction capital costs. The estimates are provided in Table 1.9. Do Minimum renewals have not been estimated so these figures are likely to be an overestimate.
Table 1.9 Breakdown of Whole Life Renewals Costs for Each Option (Q4 2015 Price Base, Undiscounted Resource Prices)

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Option A cost (000s)</th>
<th>Option B cost (000s)</th>
<th>Option C cost (000s)</th>
<th>Option D cost (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highway</td>
<td>£620</td>
<td>£218</td>
<td>£1,675</td>
<td>£1,930</td>
</tr>
<tr>
<td>Busway</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Equipment and System</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other Infrastructure</td>
<td>-</td>
<td>£238</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>£620</td>
<td>£457</td>
<td>£1,675</td>
<td>£1,930</td>
</tr>
</tbody>
</table>

Maintenance costs

Table 1.10 provides a summary of the annual highway maintenance cost for each option.

Table 1.10 Annual Maintenance Costs for Each Option (Q4 2015 Price Base, Undiscounted Resource Prices)

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Option A cost (000s)</th>
<th>Option B cost (000s)</th>
<th>Option C cost (000s)</th>
<th>Option D cost (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highway</td>
<td>£3</td>
<td>£1</td>
<td>£11</td>
<td>£9</td>
</tr>
</tbody>
</table>

1.4.3. Risk Allowance

The risk allowance breakdown per option is presented in Table 1.11.

Table 1.11 Risk Allowance Breakdown per Option (Q4 2015 Price Base, Undiscounted Resource Prices)

<table>
<thead>
<tr>
<th>Option</th>
<th>Risk Allowance (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A</td>
<td>£677</td>
</tr>
<tr>
<td>Option B</td>
<td>£301</td>
</tr>
<tr>
<td>Option C</td>
<td>£2,293</td>
</tr>
<tr>
<td>Option D</td>
<td>£1,863</td>
</tr>
</tbody>
</table>

1.4.4. Inflation and Optimism Bias

Inflation and optimism bias has been added to the scheme costs based on WebTAG unit A1.2 guidance. The contribution of real cost inflation in addition to base costs are presented in Table 1.12, with the contribution of optimism bias presented in Table 1.13. Optimism bias has been added to the risk adjusted costs in accordance with WebTAG A1.2. The investment costs (including real cost increase) with optimism bias are presented in Table 1.14.

Table 1.12 Real Cost Inflation to be added (Q4 2015 Price Base, Undiscounted Resource Prices)

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Option A cost (000s)</th>
<th>Option B cost (000s)</th>
<th>Option C cost (000s)</th>
<th>Option D cost (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>£321</td>
<td>£122</td>
<td>£1,137</td>
<td>£858</td>
</tr>
<tr>
<td>Renewals</td>
<td>£207</td>
<td>£153</td>
<td>£560</td>
<td>£645</td>
</tr>
<tr>
<td>Annual Maintenance</td>
<td>£63</td>
<td>£24</td>
<td>£224</td>
<td>£169</td>
</tr>
<tr>
<td>Risk</td>
<td>£95</td>
<td>£42</td>
<td>£321</td>
<td>£261</td>
</tr>
</tbody>
</table>
## 1.4.5. Present Value of Costs

To produce a Present Value of Costs for each option, it is necessary to convert to 2010 prices (as per the DfT base year) using the GDP deflator, adjust for market prices and discount.

Benefits of the scheme have been calculated at market prices (i.e. inclusive of taxes) and it is therefore necessary to adjust the cost estimates so that the benefits and costs are consistent. As specified in WebTAG unit A1.2, the average rate of indirect tax in the economy is currently 19%, and accordingly, the resource costs have been factored up by 1.19.

Discounting is an adjustment applied to both costs and benefits to represent the preference to receive benefits sooner rather than later and for costs to be paid later rather than sooner. This means that both costs and benefits occurring further into the future are valued lower. In line with WebTAG guidance, discount rates of 3.5% p.a. from 2016 to 2046 and 3.0% p.a. from 2047 onwards have been applied.

The tables below present the cost profile used in the appraisal, from the base cost (including full appraisal period maintenance and renewal costs), risk adjusted cost and Present Value Costs (PVC) market prices, discounted to 2010 price base.

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Option A cost (000s)</th>
<th>Option B cost (000s)</th>
<th>Option C cost (000s)</th>
<th>Option D cost (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparatory</td>
<td>£397</td>
<td>£150</td>
<td>£1,405</td>
<td>£1,060</td>
</tr>
<tr>
<td>Construction</td>
<td>£3,768</td>
<td>£1,427</td>
<td>£13,344</td>
<td>£10,067</td>
</tr>
<tr>
<td>Renewals</td>
<td>£951</td>
<td>£701</td>
<td>£2,570</td>
<td>£2,961</td>
</tr>
<tr>
<td>Annual Maintenance</td>
<td>£256</td>
<td>£97</td>
<td>£907</td>
<td>£684</td>
</tr>
<tr>
<td>Risk</td>
<td>£1,111</td>
<td>£494</td>
<td>£3,763</td>
<td>£3,058</td>
</tr>
<tr>
<td>Total</td>
<td>£6,482</td>
<td>£2,868</td>
<td>£21,989</td>
<td>£17,831</td>
</tr>
</tbody>
</table>
Table 1.15  

<table>
<thead>
<tr>
<th>Option</th>
<th>Base costs Q4 2015 resource prices, excluding risk (000s)</th>
<th>Risk adjusted Q4 2015 resource costs, with real cost increase and Optimism Bias (000s)</th>
<th>Present Value Capital and Whole Life Costs, 2010 market prices discounted to 2010 (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A</td>
<td>£3,384</td>
<td>£6,482</td>
<td>£4,526</td>
</tr>
<tr>
<td>Option B</td>
<td>£1,503</td>
<td>£2,868</td>
<td>£1,855</td>
</tr>
<tr>
<td>Option C</td>
<td>£11,464</td>
<td>£21,989</td>
<td>£15,700</td>
</tr>
<tr>
<td>Option D</td>
<td>£9,315</td>
<td>£17,831</td>
<td>£12,207</td>
</tr>
</tbody>
</table>

1.5.  

Option Impacts

This section will describe the approach to monetising journey time impacts for each option. It will also discuss other non-monetised impacts of the scheme.

1.5.1.  

Journey Time Assessment Approach

The model that appraises journey time savings takes the following inputs:

- Values from the WebTAG Data Book, Spring 2016 release, v1.5, dated July 2016 – specifically taking account of:
  - GDP growth;
  - Discount rates;
  - Forecast values of time per person;
  - National average car and vehicle occupancies; and
  - National average journey purpose splits.
- Highways England traffic flow data from the M11 J11 northbound off-slip and northbound on-slip, in 15-minute intervals to factor peak hour LINSIG outputs to non-modelled time periods;
- Bus passenger loading outputs from the CSRM-based bus service model, expanded to five bus service periods Monday to Saturday, and one period covering Sunday, to reflect varying levels of passenger demand/patronage; and
- Delay and flow outputs for two weekday peak hours from the LINSIG junction model for the 2031 modelled year to derive baseline traffic flow profiles and to calculate changes in journey times resulting from the intervention. This data was provided in Origin-Destination matrix format so that bus traffic and general traffic could be easily distinguished and the full junction impacts could be assessed. These matrices are provided in the tables below.
### Table 1.16  2031 Flows - AM Peak Hour (PCUs)

<table>
<thead>
<tr>
<th>Destination</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
<td>0</td>
<td>177</td>
<td>340</td>
<td>615</td>
<td>1,132</td>
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<tr>
<td>M11 NB</td>
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<td>0</td>
<td>42</td>
<td>0</td>
<td>452</td>
</tr>
<tr>
<td>A10</td>
<td>614</td>
<td>6</td>
<td>3</td>
<td>664</td>
<td>1,287</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>1,023</td>
<td>1</td>
<td>444</td>
<td>6</td>
<td>1,474</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>2,062</td>
<td>184</td>
<td>829</td>
<td>1,285</td>
<td>4,360</td>
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</table>

### Table 1.17  2031 Flows - PM Peak Hour (PCUs)

<table>
<thead>
<tr>
<th>Destination</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
<td>4</td>
<td>313</td>
<td>546</td>
<td>984</td>
<td>1,847</td>
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<tr>
<td>M11 NB</td>
<td>193</td>
<td>0</td>
<td>38</td>
<td>4</td>
<td>235</td>
</tr>
<tr>
<td>A10</td>
<td>454</td>
<td>33</td>
<td>1</td>
<td>476</td>
<td>964</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>566</td>
<td>1</td>
<td>490</td>
<td>8</td>
<td>1,065</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>15</td>
<td>0</td>
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<tr>
<td>Total</td>
<td>1,232</td>
<td>347</td>
<td>1,075</td>
<td>1,472</td>
<td>4,126</td>
</tr>
</tbody>
</table>

### Table 1.18  2031 Do Minimum Delays - AM Peak Hour (s/PCU)

<table>
<thead>
<tr>
<th>Destination</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
<td>0.0</td>
<td>4.9</td>
<td>19.6</td>
<td>59.4</td>
</tr>
<tr>
<td>M11 NB</td>
<td>82.8</td>
<td>0.0</td>
<td>38.1</td>
<td>0.0</td>
</tr>
<tr>
<td>A10</td>
<td>79.0</td>
<td>49.9</td>
<td>55.0</td>
<td>109.0</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>34.8</td>
<td>25.5</td>
<td>51.4</td>
<td>76.4</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>34.8</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
### Table 1.19 2031 Do Minimum Delays - PM Peak Hour (s/PCU)

<table>
<thead>
<tr>
<th>Destination</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
<td>379.2</td>
<td>57.3</td>
<td>71.0</td>
<td>372.3</td>
</tr>
<tr>
<td>M11 NB</td>
<td>81.5</td>
<td>0.0</td>
<td>40.1</td>
<td>70.3</td>
</tr>
<tr>
<td>A10</td>
<td>74.8</td>
<td>50.7</td>
<td>60.7</td>
<td>153.9</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>21.5</td>
<td>22.6</td>
<td>38.7</td>
<td>68.5</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>21.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

### Table 1.20 2031 Option A Delays - AM Peak Hour (s/PCU)

<table>
<thead>
<tr>
<th>Destination</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
<td>0.0</td>
<td>4.9</td>
<td>19.6</td>
<td>59.4</td>
</tr>
<tr>
<td>M11 NB</td>
<td>82.8</td>
<td>0.0</td>
<td>38.1</td>
<td>0.0</td>
</tr>
<tr>
<td>A10</td>
<td>78.9</td>
<td>49.9</td>
<td>55.0</td>
<td>109.0</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>34.5</td>
<td>25.5</td>
<td>51.4</td>
<td>76.4</td>
</tr>
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<td>M11 SB (Bus)</td>
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### Table 1.21 2031 Option A Delays - PM Peak Hour (s/PCU)

<table>
<thead>
<tr>
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<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
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<td>57.3</td>
<td>71.0</td>
<td>372.3</td>
</tr>
<tr>
<td>M11 NB</td>
<td>81.5</td>
<td>0.0</td>
<td>40.1</td>
<td>70.3</td>
</tr>
<tr>
<td>A10</td>
<td>74.7</td>
<td>50.7</td>
<td>60.7</td>
<td>153.9</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>21.3</td>
<td>22.6</td>
<td>38.7</td>
<td>68.5</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>8.9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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Table 1.22  2031 Option B Delays - AM Peak Hour (s/PCU)

<table>
<thead>
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<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
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<td>4.9</td>
<td>19.6</td>
<td>59.4</td>
</tr>
<tr>
<td>M11 NB</td>
<td>82.8</td>
<td>0.0</td>
<td>38.1</td>
<td>0.0</td>
</tr>
<tr>
<td>A10</td>
<td>78.9</td>
<td>49.9</td>
<td>55.0</td>
<td>109.0</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>34.5</td>
<td>25.5</td>
<td>51.4</td>
<td>76.4</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>15.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 1.23  2031 Option B Delays - PM Peak Hour (s/PCU)

<table>
<thead>
<tr>
<th>Origin</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
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<td>57.3</td>
<td>71.0</td>
<td>372.3</td>
</tr>
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<td>M11 NB</td>
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<td>0.0</td>
<td>40.1</td>
<td>70.3</td>
</tr>
<tr>
<td>A10</td>
<td>74.8</td>
<td>50.8</td>
<td>60.8</td>
<td>153.9</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>21.3</td>
<td>22.6</td>
<td>38.7</td>
<td>68.5</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>11.1</td>
<td>0.0</td>
<td>0.0</td>
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</tr>
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</table>

Table 1.24  2031 Option C Delays - AM Peak Hour (s/PCU)

<table>
<thead>
<tr>
<th>Origin</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
<td>0.0</td>
<td>4.9</td>
<td>19.6</td>
<td>59.4</td>
</tr>
<tr>
<td>M11 NB</td>
<td>82.8</td>
<td>0.0</td>
<td>38.1</td>
<td>0.0</td>
</tr>
<tr>
<td>A10</td>
<td>78.9</td>
<td>49.9</td>
<td>55.0</td>
<td>109.0</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>34.4</td>
<td>25.5</td>
<td>51.4</td>
<td>76.4</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>5.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
## Table 1.25 2031 Option C Delays - PM Peak Hour (s/PCU)

<table>
<thead>
<tr>
<th>Origin</th>
<th>Destination</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
<td>379.2</td>
<td>57.3</td>
<td>71.0</td>
<td></td>
<td>372.3</td>
</tr>
<tr>
<td>M11 NB</td>
<td>81.5</td>
<td>0.0</td>
<td>40.1</td>
<td></td>
<td>70.3</td>
</tr>
<tr>
<td>A10</td>
<td>74.7</td>
<td>50.7</td>
<td>60.7</td>
<td></td>
<td>153.9</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>21.3</td>
<td>22.6</td>
<td>38.7</td>
<td></td>
<td>68.5</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>4.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td>0.0</td>
</tr>
</tbody>
</table>

## Table 1.26 2031 Option D Delays - AM Peak Hour (s/PCU)

<table>
<thead>
<tr>
<th>Origin</th>
<th>Destination</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
<td>0.0</td>
<td>4.9</td>
<td>19.6</td>
<td></td>
<td>59.4</td>
</tr>
<tr>
<td>M11 NB</td>
<td>82.8</td>
<td>0.0</td>
<td>38.1</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>A10</td>
<td>78.9</td>
<td>49.9</td>
<td>55.0</td>
<td></td>
<td>109.0</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>32.0</td>
<td>24.2</td>
<td>50.0</td>
<td></td>
<td>75.1</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>3.4</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td>0.0</td>
</tr>
</tbody>
</table>

## Table 1.27 2031 Option D Delays - PM Peak Hour (s/PCU)

<table>
<thead>
<tr>
<th>Origin</th>
<th>Destination</th>
<th>Hauxton Rd / Trumpington P&amp;R</th>
<th>M11 NB</th>
<th>A10</th>
<th>M11 SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauxton Rd / Trumpington P&amp;R</td>
<td>379.2</td>
<td>57.3</td>
<td>71.0</td>
<td></td>
<td>372.3</td>
</tr>
<tr>
<td>M11 NB</td>
<td>81.5</td>
<td>0.0</td>
<td>40.1</td>
<td></td>
<td>70.3</td>
</tr>
<tr>
<td>A10</td>
<td>74.7</td>
<td>50.7</td>
<td>60.7</td>
<td></td>
<td>153.9</td>
</tr>
<tr>
<td>M11 SB (General Traffic)</td>
<td>19.8</td>
<td>21.3</td>
<td>37.3</td>
<td></td>
<td>67.1</td>
</tr>
<tr>
<td>M11 SB (Bus)</td>
<td>2.5</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td>0.0</td>
</tr>
</tbody>
</table>

The appraisal model calculates benefits, taking account of variable journey time savings, for buses and general traffic, between each of the five bus operating time periods, using national average journey purpose...
splits over weekdays and weekends and corresponding values of time for work and non-work travel. Time benefits are assessed separately for bus and car users, based on the modelled changes in delay for the two vehicle types. All benefits are calculated annually, over a 60 year appraisal period, and discounted to the DfT base year 2010 to arrive at the model’s final results as Present Value of Benefits (PVB).

Application of LinSig Results

As described in section 1.3, junction modelling of scheme options in LinSig has produced traffic flows in PCUs and delays in seconds/PCU for the modelled year 2031. Assumptions and methods of transforming and applying LinSig results for economic assessment are outlined as follows.

- **Vehicles**: PCUs are converted to vehicles using a factor of 2.5 for buses and on a 1:1 basis for general traffic. In reality, the mix of vehicle types would vary throughout the day. It is likely that treating PCUs as cars means the economic assessment could be very slightly overestimating the numbers of users among general traffic, but it is considered unlikely that the magnitude of difference in vehicle totals would significantly affect the magnitudes of benefits between options in this case;

- **Journey time changes**: defined as the difference between Do Minimum delays and delays for each option;

- **Growth**: LinSig results for 2031 have been extrapolated to account for growth between the opening year 2021 to 2031, based on an assumption of linear growth using the background growth factors from CSRM between 2016 and 2031. The model assumes no growth in impacts beyond the final modelled year 2031;

- **Peak hour flows to daily flows**: Highways England traffic flow data was available for the M11 Junction 11 northbound off-slip and northbound on-slip. Analysis of data collected during 2015 yielded daily flow profiles for the two slip roads, from which average percentages of flow within defined time periods were derived and used to convert peak hour results to approximate daily flows.

- **Tidal flows**: To reflect diurnal commuting flows of traffic coming to Cambridge in the morning and leaving in the evening, the assessment assumes that variations in traffic volumes throughout the day can be approximated based on flow profiles on the M11 Junction 11 northbound on and off-slips:
  - Flow profiles for turning movements towards Cambridge, including M11 Junction 11 southbound off-slip left turn to Trumpington, can be approximated using M11 Junction 11 northbound off-slip daily flow profiles; and
  - Flow profiles for turning movements leaving Cambridge, including M11 Junction 11 southbound off-slip right turn to A10, can be approximated using M11 Junction 11 northbound on-slip flow profiles;

- **Annualisation**: Standard factors of 253 weekdays and 52 weekends, following TUBA General Guidance and Advice, 5.15.

Bus Service Assumptions

Outputs from separate ‘Bus Transit Line’ service scenario modelling are based on the existence of two proposed services to and from Addenbrooke’s, via the M11 Junction 11. Outline descriptions of the proposed services and frequencies are summarised in Table 1.28.

<table>
<thead>
<tr>
<th>Route (model reference)</th>
<th>Direction</th>
<th>Route description</th>
<th>Assumed frequency (buses/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Inbound – toward Cambridge</td>
<td>Madingley Mulch P&amp;R – M11 – Trumpington P&amp;R – Addenbrooke’s</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Outbound – leaving Cambridge</td>
<td>Addenbrooke’s – Trumpington P&amp;R – M11 – Madingley Mulch P&amp;R</td>
<td>3</td>
</tr>
</tbody>
</table>

### Key Junction Movement Time Benefits

For the key turning movement from the M11 southbound off-slip to Hauxton Road, towards Cambridge, a chart of the magnitudes of journey time savings between the four options is presented in Figure 1.4. The figure shows the relatively small benefits to general traffic as well as showing the variations in journey time benefits for buses.

![Figure 1.4 Journey Time Savings](image)

#### Car Occupancy

In order to calculate benefits, conversion of cars to persons has been based on national average car occupancy rates, by journey purpose from table A1.3.3 of the WebTAG Data Book, which also gives forecast changes in occupancy per annum through to 2036. Car occupancy rates have been calculated for each year accordingly, with zero change from 2036 onwards. A summary of the rates applied in this assessment is presented in Table 1.29.
### Table 1.29 Car Occupancy per Trip and Change per Annum

<table>
<thead>
<tr>
<th></th>
<th>Weekday Average</th>
<th></th>
<th>Weekend Average</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>1.21</td>
<td>-0.44</td>
<td>1.30</td>
<td>-0.48</td>
</tr>
<tr>
<td>Commuting</td>
<td>1.15</td>
<td>-0.59</td>
<td>1.13</td>
<td>-0.52</td>
</tr>
<tr>
<td>Other</td>
<td>1.72</td>
<td></td>
<td>1.96</td>
<td></td>
</tr>
</tbody>
</table>

Source: WebTAG Table A1.3.3

### Bus Passenger Demand Assumptions

‘Bus Transit Line’ scenario modelling forecasts maximum hourly passenger loads, during the 12-hour weekday modelled period 7:00-19:00, where the maximum loading is a measure of maximum total bus occupancy during a given hour. Given the location of the M11 Junction 11 roundabout, situated between the two Park & Ride sites (both of which are likely to be significant pick-up points), this assessment assumes the planned bus services will not have reached their maximum occupancy by the time they traverse the M11 Junction 11 roundabout. Journey time benefits due to the scheme would only be felt by passengers on the buses. The starting point of assessment is 75% of maximum occupancy during the 12-hour modelled period.

Consideration of passenger demand in the non-modelled periods (06:00-07:00 and 19:00-23:00) has been based on factoring passenger demand in line with traffic flow profiles from Highways England TRIS data. Saturday patronage is assumed to be half of weekday patronage and Sunday patronage is assumed to be a quarter of weekday patronage. A summary of the maximum passenger loads from bus modelling and the assumed passenger load for the purposes of this assessment is shown in Table 1.30.

### Table 1.30 Bus Service Periods and Passenger Numbers

<table>
<thead>
<tr>
<th>Service period</th>
<th>Period Start</th>
<th>Period End</th>
<th>Bus model forecast Max Passenger Loads (inbound)</th>
<th>Assumed Passenger Load at M11 J11 (inbound)</th>
<th>Weekday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM off-peak</td>
<td>06:00</td>
<td>07:00</td>
<td>N/A</td>
<td>61</td>
<td>31</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>AM</td>
<td>07:00</td>
<td>10:00</td>
<td>898</td>
<td>707</td>
<td>353</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM</td>
<td>10:00</td>
<td>16:00</td>
<td>352</td>
<td>288</td>
<td>144</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM</td>
<td>16:00</td>
<td>19:00</td>
<td>121</td>
<td>115</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM off-peak</td>
<td>19:00</td>
<td>23:00</td>
<td>N/A</td>
<td>122</td>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sundays</td>
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<td>17:00</td>
<td>N/A</td>
<td></td>
<td>646</td>
<td>323</td>
<td></td>
</tr>
<tr>
<td>Daily total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,371</td>
<td>1,292</td>
<td>646</td>
</tr>
</tbody>
</table>

The bus demand forecasts reflect the commuting demand, with an inbound peak in the morning and outbound peaks in the afternoon to evening. This is visualised in a chart of the Weekday and Saturday demand profiles, shown in Figure 1.5.
Journey Purposes

In order to monetise journey time benefits, car and bus users have been assigned values of time according to their journey purposes. Car user numbers have been based on ‘vehicles’ from traffic counts, while bus user numbers have been based on passenger demand forecasts. This assessment has assumed no changes in trip purpose proportions over time. Trip purpose splits from table A1.3.4 of the WebTAG Data Book are summarised in Table 1.31.

Table 1.31 Trip Purpose Splits

<table>
<thead>
<tr>
<th>Car (% of vehicle trips)</th>
<th>Buses (% of person trips)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weekday average</td>
</tr>
<tr>
<td>Work</td>
<td>6.5</td>
</tr>
<tr>
<td>Commuting</td>
<td>25.4</td>
</tr>
<tr>
<td>Other</td>
<td>68.1</td>
</tr>
</tbody>
</table>

Source: WebTAG Table A1.3.4

1.5.2. Present Value of Benefits

Benefits have been calculated annually from the scheme opening year, 2021, over a 60 year appraisal period and market price values have been discounted to 2010. A summary of total present values of benefits, by option, is shown in Table 1.32.

Table 1.32 Present Value of Benefits for Each Option (2010 Prices, Discounted to 2010)

<table>
<thead>
<tr>
<th></th>
<th>Bus Users</th>
<th>General Traffic</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A (000s)</td>
<td>£459</td>
<td>£109</td>
<td>£568</td>
</tr>
<tr>
<td>Option B (000s)</td>
<td>£394</td>
<td>£98</td>
<td>£491</td>
</tr>
<tr>
<td>Option C (000s)</td>
<td>£607</td>
<td>£128</td>
<td>£735</td>
</tr>
<tr>
<td>Option D (000s)</td>
<td>£656</td>
<td>£1,074</td>
<td>£1,730</td>
</tr>
</tbody>
</table>
The ranking of the four options based on their benefits values (in isolation, i.e. irrespective of costs) are consistent with the ranking of changes in delay for each option, which is as expected given the underlying presumption that travel demand will not change due to the scheme.

### 1.5.3. Reliability Impacts

In terms of reliability impacts, there has been no modelled assessment of benefits but high-level analysis of baseline data indicates that increasing levels of segregation provides increasing levels of journey time reliability due to the potential congestion encountered by online options. The reliability of a bus service is given by how closely the service runs to timetabled times and the increased reliance that the end user is therefore able to place upon the service.

Analysis of data recorded from Real Time Passenger Information (RTPI) systems in Cambridge for all school term days in November 2015 across a range of different infrastructures (On-street with no bus infrastructure provision, on-street with bus lane provision, segregated busway in a rural context and segregated busway in an urban context) demonstrated that in the AM peak there was a significant reduction in the level of variation in journey times (-72% in a rural context, -29% for an urban context) when a fully segregated section of infrastructure was provided for bus service. The provision of bus lanes did show a marginal improvement in levels of variation of -14%.

The level of improvement for a bus lane became more marginal during both the Inter and PM peak periods, where there was less than 5% difference between the variation levels for services that do and do not use a bus lane. However, the level of reliability of a service running on fully segregated infrastructure remains at the same level as the AM peak.

Based on the above high level analysis those options which contain the greatest lengths of dedicated infrastructure are likely to yield the highest levels of reliability benefits, in terms of lower levels of variation from timetabled times throughout the day compared to those services that are using on-line infrastructure. This would enable the end user to have a greater reliance upon the service provided.

Given that all four options are segregated routes, they will all generate reliability benefits by avoiding congestion at the junction. However the variation in reliability impacts between options is expected to be negligible due to the similar levels of segregation across the options.

### 1.5.4. Environmental Impacts

#### 1.5.4.1. Air Quality and Greenhouse Gas Emissions

The proposed scheme has been assessed in general accordance with the Department for Transport’s (DfT) Transport Analysis Guidance (TAG) ,Unit A3 Environmental Impact Assessment (December 2015) and associated worksheets with reference to methodologies within the Highways Agency Design Manual for Roads and Bridges ,Volume 11 section 3, part 1, Air Quality, revision May 2007 (DMRB HA207/07).

Daily average traffic flows, the proportion of heavy duty vehicles (HDV), daily average vehicle speeds, and road link lengths were analysed for the base year (2015) and for the forecast year (2031), for both the Do Minimum and Do Something scenarios for the four options. Traffic data provided was limited to a small area encompassing the M11 Junction 11 southbound off-slips only. The air quality study area for the scheme has been defined based on changes in traffic data and road alignment as a result of the scheme options (i.e. the Do Something scenario compared to the Do Minimum scenario). The change criteria used for defining the affected road network (ARN) for both local air quality, regional air pollution and greenhouse gas assessments are provided in DMRB HA207/07. OS Mastermap data was used to determine the location and the number of sensitive properties within 200m of the ARN.

There are a number of sensitive residential receptors located to the north of Addenbrooke’s Road and east of Hauxton Road. These properties are within 200m of the scheme alignment, specifically the proposed bus-only slip-road in options B and C. Analysis of the traffic data and scheme alignments however concluded that there was no change in flow, composition, speed or alignment which met the criteria which defines the requirement for a quantitative assessment. **The impact of the four options on local air quality, regional air pollution and greenhouse gases is therefore assessed to be not significant with any difference between the options also assessed as not significant.** Monetisation of the impact of the scheme has therefore not been undertaken for these elements.
1.5.4.2. Biodiversity

This section presents the findings of a qualitative assessment of the potential biodiversity impacts of the four proposed route options. The biodiversity appraisal has been undertaken in accordance with the ‘Biodiversity’ sub-objective from the Department for Transport WebTAG Environmental objective. A desk based study was undertaken to review existing information available in the public domain. Although information on statutory sites and select non-statutory sites is available, a data search with the local records centre was not carried out and therefore the list of non-statutory protected sites is not exhaustive. However, this is not considered to be a significant constraint to the available data. As this also means that no species record data was available, only species mentioned in protected site citations were considered in this assessment.

The following meta-databases were searched for protected habitats and species:

- MAGIC (Multi-Agency Geographic Information for the Countryside);
- Cambridgeshire and Peterborough Biodiversity Partnership; and
- Wildlife Trust for Bedfordshire, Cambridgeshire and Northamptonshire.

Ordnance Survey (OS) base maps and aerial photography publicly available from the Google website were reviewed in order to identify the potential ecological and nature conservation features within the study corridor for each of the four route options, including features that could be impacted upon both during the construction and operational phases of the development. During the desk based study particular attention was paid to the presence (or potential presence) of the following within the study corridor for each route option:

- Internationally statutory designated sites (Special Areas of Conservation (SAC), Special Protected Areas (SPA), Ramsar sites) - search radius of up to 10km;
- Statutory designated sites (including Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNRs) and Local Nature Reserves (LNRs)) - search radius of up to 2km;
- Non-statutory sites (including County Wildlife Sites (CWS)) - search radius of up to 2km;
- Watercourses (including rivers, canals, ditches / drains and streams) - search radius of up to 50m;
- Waterbodies - search radius of up to 50m concerning direct impacts from the scheme and 500m for potential impacts to amphibians;
- Woodland - search radius of route and directly adjacent;
- Hedgerows - search radius of route and directly adjacent;
- Other habitats - search radius of route and directly adjacent; and
- Protected/notable Species\(^6\) - dependent on habitat requirements.

For this desk based options appraisal, the ecological features along a particular route option have been grouped by habitat type unless a site is afforded a designation in which case their potential importance has been stated based upon the potential importance of the site given its nature conservation status (assuming its ability to support populations of protected species). With the exception of ponds and watercourses, ecological features have been described where the potential route options pass through (or over) or are immediately adjacent to the feature. Watercourses and water bodies have been described where they fall within 50m of the route option to consider the potential impacts that each route option could have upon water quality and associated ecosystems. This search area was extended to 500m when considered potential impacts to amphibians. The findings of the above study have been used to identify the biodiversity impacts associated with each of the four route options, the results of which are presented in the WebTAG worksheets. Key assumptions are as follows:

- No data was collected from the Cambridgeshire and Peterborough Environmental Record Centre, who may hold additional information on protected species records or designated sites that could support further assessments.
- The ecological appraisal of the route options has been based wholly upon information obtained during a desk study; no field work has been undertaken as part of the ecological constraints appraisal.

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\(^6\) Notable species are taken as principal species for the conservation of biodiversity listed under Section 41 of the Natural Environment and Rural Communities Act 2006; any species listed under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended); any species listed under Schedule 2 or Schedule 4 of the Conservation of Habitats and Species Regulations 2010 (as amended); any species listed in an IUCN Red Data Book and any listed under the local biodiversity action plan (LBAP).
• The indicative baseline conditions for the four route options have been determined based upon OS base maps and aerial photographs at the time of the assessment. It was not possible to confirm the date that these photographs were taken and therefore the conditions that they present, which are described within this report, may differ from those which are actually present within the study corridor of the route options.

• Due to the scale of the OS base maps and aerial photographs used during the appraisal it is possible that ecological features such as smaller ponds, drains and streams have been missed when determining the indicative baseline conditions. It is also difficult to determine the classification of grassland from aerial photographs; therefore valuable neutral and semi-improved grassland may have been missed when determining the indicative baseline conditions.

• The likely potential for protected and notable species to be present within habitats along the three scheme options has been determined from aerial photographs and would require confirmation through field walkover surveys which may be required as part of more detailed future assessment.

Options A and B have the summary assessment score of slight adverse and Options C and D have a score of moderate adverse, based on the current information available. These options have received these categorisations under the principal of ‘most adverse category’, where each scheme is assessed to reflect the most adverse assessment of the affected resources. For example options A and B are primarily located within the existing M11 and A1039 road networks, and therefore impacts are overall considered to be lower in comparison to the other two routes. These routes have the potential to have slight adverse impacts to Trumpington Meadows reserve during the construction phase. These options are likely to impact habitats directly adjacent to the existing roads, including verge habitats and fields and these have the potential to support a variety of species. It is considered that standard mitigation measures could potentially be incorporated into the scheme design and programme to reduce the likelihood of indirect impacts to habitats during the construction and operational phases.

For Option C, the route veers slightly away from the existing road network. The route may have a moderate adverse impact on Trumpington Meadows and slight adverse impacts to the fields that this route would cut through. This route could also have slight adverse impacts on Eversden and Wimpole Woods SAC due to potential impacts to habitat suitable for use by bats. This option may also have wider slight adverse impacts on habitats in the surrounding area, for example indirect impacts to Byron’s Pool Local Nature Reserve via potential impacts to the River Cam. These habitats have the potential to support a variety of species, which could also suffer slight adverse impacts from the scheme. These species include great crested newts, otter, badger, reptiles, bats, birds and other notable mammal species including harvest mouse, brown hare, polecat and hedgehog, invertebrates and protected plant species (though it should be noted that at this stage of the assessment these species have not been confirmed as being present within the scheme area). It is also considered that mitigation measures could be included to reduce the likelihood of indirect impacts, although it may not be possible to reduce the impacts resulting from any loss of habitats located along the proposed route.

For Option D, the route veers away from the existing road network at a location further north along the M11 than the route in Option C. The scheme would likely have a moderate adverse impact to Trumpington Meadows and a slight adverse impact to fields due to the proposed route cutting through these areas. This option could have a slight adverse impact on Eversden and Wimpole Woods SAC due to the removal of habitat suitable for use by bats and possible disturbance to foraging and commuting routes of bats. This route would cross the River Cam, possibly causing moderate adverse impacts on this watercourse and habitats downstream including Byron’s Pool Local Nature Reserve. This route would result in wider impacts to surrounding habitats including the potential loss of waterbodies, a hedgerow and areas of woodland. As a result, this route would likely have moderate and slight adverse impacts on a variety of species. These species include great crested newts, otter, badger, reptiles, bats, birds and other notable mammal species including harvest mouse, brown hare, polecat and hedgehog, invertebrates and protected plant species (though it should be noted that at this stage of the assessment these species have not been confirmed as being present within the scheme area). Mitigation measures could be included to reduce the likelihood of indirect impacts, although it may not be possible to reduce the impacts resulting from any loss of habitats located along the proposed route.

The following further surveys and assessments are recommended to be able to evaluate the preferred option in more advanced appraisals:
• Request for information from Cambridgeshire and Peterborough Environmental Record Centre detailing species records and designated sites (statutory and non-statutory) in the vicinity of the routes;
• Habitat Regulations Assessment for the Eversden and Wimpole Woods SAC;
• Extended Phase 1 habitat survey of the preferred Option, including construction site access routes / compounds to record evidence of protected/notable species or assess the likelihood of the habitats present to support such species; and
• Further surveys / mitigation may be required after the initial extended Phase 1 habitat survey was completed if suitable habitats for protected species are found.

1.5.4.3. Historic Environment

The impacts appraisal for Historic Environment has been carried out in accordance with:

• Department for Transport, TAG unit A3 Environmental Impact Appraisal, December 2015.

The features of key historic environment assets within a study area 200m either side of the proposed route options have been described in Historic Environment Appraisal Worksheets. A separate worksheet has been completed for each route option. The form, survival, condition, complexity, context and period of the historic environment assets within the study area are described within each worksheet. This includes description of the setting of historic environment assets under definition of ‘context’. Assessment has then been carried out in accordance with the Appraisal guidance (DfT 2015), and a score has been determined based on the criteria in Table 8 of the guidance.

Designated and non-designated historic environment assets identified for the appraisal comprise the following:

• Historic buildings, including listed buildings;
• Areas, such as registered parks and gardens, conservation areas, historic landscape features and designed spaces; and
• Archaeological sites, including scheduled monuments, and sites where only below ground remains survive.

Data on the nature and extent of these assets has been obtained from the Cambridgeshire Historic Environment Record, which includes information from aerial photographic analysis, investigations already carried out within the study area, and from spot finds of archaeological material from the plough soil or retrieved through metal detection.

Appraisal has been carried out based on the presence of known assets, as well as an assessment of potential for below ground archaeological remains to be present in areas of new land take. These remains are not known certainly to exist, but their presence is assumed based on data from within the study area. In establishing the appraisal scores three considerations have influenced the results above all others:

• The amount of offline development required, which may affect both the form and character of the historic landscape;
• The likelihood of destroying below ground archaeological remains in areas of new land take; and
• The proximity of options to key assets, such as conservation areas or listed buildings, whose settings may be affected by the presence of high quality bus priority infrastructure.

Option A may have a neutral effect on the historic environment. As the option would follow existing road infrastructure, it may not affect the fabric or setting of historic environment assets. Construction of the option would be within the existing road corridor, and therefore it is likely any archaeological remains would have already been disturbed or removed by previous construction work.

Option B may have a slight adverse effect on the historic environment, resulting from the loss of possible archaeological remains of low value and their context, though, where suitable, mitigation could be carried out to provide better understanding of these assets. Construction of the option along Hauxton Road would involve construction within areas of previously undisturbed land which may contain
archaeological remains. Any such remains may be removed or truncated by the construction work. As the option would follow closely existing road infrastructure, it may not affect the setting of historic environment assets.

**Option C** may have a moderate adverse effect on the historic environment, resulting from the loss of possible archaeological remains of low value and their context, though, where suitable, mitigation could be carried out to provide better understanding of these assets. Construction of the dedicated bus-only slip-road would involve extensive construction within areas of previously undisturbed land which may contain archaeological remains. Any such remains may be removed or truncated by the construction work. Though the option would involve the construction of new road infrastructure in undisturbed areas of farmland, it is unlikely that this will affect the setting of historic environment assets.

**Option D** may have a large adverse effect on the historic environment, resulting from the loss of possible archaeological remains of high value and their context, though, where suitable, mitigation could be carried out to provide better understanding of these assets. Two scheduled monuments are located on or adjacent to the alignment of the option: a settlement complex north east of Haslingfield and a Romano-British settlement site south west of Trumpington. Construction of the dedicated bus only link road would involve extensive construction within this landscape. The route follows the line of a disused railway, and existing road infrastructure, which may have resulted in the removal of any archaeological remains; nevertheless any remains which do survive may be of high value, and may be further disturbed. Though the option would involve the construction of new road infrastructure in undisturbed areas of farmland, it is unlikely that this will affect the setting of historic environment assets.

Once an option has been selected full analysis of the nature, extent and significance of above and below ground assets should be carried out in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 2 Cultural Heritage; Highways Agency, 2009. This must include the assessment of potential for significant buried archaeological remains within the chosen option corridor and development of proposals for suitable mitigation of any loss of archaeological information that may result from construction of the scheme. In the design of the scheme consideration should be given to the significance of the landscape setting of significant assets, in particular Scheduled Monuments.

1.5.4.4. Landscape

The assessment follows the five step approach to appraising ‘environmental capital’ described in TAG Unit A3, Environmental Impact Appraisal, December 2015, Chapter 5. As stated in Chapter 6 of TAG Unit A3 “the level of detail to which landscape character assessment and appraisal is undertaken depends very much on the purpose of the exercise and the scale of the landscape in question”. The Landscape Appraisal Worksheet has been used to capture the assessment. A separate Townscape Appraisal Worksheet has not been completed, this is due to the type and location of the proposal within the landscape. Any impacts on the townscape environment have been considered and reported within the Landscape Appraisal Worksheet. A study area of 1km from the route options has been used to identify the ‘key environmental resources’ that may be affected by the proposals in relation to landscape. The extent of this study area was identified through a site visit undertaken by two Chartered landscape architects and the potential for significant effects on landscape and visual receptors as a result of the proposals within their context. The Worksheet describes the landscape elements of the environment that provide qualities and functions which are considered by the community (local, regional, national or international) to be of particular value. This analysis has been informed by a range of data sources described below. The analysis then describes what matters, why it is important and how that may change over time in the absence of the proposal. Step 2 and 3 of the worksheets are consistent for all options to allow a comparison of the effects of each on the landscape resource of the area to be made. For each option, an overall assessment score has been derived using the seven point textual scale provided in Table 4 of TAG Unit A3.

The following broad assumptions have been made to inform the assessment at this stage:

- Potential visibility of the proposals from sensitive receptors has been derived on the basis of professional judgement made on the basis of desk-study, site walkover and assumed requirements for vegetation/earthworks removal. Actual visibility of the proposals may be lesser or greater than anticipated and would need to be verified through further design and development of environmental design/mitigation proposals.

- The level of some impacts described have the potential to be reduced through careful coordinated landscape/engineering design and mitigation of the proposal at later stages.
The level of impact described is undertaken on the basis of the overall landscape resource of the study area and not specific landscape and visual receptors. Impacts on specific receptors may be lesser or greater than those identified for the overall landscape resource.

The following information sources have been used to inform this stage of the study:

- Ordnance Survey Terrain 50;
- CPRE Tranquility Map, 2007;
- Mapping data from Natural England including Country Parks, Local Nature Reserves, Common Land, Ancient and Semi-Natural Woodland, Planted Ancient Woodland Sites, Sites of Specific Scientific Interest, Traditional Orchards and Special Areas of Conservation;
- Mapping data from Historic England including Listed Buildings, Registered Parks and Gardens and Scheduled Monuments;
- South Cambridgeshire Local Plan, 2013;
- Cambridge Local Plan, 2014;
- Cambridge Green Belt Study, 2002;
- Cambridge City Council and South Cambridgeshire District Council Inner Green Belt Boundary Study, December 2012;
- National Character Area profile: 87. East Anglian Chalk (NE529), Natural England, March 2015;
- National Character Area profile: 88. Bedfordshire and Cambridgeshire Claylands (NE555), Natural England, April 2014;
- Cambridge Landscape Character Assessment, Cambridge City Council, April 2003;
- Cambridgeshire County Council Conservation Areas and Public Rights of Way;
- South Cambridge District Council Tree Preservation Orders;
- Cambridge City Council Tree Preservation Orders; and
- Google Earth.

The summary assessment score for each of the options on the overall landscape resource of the study area is set out below:

- Option A – Neutral;
- Option B – Neutral;
- Option C – Slight Adverse; and
- Option D – Moderate Adverse.

Option D is judged to result in the largest impact on the landscape resource as it would result in a notable new element of transport infrastructure that would pass across the River Cam and through Trumpington Meadows Country Park. This would result in vegetation loss, a decrease in tranquillity and visual impacts to users of the Country Park and nearby residents of the new development. It is judged that it would not be possible to fully integrate the proposal within the landscape and would be at odds with the local landscape pattern.

Option A is judged to result in the lowest impact on the landscape resource as it would result in an incremental change to the existing character within the vicinity of M11 J11. This change would be localised and its influence would not extend into the wider landscape.

There are opportunities to mitigate the identified impacts to some degree and integrate the proposal into the landscape through careful consideration of the layout, design, retention of boundary vegetation and limiting the height of lighting proposals.

For the next stage of design the following tasks should take place to enable successful integration of the selected proposal/s into the landscape and to fully understand the level of potential impacts on the landscape and visual resource:

- Develop a coordinated project vision that pulls together engineering, development and environmental requirements.
- Prepare a concept landscape design strategy to identify how selected options could integrate with the wider landscape and townscape, align with the Cambridgeshire Green Infrastructure Strategy.
and meet the requirements of the Cambridgeshire Landscape Guidelines, particularly with regards to the River Cam and Trumpington Meadows Country Park.

- Hold a series of cross-discipline workshops to develop the engineering alignment of selected options.
- Commission a tree survey along the corridor to enable tree losses to be avoided where possible and to understand the quality and type of vegetation lost so it can be appropriately mitigated.

1.5.4.5. Noise

This section describes the methodology, baseline and assumptions for the noise assessment. The scheme has been assessed in general accordance with the Department for Transport’s Transport Analysis Guidance (TAG), Unit A3 Environmental Impact Assessment (December 2015) and associated worksheets with reference to methodologies within the Highways Agency Design Manual for Roads and Bridges, Volume 11 section 3, part 7, Noise and Vibration, revision November 2011 (DMRB HD213/11).

Traffic flows in 18hr AAWT, the percentage of heavy duty vehicles (HDV) and daily average vehicle speeds (kph) were analysed for the forecast year (2031) for both the Do Minimum and Do Something scenarios for the four options. For each option, the bus link option is approximately 1.5km long and links the M11 to Trumpington Park and Ride stop. Traffic data provided was limited to a small area encompassing the M11 Junction 11 southbound off-slips only, as well as the traffic on the bus route. The traffic on each of these links was identical in all scenarios. Traffic volumes from the M11 were not provided. In accordance with the guidance from within DMRB, the study area was defined within 600m of the route of the physical works associated with the road project, as well as any roads being bypassed or improved by the schemes; this is the affected road network (ARN). For the purposes of this assessment, the wider area was not considered. Noise level predictions were carried out at the nearest noise sensitive properties. Where AAWT traffic flows were greater than 1000 vehicles, noise levels were predicted using ‘Calculation of Road Traffic Noise’ (CRTN). For the offline bus routes, the Noise Advisory Council’s ‘Guide to Measurement and Prediction of Equivalent Continuous Sound Level Leq’ was used. The noise from other sources of noise, such as the Park and Ride were not taken into account. OS Mastermap data was used to determine the location and the number of sensitive properties within 600m of the ARN. The study area was the same for all options. This data does not include any permitted developments. There are two Noise Important Areas in the noise study area, as shown in red in Figure 1.6. No noise surveys have been carried out for this stage of the project.

Figure 1.6 Noise Important Areas from Extrium Web Viewer

Source: http://extrium.co.uk/noiseviewer.html

There are a number of sensitive residential receptors located to the north of Addenbrooke’s Road and east of Hauxton Road, south east of the park and ride, the closest of which are on Beech Drive/Harness Close.

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There is also Trumpington Meadows Primary School to the north west of the Park and Ride. These properties are within 600m of the scheme alignment. Although the distance from these properties to the bus link varies, the traffic on the Hauxton Road is more significant than the traffic on the bus links. Indicative noise level predictions have been carried out at the two closest noise sensitive receptors, where the basic noise level from the bus lanes was found to be 50dB and 70dB from Hauxton Road, both at 10m.

Analysis of the traffic data and scheme alignments concluded that there was no significant difference between the traffic flow, composition, speed or alignment, and therefore, the impact of the four options on local noise and vibration is assessed to be not significant with any difference between the options also assessed as not significant. On the basis of there being no predicted changes in noise, the monetisation of the impact of the scheme is expected to be zero for all schemes.

1.5.4.6. Water Environment

A desk-top assessment has been undertaken. The spatial scope of the assessment includes, as a minimum, features of the water environment within 1km of the options. The options have been categorised/graded based on the following criteria:

- The number of new river/drain watercourse crossings (principal criteria);
- Groundwater status (aquifer status);
- Flood risk; and
- Proximity to designated sites.

The method of assessing the importance, magnitude and significance of effects is stated within tables in the Transport Appraisal Guidance (TAG) Unit A3 (Department for Transport, December 2015) (Chapter 10 Tables 13 - 17) and has not been reproduced in this section.

At this stage, a high level desk-based assessment has been undertaken using the following publicly available data (largely web-based):

- Environment Agency online - Catchment Data Explorer;
- Environment Agency online - What’s In Your Backyard;
- Highways Agency Drainage Data Management System (HADDMs);
- MAGIC website; and
- Ordnance Survey (OS) open data (10k) in conjunction with latest design drawings.

The following assumptions have been made:

- The assessment considers the most recent option alignments;
- The assessment is based on existing data sources and has not been verified through a site walkover survey;
- It is assumed that the provision of mitigation or compensation for any effects will be equally effective for each option. To date, no investigations have been made of potential opportunities to mitigate scheme effects which may only be associated with particular options;
- The feasibility of adapting drainage infrastructure to derive benefits to the water environment has not been investigated;
- The vulnerability of the Principal Aquifer (Cam and Ely Ouse Chalk) is assumed to be consistent between the options; and
- It is assumed that cumulative effects will be comparable for each option.

The impact and overall score are based on the assumption that no mitigation is applied above standard design practice. However, when mitigation is in place, proportional to the scale of adverse impact, it is likely that any impacts can be minimized.

Option D is the only option which crosses new watercourses. It crosses four, including the River Cam WFD waterbody. Based on this, at the time of reporting this is potentially the highest impact for the water environment. Option A is the lowest impact for the water environment as the proposed works are smaller in scale and within the existing highway boundary. All options are subject to the same issues with respect to groundwater, i.e. underlain by a Principal Aquifer. The length of the new road for each option has been used as the basis for differentiating their relative effects.
Areas of uncertainty are considered as follows:

- Data quality – desk study, using mainly web-based data has only been reported at this stage and therefore the level of detail is limited and in some case unknown. For example, the exact number of other surface watercourses is unknown due to inconsistencies between OS base mapping and digital river mapping;
- Data quantity – as per quality, only open, freely licensed data has only been reported at this stage and therefore the amount of detail is limited;
- No specific consultation with relevant bodies has been undertaken;
- Ground-truth – in the absence of site visits and consultation of key stakeholders at the time of reporting, site specific data is limited;
- Cumulative impact assessment (CIA) – no data is available at the time of reporting on other schemes, projects, strategies and plans within the study area;

The following measures are proposed for the next appraisal stage:

- Formal data request to statutory stakeholders;
- Consultation with the Environment Agency, Lead Local Flood Authorities and other relevant stakeholders;
- Details on the proposed drainage strategy should be gathered to inform the surface water quality tests;
- Details of the proposed watercourse crossings in order to assess potential morphological effects of the scheme;
- Proposed traffic volume data should be obtained;
- Policy and legislation review;
- Details of existing ground conditions to assess feasibility of infiltration techniques such as soakaways, infiltration trenches and infiltration basins, accounting for the sensitivity of the Principal Aquifer;
- Surface water assessment using the Design Manual for Roads and Bridges (DMRB) (HD45/09) November 2010, accompanied by the use of the Highways Agency Water Risk Assessment Tool (HAWRAT);
- Groundwater assessment using the DMRB (Method C);
- More detailed assessment of flood risk for the preferred Option, presented in a Flood Risk Assessment (FRA) to accompany any planning application;
- Consultation with the Environment Agency to determine if a WFD compliance assessment is required and the scope of the assessment;
- Geomorphology and WFD assessment criteria to be confirmed; and
- In combination effects and cumulative impacts from other proposed schemes should be considered.

### 1.5.5. Distributional Impacts

Distributional impacts relate to the extent to which there are differences in the way impacts affect different groups in society. For example, the noise impacts of an intervention will affect different groups of households, with some experiencing increases, and others decreases. Depending on the geographical locations of different groups of people, these groups will each experience varying impact. This section outlines the key option-specific findings of the DI assessment undertaken.

The approach outlined in the DfT’s guidance ensures that the DI appraisal is proportionate to the scale of the issue and follows a process to ascertain whether a full appraisal is required. Table 1.33 shows this process, detailing key decision-making points as illustrated by the three identified steps.

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<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Output</th>
</tr>
</thead>
</table>
| 1    | Screening Process:  
- Identification of likely impacts for each indicator. | Screening Proforma |
1.5.5.1. Screening (Step 1) – Approach

The initial screening assessment considered the likely positive and negative impacts of the scheme using the eight DI indicators in relation to specific vulnerable groups, including children, older people, people with a disability, Black and Minority Ethnic (BME) communities, people without access to a car and people on low incomes.

A number of key questions are posed in a Screening Proforma published by the DfT which are considered during the initial screening. The questions cover the following:

- Is the option being considered likely to have negative or positive impacts on specific groups of people, including children, older people, disabled people, Black and Minority Ethnic (BME) communities, people without access to a car and people on low incomes?
- Can the likely impacts be eliminated or mitigated through re-design or amendment?
- Are the impacts either significant or concentrated?

1.5.5.2. Screening (Step 1) – Key Findings

The findings from the screening are summarised in Table 1.34.

Table 1.34 Summary of Proforma

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Potential impact</th>
<th>Proceed to Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>User benefits</td>
<td>Yes</td>
<td>Yes - distribution of benefits will need to be examined.</td>
</tr>
<tr>
<td>Noise</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Air quality</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Accidents</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Security</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Severance</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Accessibility</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Affordability</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
1.6. Option Performance

This section will bring together the costs and benefits to understand the value for money of each option. As noted earlier, subsequent to the analysis outlined in this Economic Case, and in particular the high-level desk-based environmental assessment, some of the option alignments have been refined and developed as discussed in the Strategic Case. However these refinements and developments are not captured in this Economic Case in terms of a formal assessment of costs, traffic impacts and benefits. Option performance in this Economic Case is based on the options described in section 1.2.4 and does not capture the subsequent refinements.

An economic appraisal of the four shortlisted routes has been undertaken in accordance with the DfT’s WebTAG guidance and is summarised in the following economic results:

- Present value of benefits (PVB) giving the monetised value of the benefits arising from the scheme;
- Present value of costs (PVC) giving the net cost to the public sector of constructing, maintaining and operating the new infrastructure after adjustment for revenues received;
- Benefit Cost Ratios (BCRs) giving the ratio between Present Value Benefits (PVB) divided by the Present Value Costs (PVC)

As required by WebTAG, PVB’s and PVC’s are all shown in 2010 prices discounted to 2010 to take account of the differences of when the benefits and costs occur over time. Table 1.35 summarises the PVB, PVC, Net Present Value (NPV) and BCR for each option as well as the environmental impacts.

Table 1.35 PVB, PVC, NPV, BCR and Environmental Impacts for Each Option

<table>
<thead>
<tr>
<th></th>
<th>Option A</th>
<th>Option B</th>
<th>Option C</th>
<th>Option D</th>
</tr>
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<tbody>
<tr>
<td>PVB Bus Users (000s)</td>
<td>£459</td>
<td>£394</td>
<td>£607</td>
<td>£656</td>
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<tr>
<td>PVB General Traffic (000s)</td>
<td>£109</td>
<td>£98</td>
<td>£128</td>
<td>£1,074</td>
</tr>
<tr>
<td>PVB Total (000s)</td>
<td>£568</td>
<td>£491</td>
<td>£735</td>
<td>£1,730</td>
</tr>
<tr>
<td>PVC (000s)</td>
<td>£4,526</td>
<td>£1,855</td>
<td>£15,700</td>
<td>£12,207</td>
</tr>
<tr>
<td>NPV (000s)</td>
<td>-£3,908</td>
<td>-£1,345</td>
<td>-£14,790</td>
<td>-£10,345</td>
</tr>
<tr>
<td>BCR</td>
<td>0.13</td>
<td>0.27</td>
<td>0.05</td>
<td>0.14</td>
</tr>
<tr>
<td>Air Quality</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Slight Adverse</td>
<td>Slight Adverse</td>
<td>Moderate Adverse</td>
<td>Moderate Adverse</td>
</tr>
<tr>
<td>Historic Environment</td>
<td>Neutral</td>
<td>Slight Adverse</td>
<td>Moderate Adverse</td>
<td>Large Adverse</td>
</tr>
<tr>
<td>Landscape</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Slight Adverse</td>
<td>Moderate Adverse</td>
</tr>
<tr>
<td>Noise</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Water Environment</td>
<td>Moderate Adverse</td>
<td>Moderate Adverse</td>
<td>Moderate Adverse</td>
<td>Large Adverse</td>
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</table>

The BCRs for all options are very poor. Option D has the highest PVB but Option B has the highest BCR due to the relatively low cost. The PVBs for each option are consistent with the outputs from the LinSig model. The PVB for car time for Option D is relatively high because this option has more impact on general traffic approaching the junction from the M11 southbound in both the AM and PM peaks. This is because the bus-only slip-road in option D leaves the M11 southbound earlier than the other options so general traffic approaching the junction from the M11 southbound is free of bus traffic for a longer period. In terms of bus delay, option B is the worst performing option because the bus-only slip-road terminates at Hauxton Road and the bus service then re-joins the main carriageway with general traffic. Option D results in the lowest bus delay and is therefore the best performing option. The delay benefits of each option are greater in the AM peak than the PM peak because there is more traffic congestion in the AM peak than the PM peak.

The poor BCRs are a result of the combination of high costs of construction of offline infrastructure and the modest modelled transport benefits reflecting the limited impact of the scheme and the low demand for...
public transport by commuters and business travellers due to the relatively faster journey times of car and high levels of car dependency in Cambridgeshire.

Options A and B are the best performing options in terms of limiting impact on the local environment. In terms of engineering and design, a preferred solution is not forthcoming as each option presented has their own strengths and weaknesses. Option C potentially provides the best engineering solution, but is also the most expensive.

With all of the options presented, further investigations to assess their viability is recommended, including liaison and collaboration with all key stakeholders. The compilation of additional information including proposed developments and infrastructure will provide greater certainty with respect to the proposed alignments as well as the estimated costs. This will therefore enable a more informed decision to be made with respect to the preferred solution. The interaction between the scheme and Trumpington Park and Ride will need to be reviewed in greater detail. Bus services and patronage are being assessed as part of the Western Orbital business case.

The value for money assessment is based on early stage option design development. The costs and benefits are subject to change through more detailed analysis that may allow for design and benefits optimisation and thereby increase the ratio of benefits to costs.
M11 Junction 11 bus-only slip-road
Strategic Outline Business Case – Strategic Case
City Deal Partners
25 November 2016
Notice

This document and its contents have been prepared and are intended solely for the City Deal Partners’ information and use in relation to the M11 Junction 11 bus-only slip-road business case.

Atkins assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 68 pages including the cover.

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1. Purpose of Document

1.1. Purpose of the Strategic Case

The Strategic Case sets out the evidence that demonstrates the need for a transport scheme.

According to the Department for Transport (DfT) publication The Transport Business Cases, the primary purpose of the Strategic Case is to clearly articulate the case for change and the need for a project.

Given that there are many calls on public investment, it is essential that a transport scheme is able to provide convincing evidence of need along with evidence of how transport and wider policy objectives are likely to be addressed as a direct result of the intervention. This involves comparing the intended benefits with a “Reference Case” or Do-Minimum situation where the scheme would not be built, but where other planned infrastructure and development (such as already approved transport schemes, housing and mixed-use) does take place.

The purpose of the Strategic Case is to set out the strategic and policy context, demonstrate the need for the scheme and provide an initial strategic assessment of the scheme options impact in addressing transport and wider policy requirements.

The assessment and demonstration of the need for a transport scheme follows a clear logic chain (Figure 1-1).

Figure 1-1 Logic Chain for the Strategic Case

The Logic Chain approach demonstrates a clear progression from the scheme context through to the transport outcomes and higher level strategic impacts that will be delivered by the scheme.

---

1.2. Strategic Outline Business Case

The Strategic Outline Business Case (SOBC) sets out the case for change and how this will further the Sponsors’ aims and objectives (the strategic fit). It provides suggested or preferred ways forward and presents the rational supporting the strategic case for a decision.

Atkins has been commissioned by the City Deal Partners to produce a Strategic Outline Business Case (SOBC) for the M11 Junction 11 bus-only slip-road scheme to inform future decision making and scheme development.

The SOBC will follow the format of DfT and HMT’s 5-case business case model. In specific terms, the OBC:

- Begins to align the progress of the scheme towards achieving the relevant local objectives and confirms the strategic fit with these objectives and articulates the case for change in the **Strategic Case (this document)**;
- Sets out an assessment of the options based on initial findings and provides initial details of the options’ overall value for money, assessing the balance of benefits and costs against objectives in the **Economic Case**;
- Presents the initial investment / intervention proposal and sets out the financial and funding implications for the scheme in the **Financial Case**; and
- Sets out the proposed management and governance approach and commercial situation for procuring and delivering the scheme in the **Management Case** and **Commercial Case**.

At the SOBC stage a key outcome is to make a case for change and outline options that could tackle an identified transport problem. Further detailed assessment is required in future stages of assessment to fully inform a preferred option in the Outline Business Case (OBC) and ‘to continually align the progress of the project towards achieving…objectives’.

**Summary**

There are currently no existing or planned local bus services exiting southbound at the M11 Junction 11 to Trumpington Park & Ride and the Biomedical Campus. As a result, there is no transport need and no strategic case for investment in a southbound bus-only slip-road as a stand-alone scheme, unless future bus routes use the junction, met by financially sustainable bus services.

Without sufficient demand from bus services, a bus-only slip-road would be redundant infrastructure and would not enhance public transport provision or connectivity in line with City Deal goals and wider policy objectives. Any strategic case for investment will, therefore, be reliant on future demand which may come from services being proposed as part of the Western Orbital and Cambourne to Cambridge Better Bus Journeys schemes. If these schemes and services were progressed to implementation, then the M11 Junction 11 bus-only slip-road could provide a direct, fast and reliable route connecting the orbital scheme on the M11 to Trumpington Park & Ride and the Biomedical Campus.

The Western Orbital bus scheme business case and Cambourne to Cambridge Better Bus Journeys business cases are currently being considered separately to the M11 J11 cases (See accompanying business cases).

While there is no transport need and no strategic case for investment in a standalone scheme due to a lack of bus routes using the slip-road, this case also explores the potential rationale for investment should demand be identified in the future.

---

1.3. Structure of the Strategic Case

The strategic case is “objectives-led” and (despite no current rationale for investment) sets out a clear narrative as to how and why investment in public transport on the M11 Junction 11 could deliver benefits to the Greater Cambridge area, if bus routes were to use the junction in the future.

The Strategic Case commences by considering the high level strategic issues and scheme objectives, before proceeding with a detailed analysis of the problems and challenges, setting out the options and concluding with an assessment of the groups of people who benefit. There are individual chapters dealing with:

- The Cambridge phenomenon and vision;
- The Greater Cambridge City Deal;
- The spatial context;
- Spatial, economic and environmental challenges;
- Transport problems to be addressed by the scheme;
- Scheme objectives;
- Option Identification;
- Beneficiaries;
- Performance of options; and
- Conclusions.
2. The Cambridge Phenomenon and Vision

2.1. The Cambridge Success Story

Cambridge is a member of the Fast Growth Cities group that contains some of the UK’s most successful cities in terms of economic indicators such as productivity and knowledge based jobs\(^3\). Cambridge’s GVA per worker was £55,900 in 2014, having grown 21% since 2004. Over the same period Cambridge’s population grew by 14.5\(^3\).\(^3\)

Greater Cambridge competes on a global stage and is a gateway for high-tech investment into the UK. The area is also the innovation capital of the country, with more patents per 100,000 population than the next six UK cities combined\(^4\).

Greater Cambridge’s current economic success is attributed to being a networked and connected city-region characterised by world-leading innovation. Research\(^4\) into the “Cambridge Phenomenon”, the cluster of technology firms around Cambridge, presented in the City Deal Document shows this success is due to:

- A world class university drawing talent into the area from across the globe, fostering innovation and encouraging business spinout which has developed into strong hi-tech, bio-medical and other clusters (with over 1,525 technology companies employing more than 54,000 people and a combined revenue over £12 billion);
- The area’s scale and connectedness which allows overlapping networks to develop and facilitate a culture of co-operation and cross-fertilisation between entrepreneurs and with academics; and
- Being an attractive place and competing with other world cities as a good place for business leaders and their families to live, not just a good place to do business.

Greater Cambridge therefore has a diverse economic base with strengths across a broad base of knowledge-intensive sectors: professional, scientific, bio-medical, clean-tech, technology and advanced manufacturing.

Whilst economic success to date has been widely celebrated, it is now contributing to a shortage of housing and significant transport congestion that threatens to choke off further economic growth and compromise the high quality of life that has hitherto existed.

The City Deal proposes that growth up to 2031 will lead to the need for 33,500\(^5\) new homes and generation of 45,000 new jobs. In order to deliver more jobs, housing and economic growth, and to unleash the next wave of the “Cambridge Phenomenon”, the Greater Cambridge area has to:

- Grow physically to accommodate the houses and employment sites that are spread across the area;
- Maintain ease of movement between key economic hubs - new economic centres of gravity including the Addenbrooke’s Bio-Medical campus to the south, and the University of Cambridge sites to the west and north-west; and

---

\(^3\) Centre for Cities, Williams, M, March 2016: Fast Growth Cities: The opportunities and challenges ahead

\(^4\) City Deal, Greater Cambridge City Deal Document

\(^5\) Figures from city deal website [http://www.gccitydeal.co.uk/citydeal/housing](http://www.gccitydeal.co.uk/citydeal/housing)
• Protect and enhance the high quality of life that contributes so significantly to the area’s attractiveness and success.

**Economic growth in a successful area such as Cambridge is dependent on investing in physical infrastructure capacity that addresses key issues such as housing shortages and a congested transport network, in line with the vision and relevant policies for the area.**

### 2.2. The Vision for Cambridge and South Cambridgeshire

The purpose of a vision is to set out a compelling “alternative future”, so that it inspires people to start taking practical steps towards achieving it. The Cambridge City Council Local Plan (proposed) sets out its vision for Cambridge and highlights the need for sustainable growth that offers opportunities for all citizens.

“The vision for Cambridge is of a compact, dynamic city, located within the high quality landscape setting of the Cambridge Green Belt. The city will draw inspiration from its iconic historic core, heritage assets and structural green corridors, achieving a sense of place in all its parts, with generous, accessible and biodiverse open spaces and well-designed architecture. Building on the city’s reputation for design excellence, **Cambridge’s new development will be innovative and will promote the use of sustainable modes of transport, helping to support the transition to a more environmentally sustainable and successful low carbon economy.** The city will continue to develop as a centre of excellence and world leader in the fields of higher education and research, and will foster the dynamism, prosperity and further expansion of the knowledge-based economy, while **retaining the high quality of life and place that underpins that economic success.** It will also grow in importance as a sub-regional centre for a wide range of services. Housing provision in the city will be of a high quality and will support the development and enhancement of balanced and mixed communities through provision of housing of a mix of sizes and types, including a high proportion of affordable housing. **The Cambridge Local Plan 2014 seeks to guide and facilitate growth and the infrastructure required to support development, so that the city grows in a sensitive and sustainable manner.** This will ensure that the high environmental quality of the city is protected and enhanced and that future developments offer a full range of opportunities to all.6**

The South Cambridgeshire Local Plan is consistent with the Cambridge Local Plan Vision.

“**South Cambridgeshire will continue to be the best place to live, work and study in the country. Our district will demonstrate impressive and sustainable economic growth.** Our residents will have a **superb quality of life in an exceptionally beautiful, rural and green environment**.7”

As part of the transport strategy to deliver this vision, it is stated that there is a need to maximise potential for journeys to be undertaken by sustainable modes of transport including walking, cycling, bus and train.

In terms of public transport, both the South Cambridgeshire and Cambridge Local Plans promote the accessibility of new and existing development by High Quality Public Transport (HQPT), noting that new homes should be located close to employment centres or HQPT routes which have access to the City Centre and major employment centres. HQPT is discussed in more detail in Section 7.5.

This vision is articulated through a number of local economic, planning and development policies which are discussed in more detail in Section 7. In particular these documents are supported by the Transport Strategy for Cambridge and South Cambridgeshire (TSCSC) that sets out a detailed policy framework and programme of schemes for the area and is consistent with the Local Transport Plan 2011-2016 (LTP3). The TSCSC also supports the Cambridge and South Cambridgeshire Local Plans, outlining like transport infrastructure to deliver expected growth8.

The vision set out in the TSCSC is:

“**In the future, Cambridge and the surrounding area of South Cambridgeshire will be renowned for its efficient, accessible and sustainable transport system which will support a thriving and”**

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7 South Cambridgeshire District Council (2013). South Cambridgeshire Local Plan: Proposed submission.
beautiful historic core, and provide efficient and networked links to and from the city, its major employment hubs, and the bustling villages and key centres beyond.

More and more people will walk, cycle or use community or passenger transport as the more sustainable option when travelling. This will help to reduce car traffic on key routes and protect the area’s distinctive character and environment while supporting continued growth of the area as an internationally important cluster for high tech industries and research and development.

There will be an extended network of dedicated passenger transport routes with fast and frequent links to and from key destinations. This will link up with community or local transport at hubs which will connect with some more rural parts of the area. An improved system of safe and direct cycle and walking routes will provide a viable alternative for journeys between key destinations. Information about sustainable travel options will be readily available and new technology will make this even easier to access. This enhanced accessibility will help to sustain and enhance the quality of life and wellbeing of residents.

Both the strategic and local road networks will operate efficiently and reliably, with most car traffic choosing to access the rural hubs or Park & Ride hubs. Accident clusters and congestion hotspots will be addressed and the impacts of congestion on the bus network will be reduced significantly. Although car trips to the city centre will still be possible, they will be channelled along routes away from buses and cyclists. A frequent and reliable rail service with enhanced services and capacity to London, market towns and cities across the region will ensure that rail travel will continue to be a popular choice for a growing number of residents, commuters and visitors. The Science Park Station and improved City Station will provide links to St Pancras International, Stansted and Gatwick airports, to the European mainland, and to the rest of the UK. The Cambridge City Region’s profile as a thriving, attractive and accessible business destination will be further enhanced.”

The Cambridge City deal was set up to align for the wider visions of Cambridge and the wider Sub-Region. The Greater Cambridge City Deal is an agreement to invest in infrastructure to stimulate growth between the government and Greater Cambridge partners – namely Cambridge City Council (CaCC), South Cambridgeshire District Council (SCDC), Cambridgeshire County Council (CCC), the University of Cambridge (UoC) and the Greater Cambridge, Greater Peterborough Local Enterprise Partnership (LEP).

The Cambridge and South Cambridgeshire Local Plans, and the TSCSC, present a clear and distinct overall vision that there is a need to ensure that growth takes place in a sensitive and sustainable manner and that development offers opportunities to all of its citizens. New development will promote the use of sustainable modes of transport and should seek to facilitate the infrastructure required to support growth. The transport system will encourage sustainable modes and will be centred on high quality “dedicated passenger transport routes with fast and frequent links to and from key destinations””. The visions indicates that car use will continue in the future, but that car trips will be on routes away from buses and cyclists.

Ibid.
3. The Greater Cambridge City Deal

3.1. Purpose and Objectives

Since 2010, the government has pursued a policy of devolving increasing levels of powers and funding away from Whitehall and down to local / regional areas.

City Deals are a key part of the devolution process and a means for central government and local partners to agree key investment programmes and outcomes, especially around promotion of local economic growth and development.

The City Deal Assurance Framework establishes the key strategic objectives against which investment projects will be prioritised:

- To nurture the conditions necessary to enable the potential of Greater Cambridge to create and retain the international high-tech businesses of the future;
- To better target investment to the needs of the Greater Cambridge economy by ensuring those decisions are informed by the needs of businesses and other key stakeholders such as the universities;
- To markedly improve connectivity and networks between clusters and labour markets so that the right conditions are in place to drive further growth; and
- To attract and retain more skilled people by investing in transport and housing whilst maintaining a good quality of life, in turn allowing a long-term increase in jobs emerging from the internationally competitive clusters and more university spin-outs.

The OBC will be assessed by City Deal Growth Partnership Members to ascertain the extent to which any transport investment meets the strategic objectives of the City Deal:

1. How do options support business investment and confidence?
2. How do options represent targeted investment where business needs it?
3. How do options link effectively the key growth sites?
4. How do options support the transport infrastructure and quality of life?

In addition the Assurance Framework sets out the requirements of Value for Money in which it states that, “Schemes with a BCR of less than 2:1 will not normally be funded, unless wider appraisal evidence provides a compelling case for investment.”

The document goes on to state that a compelling case may be:

“…where a scheme is required to unlock a barrier to growth, deliver wider economic benefits, environmental and or social/distributional impacts. Where this occurs, scheme promoters will be required to justify the investment through provision of an evidence base and a proportionate quantitative analysis of benefits not included in the central benefit-cost analysis, and to demonstrate how these help deliver the policy objectives, to enable a comparative assessment of the economic case and comparison of the value for money with other schemes in the programme.”

Any proposed City Deal funded transport investment must provide clear evidence that it is able to meet the relevant objectives as well as delivering Value for Money.

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10 Greater Cambridge City Deal Draft Assurance Framework
The City Deal provides the framework through which up to £500 million of funding toward infrastructure is proposed to be invested in the region to “help Greater Cambridge to maintain and grow its status as a prosperous economic area” and toward achieving the following outcomes in support of economic growth:

- Accelerating delivery of over 33,500 new homes on a combination of major sites and rural exception sites in and around the city;
- Delivering 45,000 new jobs, via a number of employment growth sites identified and in development around Cambridge to build on the city’s world leading science research business credentials; and
- Improving transport infrastructure to support this housing and employment growth while retaining the high quality of life in the region.

The last of these outcomes – improving transport infrastructure – is the intended result of the M11 Junction 11 Scheme. However, this investment also is clearly linked back to City Deal objectives, such as the delivery of new homes and jobs; linking growth sites; targeted investment and business investment and confidence. Businesses are more likely to invest in areas that are well connected and have a skilled and mobile workforce than an area that does not have these key attributes that development in Cambridge aspires to.

To that end, the City Deal has created an investment fund for the five year period 2015/16 to 2019/20 – which consists of £100 million from the government (£20 million per year). In addition, Greater Cambridge partners have pledged to invest over £500 million from a range of sources. Depending on the economic impact of this local investment, a “gain share” mechanism could potentially lead to an additional £400 million over a 10-15 year period.

It is essential the transport investment is targeted in a way that delivers strongly against each of the City Deal objectives; improving quality of life and connectivity whilst ensuring business investment, confidence and the provision of more housing is encouraged in line with the Local Plans. In turn this will maximise the wider economic benefits that can be achieved through infrastructure investment.

3.2. The City Deal Proposal

In order to deliver planned numbers of jobs and economic growth, the Greater Cambridge city region has to accommodate new and expanding businesses and research centres and house the people who work in them. The region needs to ensure ease of movement between the City Centre, new developments, research institutes, science and business parks; transport hubs, the Alconbury Enterprise Zone, universities and residential areas.

To achieve this, the City Deal proposes an ambitious programme to enhance transport capacity, especially in areas where capacity is identified as an issue (Figure 3-1). This capacity is needed along key strategic corridors to and from the city (particularly along those corridors where significant new housing and / or employment growth is planned) as well as within the built up area of the city. Development of a sustainable transport network aims to improve access to employment hubs and high-tech clusters in Greater Cambridge by making movement between them more straightforward, efficient and convenient (Figure 3-2).

The backbone of the proposed strategy is a transport network that links areas of population and employment within the City Deal area, featuring:

- New orbital bus routes around Cambridge that taken together provide a wider variety of direct bus connections than would be traditionally possible under a traditional radial city centre “hub and spoke” model;
- New high quality public transport services into Cambridge on key corridors, connecting existing and new housing developments with major employment centres;
- A comprehensive network of pedestrian and cycle routes within Cambridge; and
- The main radial and orbital routes will have high quality bus priority measures that protect services from congestion and provide journey times that are competitive with the private car.

This strategy aims to transform connectivity within City Deal area, and consequently allow significant increases in bus and cycle use that will maximise the capacity for movement, particularly within the historic core of Cambridge. This strategy also supports carbon reduction objectives and promotes high quality of life for local communities, by minimising the environmental impact of transport whilst promoting the ability for the area to grow.

Figure 3-1 Planned Growth and Pressure on the Transport Network
Figure 3-2  City Deal Transport Investment Package

Figure 3-1 identifies potential capacity constraints on the network. Junction 11 of the M11 is identified as having ‘severe capacity issues’ (See Section 6). In the future, queuing traffic on the M11 Junction 11 southbound slip-road would have a negative impact journey times for potential new services exiting at the junction. Figure 3-2 shows the City Deal Transport Interventions that have been identified as potential solutions for capacity issues. Option 5a identifies a proposed orbital bus corridor (the ‘Western Orbital’) to serve West Cambridge and Addenbrooke’s (including both the hospital and biomedical campus, via Trumpington Park & Ride).

Because there is no current local bus routes that use the southbound M11 J11 slip-road, there is no strategic case to provide a standalone bus-only slip-road scheme. Despite congestion, there is no current need for transport investment based on making improvements for bus services.

Future forecast demand from buses using the Cambourne to Cambridge Better Bus Journeys and Western Orbital schemes, may provide a future strategic rationale for investment. The Western Orbital route is considered in a separate business case and the M11 J11 bus-only slip-road will provide a phase of infrastructure (Figure 3-2, Intervention 5a) for any future bus services to bypass any congestion and facilitate fast and reliable journey times to Trumpington Park & Ride and the Cambridge Biomedical Campus. In this case the slip-road scheme could also support wider growth in housing and other development by improving connectivity to the Cambridge Southern Fringe, where up to 4,400 homes could be constructed, and the Biomedical Campus (Figure 3-1).
3.3. Links to the Western Orbital and A428

The Western Orbital scheme is particularly important to view in combination with the M11 Junction 11 scheme as it may be an enabler of future demand (Figure 3-3). The Western Orbital aims to create a new, fast and reliable link for bus services that could run between the west and south of Cambridge either along or near the M11.

In order to progress from A1303 Madingley Road to the development areas in the south of the city (e.g. around Addenbrooke’s), buses currently traverse the congested City Centre. Bus operator Stagecoach timetables its “Uni 4” service at 32 minutes for a journey of just five miles. It is estimated that journeys along an M11 bus link would take approximately 18/19 minutes; and a bus link parallel to the M11 approximately 15/16 minutes. This could allow bus services to benefit from significant journey time and reliability improvements, potentially increasing the attractiveness compared to the private car.

Given the scale of existing and future development to the south of Cambridge, there could be significant potential demand for a direct orbital journey at times competitive with the private car (which can already use the M11 to bypass the City Centre). A combination of the Cambourne to Cambridge Better Bus Journeys (via the A428), Western Orbital and M11 J11 bus-only slip-road schemes could open up a much wider range of public transport possibilities and deliver an integrated network that links corridors and the various development areas, especially in the West of Cambridge (Figure 3-4).

Without future local bus demand that would use the M11 J11 southbound slip, there is no rationale for investment, and as a result the scheme is completely dependent on services that would be introduced as part of the Western Orbital.

![Figure 3-3 Western Orbital Proposal](source: Greater Cambridge City Deal)

![Figure 3-4 M11 J11 - Sub-Regional Context and interaction with other proposed schemes](source: Atkins M11 Junction 11 bus-only slip-road | Version 2.0 | 25 November 2016)
There is a clear and coherent transport and wider economic investment strategy for Cambridge which is based on developing efficient and high capacity radial and orbital movement corridors. However with no identified local bus routes at the M11 J11 southbound slip, there is no current rationale for investment in this scheme on its own.

In the future, the M11 J11 bus-only slip-road could enhance the connectivity for any planned bus services using the proposed Western Orbital scheme allowing them fast, efficient and reliable access from the M11 to Trumpington Park & Ride and Addenbrooke’s (including the Hospital and Biomedical Campus), avoiding any congestion. This in turn will enhance a much wider network of movement and connectivity, which could better link growth sites and support transport infrastructure and quality of life. This could result in wider business investment, confidence and ensure investment is targeted where businesses need it.
4. Spatial Context

4.1. Introduction

The general and geographic context is essential for understanding how potential transport improvements relate to existing and future spatial development patterns – in particular where people live and the destinations they need to get to for specific journey purposes such as employment, education and shopping.

Describing how different places are connected by transport infrastructure is essential for understanding travel demand and wider economic roles of the transport network.

This chapter sets out the geographic context of the M11 Junction 11 scheme and focusses on a description of the area, its transport function and spatial context.

4.1.1. M11 J11

The M11 is part of the Strategic Road Network (SRN), managed by Highways England. The approximate 7,100 kilometre SRN consists of motorways and major trunk roads provides the “capacity and connectivity to support national and local economic growth, effectively linking communities and allowing us to commute to work, transport goods and visit friends and family”.

The M11 is an 82km motorway from London to Cambridge, connecting the North Circular Road in London to the A14 north west of Cambridge and onward destinations to the north and east. Figure 4-1 shows the M11 and junctions with other key corridors and locations.

As well as being one of the key trunk roads for long-distance trips, the M11 forms part of a commuter corridor, allowing access to and from local towns via the A428, A1303, A14 and A10. The motorway facilitates access to the centre of Cambridge via junction 12 and 13, and also provides access to businesses and other developments to the north and south of the city, via junctions 14 and 11.

Figure 4-1 The M11 and M11 Junction 11 Context

Source: Contains OS data © Crown copyright and database right (2016)

4.2. Route Function

The function of a route describes the types of travel demand that are present – for both private vehicles using the highway and for public transport (bus) services.

4.2.1. Highway

Junction 11 is a key node on the M11 and local road network in terms of access to Cambridge by:

- Linking Cambridge, Trumpington and Addenbrooke’s to the M11 via the Hauxton Road Approach to the Junction;
- Linking areas to the south west of Cambridge (via the A10 and A505), including Royston and Hitchin and areas further afield via the A1(M);
- Serving as a busy commuter route connecting Trumpington Park & Ride and the Biomedical Campus to areas South-West of Cambridge; and
- Enabling access and egress relating to future development at the Cambridge Southern Fringe Housing Development and Biomedical Campus, as well as improving connectivity between these destinations and the proposed A428 and Western Orbital bus scheme improvements.

4.2.2. Public Transport

There is currently no railway directly serving Trumpington or the Addenbrooke’s Hospital / Biomedical Campus and Bus is the main form of public transport serving these destinations. Bus is the key future PT mode for new and existing development in the M11 J11 area.

In general, bus services make a valuable contribution to the UK and local economy. The University of Leeds Report *Buses and Economic Growth* estimates that 12% of the UK working population (accounting for £64 billion Gross Added Value) rely on the bus for commuting. People use the bus to make shopping and leisure trips to a value of £27.2 billion per annum; of which £21.5 billion is spent in town and city centres.

4.2.2.1. Current services

Figure 4-2 to Figure 4-4 show the key bus services in Cambridge that serve Trumpington and Addenbrooke’s, adjacent to the M11 J11. Trumpington is currently served by the Stagecoach Citi 1 and the Guided Busway. Citi 1 offers a standard stopping service, whereas the guided busway offers a more direct, and faster public transport option. Both of these services are radial routes, and as such connect inner-city destinations via Cambridge Centre. Addenbrooke’s is currently served by the Stagecoach Citi 1, 2, 7 and Uni 4 routes along with the Whippet 31, 114, 115 and U services. It is also served by the Guided Busway. Again, these services are radial routes, and as such connect inner-city destinations via Cambridge Centre.

National Express coaches from London to Cambridge call at Trumpington Park & Ride up to 10 times per day and services from Cambridge to London call up to 8 times per day, with two also calling at Stansted airport. Other National Express services that call at Trumpington Park and Ride include Brighton to Norwich and Cambridge to Heathrow. These services do not currently use the southbound slip-road. It could be expected that the need will remain for coach services to continue to call at destinations towards the City Centre, via Trumpington Road.

There are currently no bus routes that use the southbound slip-road at Junction 11 of the M11. Future services / routes would need to be identified in order to make the investment in infrastructure viable.
Figure 4-2  
Stagecoach Bus Routes in the South and West of Cambridge

Source: Stagecoach

Figure 4-3  
Whippet Coaches Bus Routes in the South and West of Cambridge

Source: Whippet Coaches

Figure 4-4  
Busway Routes in the South of Cambridge

Source: The Busway
4.2.2.2. Potential New Services

For the M11 J11 scheme to be viable, it is essential that there is demand for for bus routes to use the southbound slip-road in the future. Early assessments for the Western Orbital scheme have identified a number of potential new services that could use the orbital route infrastructure, and subsequently benefit from the M11 J11 bus-only slip-road. These services were identified based on the locations of housing growth and employment in western Cambridge (see Figure 3-2) and are summarised in Table 4-1\(^\text{12}\).

Table 4-1 Potential New / Diverted Services

<table>
<thead>
<tr>
<th>Service</th>
<th>Corridor</th>
<th>New / Diverted</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>St Neots – Cambourne – Bio-medical Campus</td>
<td>A428</td>
<td>New</td>
<td>From St Neots as per the X5 to Cambourne and Junction 13 where it would take the orbital route to Junction 11 and Trumpington Park &amp; Ride. The route could terminate at the Bio-medical Campus via the Busway.</td>
</tr>
<tr>
<td>St Neots – Cambourne – Chesterton Station</td>
<td>A428</td>
<td>New</td>
<td>From St Neots as per the X5 to Cambourne and Madingley Park &amp; Ride. The service could route through North West Cambridge and terminate at Chesterton Station via the Busway.</td>
</tr>
<tr>
<td>Whippet X3 to Bio-medical Campus</td>
<td>A428</td>
<td>Diverted</td>
<td>Diversion of the Whippet 3/X3 to the Biomedical Campus.</td>
</tr>
<tr>
<td>Huntingdon – Busway – Histon &amp; Impington – NW Cambridge – Bio-medical Campus</td>
<td>A14</td>
<td>New</td>
<td>As per route B from Huntingdon Bus Station to Histon &amp; Impington, then onto the Busway, through North West Cambridge to M11 J13, M11J11, Trumpington Park &amp; Ride. The route could terminate at the Bio-medical Campus via the Busway.</td>
</tr>
<tr>
<td>Cambourne – Barton – Bio-medical Campus - Cambridge</td>
<td>A603</td>
<td>Diverted</td>
<td>18 route from Cambourne to Barton via M11 Junction 12 and 11 to Trumpington Park &amp; Ride. From here the service could access the Rail Station and the City Centre.</td>
</tr>
<tr>
<td>Chesterton – NW Cambridge – Bio-medical Campus – Cherry Hinton</td>
<td>North – South Citi Service</td>
<td>New</td>
<td>Chesterton Station to NW Cambridge via the Busway - M11 J13 - M11 J11 via the Western Orbital then to Addenbrooke’s Bus Station and Cherry Hinton</td>
</tr>
</tbody>
</table>

The frequency of services on the potential routes will be defined by the likely patronage and the requirement to provide a High Quality Public Transport service to meet the GCCD aims. Minimum and maximum frequencies identified for each potential route are as follows\(^\text{13}\):

- St Neots – Cambourne – ‘old’ A428 – Bio-medical Campus – 3-6 buses per hour;
- St Neots – Cambourne – ‘old’ A428 – Chesterton – 2-4 buses per hour;
- Huntingdon – Papworth – Cambourne – ‘old’ A428 – Bio-medical Campus – 3-6 buses per hour;
- Huntingdon – St Ives – Cambridge North West – Bio-medical Campus – 3-6 buses per hour;
- Cambourne – Barton – Bio-medical Campus – Cambridge – 2-4 buses per hour;
- Chesterton – Science Park – Cambridge North West – Bio-medical Campus – 2-4 buses per hour.

The frequency of buses along the corridor impacts on the potential passenger capacity of the corridor. Table 4-2 shows the possible capacity of the Western Orbital and its relationship with the frequency of services. The Western Orbital will provide additional infrastructure that complements the M11 Junction 11 bus-only slip-road, and as such demand on the slip-road will be dependent on demand for services on the M11 / Western Orbital corridor.


\(^{13}\) Ibid.
Table 4-2 Impact of Bus Frequency on Capacity

<table>
<thead>
<tr>
<th>Number of buses per hour in each direction</th>
<th>Double Deck Passenger Capacity (78 Seated + 23 standing) per hour</th>
<th>Single Deck Passenger Capacity (49 seated + 27 standing) per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>202</td>
<td>152</td>
</tr>
<tr>
<td>3</td>
<td>303</td>
<td>228</td>
</tr>
<tr>
<td>4</td>
<td>404</td>
<td>304</td>
</tr>
<tr>
<td>5</td>
<td>505</td>
<td>380</td>
</tr>
<tr>
<td>6</td>
<td>606</td>
<td>456</td>
</tr>
</tbody>
</table>

*Bus capacity taken from www.gov.uk, bus length data

Table 4-2 shows that increasing the frequency of buses on a route has the potential to increase the passenger capacity per hour by 101 for each double deck bus and 76 for each single deck bus.

The optimal confirmed service specification and commercial viability of bus services for the Western Orbital corridor is subject to further work. At this stage of the business case process there is a working assumption that up to six buses per hour could use the M11 Junction 11 bus-only slip-road scheme in the future - with three buses per hour from each of the Western Orbital and Cambourne to Cambridge Better Bus Journeys corridors. This assumption will allow the potential Value for Money of the slip-road scheme to be assessed, should services be identified in the future. The provision of any services, if commercially viable, will be considered for inclusion in future business case work. Should this assumed demand be lower or higher, the rationale for investment and resulting business case could be affected.

4.2.2.3. Park & Ride

Two existing Park & Ride sites are in operation to the west of Cambridge, Madingley Park & Ride at Junction 13 and Trumpington Park & Ride at Junction 11. The Trumpington Park & Ride site is located to the north-east of Junction 11, with 1,340 car parking spaces, an additional 24 spaces for disabled users and 250 spaces for bicycles. The Park & Ride service runs every 10-15 minutes to Addenbrooke’s and the city centre depending on the time of day.

There is no current or confirmed future local bus demand identified at the M11 J11 and, therefore, no transport need or rationale for investment in a standalone scheme.

Should bus demand be identified in the future, for example from the Western Orbital or Cambourne to Cambridge Better Bus Journeys schemes, then the M11 J11 bus-only slip-road could facilitate direct and uncongested access to Trumpington Park & Ride.

4.3. Housing and mixed use development context

The housing context sets out the location of the areas where people live, which is essential starting point for understanding travel demand.

4.3.1. Cambridge Southern Fringe

The Cambridge Southern fringe consists of a number of separate developments to the west of Cambridge Biomedical Campus, the largest of which are Clay Farm (up to 2,300 homes) and Trumpington Meadows (1,200 homes). Plans also include secondary and primary schools, sports facilities, shops, public open spaces and student accommodation (Appendix A).

The proximity of this development, its mixed-use nature and proximity to Addenbrooke’s (including the Hospital and Biomedical Campus) is important because it provides both housing and employment land uses in the same area, which in theory means that it is possible to reduce travel distances and make walking and cycling more viable – as well as providing two-way demand for public transport.

4.3.2. Cambridge Biomedical Campus

There are plans in place to expand the Cambridge Biomedical Campus. The 2020 Vision for the site has been prepared in joint partnership with Cambridge University Hospitals NHS Foundation Trust, the University of Cambridge and the Medical Research Council. The vision includes the development of over 350,000 square metres of land to enhance the current site and facilities, as well creating space for commercial organisations. When taken alongside the wider Southern Fringe development and creation of a 121-acre country park, in the future the Campus is planned to be an “urban healthcare village” – a memorable place with streets, squares, gardens and courtyards that reflect the unique nature of Cambridge with its world renowned University.

Ongoing developments at the site as part of “Phase 1” include development at Hills Road, highway upgrades with fast and direct access to the M11, and a 1,200 space multi-storey car-park. Future developments include a new energy centre, conference centre, hotel, private hospital, shops and restaurants. Other key projects include an R&D Centre and Corporate HQ for AstraZeneca, the now completed Medical Research Council’s Laboratory for Molecular Biology and the upcoming relocation of Papworth Hospital, scheduled for 2017.

Future developments as part of “Phase 2” are planned to include 75,000 square meters of new floorspace (excluding plant areas) for Research & Development and Clinical use, higher education and related support activities in addition to two multi storey car parks; open space and landscaping and all other associated supporting infrastructure.

The Biomedical campus is currently well linked to the public transport network, with both bus and guided bus linking the campus to the centre of Cambridge and onward destinations. Links to the West, beyond Trumpington Park & Ride, and to the North of Cambridge are currently not well served by direct and high quality public transport links, so future demand from these areas is likely to be car dominated, unless a sufficiently attractive alternative is developed.

It is expected that the site will employ over 3,000 people when fully operational, not including visitors and clinical patients. Along with bus routes, it is expected that future provision will include 1,730 car parking spaces and over 1,000 bicycle parking spaces. The demand for travel will therefore be extensive, with over 8,000 daily trips expected. Around 30% of these trips are expected to be made by private car.

4.3.3. Wider development

Further development in Cambridge, related to the Western Orbital and Cambourne to Cambridge Better Bus Journeys schemes, must be considered alongside the development located adjacent to the M11 Junction 11, which will help to generate demand for Public Transport for employment purposes in particular. These developments, the subsequent demand generated and the rationale for new HQPT services along these routes are discussed in the respective business cases. A short summary of these key developments are listed below:

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15 Cambridge Biomedical Campus (www.cambridge-biomedical.com)
The market town of St Neots is attractive for commuting eastbound to Cambridge. Demand for housing in St Neots has remained consistently strong even through the recent recession, and further significant housing development is planned.

Further east towards Cambridge, the new village of Cambourne has grown significantly (population around 8,820 in 2012) and contains around 3,250 houses (2012 figures), a large business park, retail centre and the offices of SCDC. The settlement also has a strategic location at the Junction of the A428 and A1198. Further development at Cambourne, and the adjacent site at Bourn Airfield, will significantly expand the size of the town – both as a dormitory for Cambridge and as a self-contained settlement which offers its own employment opportunities.

Both north and south of the A428 there are a number of much smaller traditional villages. The largest of these – Papworth Everard – is the current home of the world famous heart hospital which will be relocating to the Biomedical Campus. Other larger village settlements include Gamlingay, Hardwick and Dry Drayton. All of these villages, which are attractive commuting locations for Cambridge, are not located directly on the A428 / A1303 corridor but are close enough to be considered as within its sphere of influence.

The North West Cambridge Development will provide 3,000 homes and 100,000 square metres of employment space (estimated 4,350 employees). Provision for a bus link from the site to Cambridge Science Park has been allowed for in the site planning and is a central component of the Western Orbital proposal.

The historic village of Grantchester is accessed from M11 Junction 12 and the A603. The village is located in the Green Belt between Cambridge and the M11. Grantchester has a population of 540 (2011 census).

The village of Barton is located to the west of the M11 at Junction 12 and is accessed off the A603. The village has a population of 846 (2011 Census).

The village of Coton is located to the west of the M11 at Junction 13 and is accessed from the A1303. The village has a population of 910 (2011 Census).

4.4. **Context Summary**

Based on this review of the general and geographic context the key considerations for the M11 J11 are:

- Junction 11 of the M11 serves as a key connection from the M11 to Trumpington Park & Ride, Addenbrooke’s Hospital and the Biomedical Campus from the North and West of Cambridge, avoiding congestion in the City Centre;

- The junction will serve future Southern Fringe housing and mixed use development related to the Cambridge Biomedical Campus;

- The junction forms part of regional and national strategic routes and thus performs both a nationally important strategic role as well as being a vital local access route into Cambridge from the south-west; and

- The scheme is dependent on future bus routes using the infrastructure, for example, from the Cambourne to Cambridge Better Bus Journeys and Western Orbital Schemes. For the purpose of the initial business case assessment it is assumed that there will be a future demand of 6 buses per hour on the bus-only slip-road scheme. This will allow an assessment of the potential Value for Money of the scheme, should bus demand be identified in the future. Note that should this demand be lower or higher, the rationale for investment and resulting business case could be affected.
5. Spatial, Economic and Environmental Challenges

5.1. Introduction

Transport is not an end in itself and is instead a means of addressing a wider range of demographic, economic, spatial, social and environmental challenges. It is also often the case that in the existing situation, transport directly contributes to the problems in these wider policy areas.

This chapter considers the wider policy challenges in the GCCD area and outlines how promotion of bus-based public transport can help to address them.

5.2. Demographic Challenges

Both the total population level and the mix of socio-demographic factors can strongly influence the demand for travel.

At the 2011 census, the Cambridge and South Cambridgeshire population totalled approximately 275,000. Population growth in Cambridgeshire as a whole from the 2001 to 2011 census was faster than in any other English county.

By 2031, now just 15 years away, the population is projected to increase by another 70,000 – to 345,000. This alone will significantly increase the demand for transport, even if the average person does not travel any further. In fact, there are also grounds for believing that average levels of travel could increase as well.

This increase in population by 2031 is forecast to be matched by:

- 33,000 extra houses;
- 40,000 extra jobs; and
- 27,000 of these being in research.

In overall terms, the result of these demographic trends will be more people who are travelling further and therefore placing significant additional pressure on the transport network and (in particular) areas of existing congestion on major road corridors and junctions.

Bus services have a vital role to play in mitigating the potentially negative impact of these demographic trends by accommodating demand on public transport rather than increasing private car usage.

5.3. Economic Challenges

The level of economic development strongly influences demand for travel – traditionally, higher levels of economic growth and rising personal incomes lead to more car use in particular.

5.3.1. Introduction

The Cambridge area has historically been one of the most economically successful areas of the United Kingdom.

The Greater Cambridge Greater Peterborough (GCGP) Strategic Economic Plan (SEP) states that the area is one of the UK’s fastest growing and most dynamic areas and makes a strong contribution to UK plc, in the form of £30 billion Gross Value Added (GVA) per annum. However, it is argued that transport infrastructure constraints represent a key challenge to supporting housing and employment growth and continued economic prosperity, in particular:

- Road and rail “bottlenecks” causing congestion and unreliable journey times;
- Limitations on the capacity of the rail network;
- Barriers to the delivery of housing for local workers;
- Limited public transport in rural areas;
- East-west connectivity across the LEP area, and beyond;
- Potential for mode shift towards sustainable travel modes which are not fully realised; and
- Access issues in relation to Stansted and Luton airports as well as Heathrow and Gatwick.

The SEP states that these are current problems that will worsen without further investment – especially in transport.

### 5.3.2. Use of Road Space

**If they are well-used, buses are much more efficient in moving people (per unit of road space) compared with the private car.**

The bus can be a relatively efficient means of using scarce road space. Table 5-1 shows the number of vehicles required to move a nominal 10,000 people one kilometre:

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Theoretical Number of Passengers Per Vehicle</th>
<th>To Move 10,000 People 1 Kilometre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Vehicles Required</td>
<td>Road Space Occupied (Square Metres)</td>
</tr>
<tr>
<td>Private car</td>
<td>5</td>
<td>2,000</td>
</tr>
<tr>
<td>Midi bus</td>
<td>25</td>
<td>400</td>
</tr>
<tr>
<td>Double Deck Bus</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Articulated Bus</td>
<td>175</td>
<td>57</td>
</tr>
</tbody>
</table>

Source: Volvo Corporation

It can be seen that to transport 10,000 people, on the basis of the table above, using fully laden 100-seat double decker buses the road-space requirement would be around one-sixth of the road space required by private cars. Of course these are theoretical numbers and are not based on actual occupancy. If each double decker bus carried only 20 passengers instead of 100, the additional number of vehicles required would occupy 17,000 square metres - still only 70% of the road space of the 2,000 fully occupied cars. If an average occupancy of 1.2 is used, the number of private cars increases to 8,333 and the road space occupied to 100,000 square metres. This would be nearly six times the road space occupation of the bus with 20 passengers.

This relative space efficiency is one of the most important benefits that any scheme to improve bus-based public transport can bring. If there is to be an increase in travel demand as a result of housing and employment growth, there needs to be a transport system that makes the best use of what will always be limited road space.

### 5.3.3. Housing Growth

**If people are to be attracted to work in an area, houses need to be both attractive to live in and affordable to buy or rent.**

The most acute housing challenge in the GCCD area is one of affordability. The GCCD document notes that:
The area’s economic success and high quality of life have made it an attractive place to live and work;

The shortage of available, and affordable, housing within a reasonable distance of key employment centres has driven an unsustainable increase in house prices, which in turn affects the recruitment and retention of talented employees; and

Average house prices in Cambridge have increased 50% in the last eight years, and are now 9.2 times average salary compared to 6.7 for England as a whole.

In transport terms, the impact is likely to be an increase in commuting distances as people are forced to live in areas away from the city which are relatively cheaper. In many cases, the car is the most attractive or only realistic option for this commuting activity.

The GCCD proposes a number of pro-active approaches to significantly accelerate house building in order to tackle the affordability issue:

- Provision for a number of large strategic sites within Local Plans (including those related to the Western Orbital and Cambourne to Cambridge Better Bus Journeys schemes);
- A Joint Venture (JV) company to draw in land holdings from a range of partners in order to quickly deliver 2,000 affordable housing units for rent to locally-based employees;
- Early review of Local Plans to adapt to the changing market and infrastructure situation;
- Working with the Statutory Environmental Bodies and Department for Farming and Rural Affairs (Defra) to address environmental constraints to growth; and
- A streamlined and joined-up “one-stop-shop” approach to planning.

### 5.3.4. Employment Growth

Employment growth in the GCCD area will be heavily dominated by high value jobs in both traditional and emerging sectors that are part of the continuing Cambridge success story.

According to the Cambridge City Council (CaCC) Local Plan, the aim is to ensure sufficient land is available to allow the forecast of 22,100 new jobs in the city by 2031, including some 8,800 in B-use class (offices and industry). The plan seeks to deliver new employment land at six key locations in Cambridge:

- Area around Cambridge Station;
- West Cambridge;
- Cambridge Biomedical Campus (including Addenbrooke’s);
- North West Cambridge (covered by the North West Cambridge Area Action Plan);
- Fulbourn Road; and
- Cambridge Northern Fringe East.

The challenge is that these jobs will be created on a range of sites outside of the traditional City Centre area of Cambridge (see Figure 5-1). This means that catering for travel demand by public transport becomes more of a challenge.
Based on Figure 5-1, key development sites related to M11 J11 include a Major Development Site within South Cambridgeshire and four Areas of Major Change within Cambridge, namely the Southern Fringe (Section 4.3.1 & Appendix A) and Biomedical Campus Developments. Given that M11 J11 serves key corridors to the west of Cambridge, it is also likely that development elsewhere in the region will be related to the junction due to its function as a key route connection.

Source: SCDC Local Plan
5.4. Spatial Challenges

The spatial challenge in the GCCD area involves finding suitable land to allocate for housing and employment development in particular.

In a historic city – surrounded by attractive countryside – it is a challenge to identify and progress suitable sites for new development.

In purely environmental terms, there are many considerations regarding the suitability of potential sites – which include impacts on landscape, water quality, flooding, heritage and biodiversity.

In transport terms, “suitability” is defined in paragraph 30 of the National Planning Policy Framework (NPPF):

“In preparing Local Plans, local planning authorities should therefore support a pattern of development which, where reasonable to do so, facilitates the use of sustainable modes of transport.”

In more specific terms, the NPPF states that Spatial Plans and individual decisions should take account of whether:

- Opportunities for sustainable transport modes have been taken up depending on the nature and location of the site, to reduce the need for major transport infrastructure;
- Safe and suitable access to the site can be achieved for all people; and
- Improvements can be undertaken within the transport network that cost effectively limit the significant impacts of the development (and development should only be prevented or refused on transport grounds where the residual cumulative impacts of development are severe).

The NPPF then states:

“Plans and decisions should ensure developments that generate significant movement are located where the need to travel will be minimised and the use of sustainable transport modes can be maximised. However this needs to take account of policies set out elsewhere in this Framework, particularly in rural areas.”

Within the context of the planned 19,000 new homes in South Cambridgeshire, some 4,400 are planned in the Southern Fringe development. Wider developments are shown in Figure 3-1.

The Third Cambridgeshire LTP 2011-2031: Long Term Transport Strategy (LTTS) identifies a longer term need for orbital highway capacity in Cambridge in order to address future capacity issues as a result of growth, though where a current need has not yet been established. Specifically the strategy identifies a potential need for “additional [orbital] capacity on M11 corridor between Trumpington and Girton”.

This orbital capacity will be provided through the Western Orbital scheme and the M11 J11 bus-only slip-road could enhance the Western Orbital reliability and improve journey times through the provision of direct, bus-only access from the M11 into Trumpington.

5.5. Environmental Challenges

The fundamental principle of sustainable development is that growth should not compromise the health of the natural and built environment on which we ultimately rely for our existence.

5.5.1. Introduction

In transport terms, environmental challenges can be divided into two types:

- Localised impacts; and
- Global impacts.
5.5.2. Localised Environmental Impacts

Localised impacts are those which are either directly attributable to vehicle movements or the infrastructure (primarily roads and railways) that supports them.

For vehicle movements the most significant impacts relate to air quality – from fossil-fuel powered units – and noise.

In air quality terms, public transport schemes are likely to have lower environmental impacts because they are able to move a greater number of people per unit of pollutant emitted. If buses are able to avoid stop-start traffic conditions, then emissions of pollutants are likely to be lower. Furthermore, if bus priority schemes are able to reduce costs to operators then it is more likely that they can invest in more modern cleaner vehicles - perhaps as part of Quality Bus Partnership (QBP) arrangements.

For infrastructure the impacts are potentially very varied and, depending on the precise location, can include:

- Landscape (primarily in rural areas);
- Townscape (primarily in urban areas);
- Biodiversity;
- Heritage;
- Flooding; and
- Water quality.

Relevant assessments of Environmental impacts are being undertaken as part of the Business Case. See the Economic Case.

5.5.3. Global Environmental Impacts

Global environmental impacts do not necessarily directly affect an area where they are initially generated, but are collectively represent a huge challenge for the whole world because of their impact on the climate and dependent activities such as agriculture and resource use.

Global environmental impacts primarily relate to:

- Non-renewable energy use associated with infrastructure construction and usage by fossil-fuel powered vehicles; and
- Greenhouse Gas (GHG) emissions also associated with infrastructure construction and usage by fossil-fuel powered vehicles.

In both cases, promotion of public transport services for the movement of people is likely to have greater environmental benefits. This is because the vehicles (buses, coaches and trains) should be able to move a greater number of people per unit of energy and GHG emissions.

In terms of infrastructure, the global environmental impact of constructing new transport alignments is related to the energy and GHG emissions associated with construction processes. The type of scheme – either road-based or public transport is perhaps less relevant than the decision to build the infrastructure in the first place. The design and construction industry have various techniques available to minimise the overall global environmental impact of infrastructure delivery.
6. Transport Problems to be Addressed by the Scheme

6.1. Introduction

The transport problems that can be addressed by a scheme are those that are experienced by users of the network on a regular basis and that can be a significant influence on demand for travel. Transport schemes are likely to offer better value to a wider range of transport users where they successfully address these problem areas.

The M11 J11 south-bound slip road is currently congested, with queues forming particularly in the AM peak. Although there is no current bus demand and no rationale for investment in a standalone scheme, a bus-only slip road would enable any future bus services to bypass this congestion.

Access to the South of Cambridge from developments in the North and West is currently car dominated. Future developments in Cambridge, particularly that at the Biomedical Campus, is likely to lead to further private car demand and this will exacerbate congestion issues on the M11 Junction 11. Reversing this trend by encouraging significant uptake of public transport and active travel it is key to achieving the visions for Cambridge and South Cambridgeshire. The M11 Junction 11 bus-only slip-road scheme offers the opportunity to improve access (journey times and reliability) for future bus services using the Western Orbital and in doing so could improve the attractiveness of services. Without the scheme, it is likely that future bus services will have to queue with general traffic in order to exit the junction, offering very few ‘last-mile’ benefits to users that currently drive from the North and West of Cambridge to access Trumpington Park & Ride and the Biomedical Campus.

With the level of development at sites on the edge of Cambridge, it is likely that there will be an increase in demand for orbital movements using the A14 and M11. In the absence of any viable and attractive bus services for orbital movements, the additional travel demand will be for private car. This additional car traffic will add to issues of congestion on the M11 and will not assist with its role as a strategic route or a means of accessing employment opportunities.

While a transport problem exists at the junction, there is no current strategic case for investment due to a lack of bus routes using the southbound slip road. This business case is, therefore, primarily focussed on exploring the potential for the scheme to improve provision for future bus services by providing faster journey times and more reliable access through the junction and to improve connectivity between current and future development sites and infrastructure schemes. Improved bus connectivity, with journey times more comparable to the private car will make bus services more attractive and encourage mode shift to bus from the private car.

With future bus demand, the scheme could make a contribution to addressing wider problems across the GCCD area and in doing so there could be an opportunity to satisfy the wider objectives of the GCCD (See Section 3). The scheme could assist in changing the current status quo, by addressing:

- High demand for motor vehicle (especially car-based) travel resulting in significant current and forecast levels of traffic congestion;
- The level of quality and service provision of bus services from the west and orbital provision that bypasses the centre of Cambridge is currently limited and, therefore, bus does not provide an adequately attractive alternative to car travel;
- Complex and diverse travel patterns of network users in Greater Cambridge;
- High levels of car-dependency, especially in the more rural areas;
- Lack of direct and continuous cycle routes from existing villages and future developments into Cambridge; and
- No clear and consistent approach to demand management for car-based travel.
Each of these problems has a number of root causes which (as far as is possible) the scheme needs to tackle and resolve. Furthermore these problems are very much inter-linked and therefore need to be tackled in an integrated way. For example, high demand for car-based travel in any location is at least partly a function of the lack of a viable alternatives to the car. In this context high levels of car use may be an indicator that public transport alternatives are not sufficiently attractive to encourage mode shift and that there may be insufficient demand management to discourage car use and encourage the use of public transport and active modes. For example, free and/or readily available parking at key destinations may encourage the use of the private car, both now and in the future.

Importantly, each of the above issues are likely to be barriers to achieving the GCCD Objectives (Section 3) which seek to improve connectivity to key growth sites, support transport infrastructure and quality of life and in doing so support business investment. Where congestion is high and the complex and diverse travel patterns of the area are not sufficiently connected, then this will hinder movement between growth locations and businesses.

A future rationale for investment is dependent on other public transport schemes which could generate future bus demand for a southbound slip road at M11 J11.

The specific and wider transport issues relating to the Western Orbital and Cambourne to Cambridge Better Bus Journey schemes are discussed in detail in their respective strategic cases. A summary of general issues in the Cambridge and wider sub-region, along with a description of specific congestion issues on the M11 Junction 11, is presented in the remainder of this section.

6.2. High Demand for Motor Vehicle Travel

Private cars, vans and Heavy Goods Vehicles (HGVs) currently constitute the most significant elements of travel demand in virtually all areas of the United Kingdom.

6.2.1. Current Demand and growth

Current demand provides the “baseline” against which all future development and transport scheme proposals are judged.

As an economically successful area, there is already a very high demand for motor vehicle travel in Cambridge which is leading to increasing levels of congestion and delay.

The 2015 Traffic Monitoring Report for Cambridgeshire found that:

- Traffic density on Cambridgeshire’s rural trunk A roads is over two and a half times the national average and 39% above average on other rural A roads.;
- The highest growth since 2002 on trunk roads within the County has occurred on the A428 (25%) which is primarily related to development at Cambourne.
- On the principal road network, the greatest growth in traffic over the past 10 years has been on the A10 (26%).

An analysis of 2012 TrafficMaster data indicates that there is queuing on the southbound exit of the M11 J11, in particular in the AM peak (Figure 6-1 and Figure 6-2). Congestion continues on Hauxton Road, immediately to the north-east of the junction.

The current configuration of the junction will require any future bus services to exit from the M11 into Trumpington Park & Ride (and onwards to the Biomedical Campus) with general traffic. As a result, buses will not be able to avoid congestion and, therefore, experience journey time delays and reliability issues. In addition, it is expected that as a result of general economic growth and location-specific development, there will be a continued increase in demand for travel, which will exacerbate any current congestion issues.

Figure 6-1 Queueing on the M11 J11 exit and Hauxton Road (2012, AM)
Figure 6-2  Queueing on the M11 J11 exit and Hauxton Road (2012, PM)
6.3. Car Dependency

The study area is subject to high levels of car ownership which, in the absence of viable alternatives, is likely to exacerbate levels of traffic and congestion still further.

Once people invest often substantial costs in the purchase and maintenance of a car, there is a clear incentive to use it as much as possible and even when buses provide a viable alternative. Lack of demand means that the ability for operators to provide commercially viable bus services is undermined – which reduces choice for people who do not have access to a private car.

The 2011 Census shows that in Cambridgeshire:

- 85% of households have access to a car compared with the national average of 74%;
- 42% have access to more than one car; and
- High car ownership is matched by high levels of employment, with an unemployment figure of 2.3% compared to the national average of 3.2%, with a bias towards highly skilled occupations.

There are a number of key employment areas within the City Centre including the UoC as well as those on the outskirts of the city such as the Cambridge Biomedical Campus at Addenbrooke’s and Cambridge Science Park. With the level of development proposed in the wider Cambridge sub-region, as well as on the Southern Fringe and the Biomedical Campus it will be important to ensure that as much additional demand as possible is through sustainable modes and thus an attractive alternative to the car must be provided.

6.4. Travel Patterns

Travel patterns describe where people wish to travel from and to, and they are crucial in determining the options for choice of travel mode.

In addition to the current and future forecast demand, origin to destination travel patterns are a key challenge. Private cars are inherently flexible and can be driven between any two points where a road exists. Bus services are likely to be most attractive for origin to city centre radial movements, and as a result tend to follow fixed routes without the same degree of flexibility. Therefore a particular challenge for developing attractive and commercially viable bus services comes when there are significant multiple destinations across an urban area – in particular orbital movements. Figure 6-3 shows how car commuting to South and South West Cambridge has a wide variety of origins. The car gives commuters the flexibility to travel from any residential area in the local region. In contrast, Figure 6-4 shows that the relative number and origins of trips (indicated by bar width and density) made by bus are significantly lower.

Therefore, the challenge is to plan and design bus infrastructure and services that, as far as possible, provide journey options for a wider range of potential passengers. This presents a key opportunity for future development to better connect growth areas to key employment centres, in line with the GCCD objectives.
Figure 6-3  Travel to Work to South and South-West Cambridge by car

Source: 2011 Census (Datashine Commute)

Figure 6-4  Travel to Work to South and South-West Cambridge by bus

Source: 2011 Census (Datashine Commute)
6.5. Bus Service Attractiveness

Since the 1960s numbers of passengers on bus services in the UK have declined as use of the private car has increased, although there is growing evidence to suggest that this trend can be tackled.

Although there are no regular bus services running through the M11 J11, it is important to ensure that any future service provided is attractive to potential passengers (in particular in terms of journey times, reliability and quality) to encourage mode shift from the private car to bus. In order to provide a service which is likely to be attractive to people who have access to a private car, a frequent and fast HQPT service is required that connects housing with key employment sites.

Where demand is greatest, HQPT services seek to provide service frequencies that allow a passenger to “turn up and go” – which for example could mean a minimum of a bus every 10 minutes. Journey times (including walking elements at either and the wait at the stop) need to be comparable with those of the private car. Most importantly, services need to provide reliable and consistent journey times – day in and day out.

Future bus service provision on the M11 J11 could be associated with the Western Orbital and Cambourne to Cambridge better bus schemes. The current working assumption is that that up to 6 buses per hour in total in the peak period could use the M11 J11 bus-only slip-road from these schemes in the future, although the service provision will be defined and optimised with further work. These new services will have to be sufficiently attractive to encourage mode shift from the private car.

6.6. Cycling

Cycling is one of the healthiest and space-efficient modes of transport and is particularly attractive for shorter journeys within urban areas.

Local cycling routes are provided in and around Trumpington and the Biomedical Campus, with connections via local links to Addenbrooke’s. There is limited connectivity or direct routes running parallel to the M11.

There may be scope to integrate cycling facilities into both the Western Orbital and M11 Junction 11 scheme, depending on the final configuration. Further work is required to establish the likely demand and potential configuration of facilities.

6.7. Contribution of the Scheme to Addressing the Problems

The M11 J11 bus-only slip-roads scheme could enable future bus services to access Trumpington Park & Ride and Addenbrooke’s (including the Hospital and Biomedical Campus) via the M11 on dedicated routes. Although there are no regular bus services using the junction currently (and no rationale for a standalone scheme as a result), the future provision of bus services related to Western Orbital and Cambourne to Cambridge better bus schemes could result in buses using the junction (up to 6 per hour).

A future scheme combined with the Western Orbital could directly address the issue of traffic congestion at the junction and on Hauxton Road, thereby enhancing reliability of access and improving journey times for bus services using the segregated slip-roads in the future, compared to traffic using the main junction provision. This could enable future bus services using the Western Orbital to run on a completely segregated route for the entirety of the journey, potentially making the services more attractive to current users of private car, encouraging modal shift.

As a standalone scheme and with no current bus routes using the southbound slip road, the proposed scheme does not contribute to resolving a transport problem.
7. Scheme Objectives

7.1. Introduction

The definition of objectives is an essential part of any Strategic Case, as it provides a clear set of outcomes which a scheme has to meet in order to address current challenges and deliver the future vision.

Furthermore, definition of objectives in terms of “spatial units” – such as areas or corridors - ensures that schemes also focus on wider outcomes and not those simply related to transport infrastructure or services. It is essential that potential beneficiaries of schemes – transport users and local communities in particular - are explicitly recognised in the scheme objectives.

This chapter firstly reviews objectives from a range of documents and outlines how the M11 J11 scheme could meet them if a future bus route uses the slip-road. Secondly, the scheme specific objectives are discussed with reference to the previous technical work undertaken by CCC and Atkins.

7.2. High Level and Planning Objectives

Transport objectives can be set both for outcomes (that is changes in travel behaviour that are considered to be beneficial) and methods (the practical means of achieving those outcomes). This section of the report summarises these key high level planning objectives that scheme options should attempt to align with.

7.2.1. Introduction

An Options Assessment Report (OAR) sets out a structured approach to identifying current / future challenges, setting objectives and formulating / sifting / appraising scheme options.

This chapter sets out a range of high level and planning objectives, which could be considered as the transport outcomes that need to be achieved in order to meet wider GCCD, SEP, Highway England and LTP3 objectives. Figure 7-1 summarises the distinction between high level and planning objectives.

Figure 7-1 High Level and Planning Objectives

- **High Level Objectives**
  - Transport outcomes needed to meet the wider GCCD and other policy objectives

- **Planning Objectives**
  - More specific transport objectives against which the success of the scheme "on the ground" should be measured

7.2.2. High Level Objectives

High level objectives describe the transport outcomes that should be achieved across the Cambridge area in order to deliver economic growth and other policy objectives.

The general high level objectives have been summarised (Table 7-1) based on a review of policy documents including the Proposed South Cambridgeshire Local Plan, Proposed Cambridge City Local Plan, TSCSC
and the NPPF. Some of the objectives are outcomes to be achieved, whilst others relate to methods of achieving those outcomes.

### Table 7-1 High Level Objectives

<table>
<thead>
<tr>
<th>Type</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>To maximise potential for journeys to be undertaken by sustainable modes of transport including walking, cycling, bus and train.</td>
</tr>
<tr>
<td></td>
<td>To support growth, help create jobs and housing, locate growth in locations that minimise the need to travel and maximise the use of sustainable modes.</td>
</tr>
<tr>
<td>Method</td>
<td>To provide bus-based HQPT western orbital route along the M11 via M11 J11 to connect areas in the north and west of Cambridge with Trumpington and Addenbrooke’s (including the Hospital and Biomedical Campus).</td>
</tr>
<tr>
<td></td>
<td>To provide high quality segregated bus-only slip-road that enable attractive journey times and high reliability of future bus services, compared to the general traffic slip-roads.</td>
</tr>
<tr>
<td></td>
<td>To provide improved public transport links along the orbital route to the west of Cambridge in order to enhance economic growth opportunities and connectivity with local and regional destinations.</td>
</tr>
</tbody>
</table>

*Source: Adapted from Options Assessment Report (Atkins, 2014)*

#### 7.2.3. Scheme-specific Planning Objectives

Planning objectives are more localised scheme-specific targets for addressing user needs and therefore changing travel behaviour.

The primary objective of the M11 J11 bus-only slip-roads scheme is to improve junction performance to accommodate future bus services from the Western Orbital scheme and the Cambourne to Cambridge Better Bus Journeys scheme.

#### 7.2.4. Contribution to Wider Objectives

Provision of transport infrastructure and services can have a direct impact on a range of wider policy objectives – everything from economic development through to environmental protection.

Both the high level and planning objectives for the M11 J11 bus-only slip-road scheme contribute to both wider transport and policy outcomes (Figure 7-2). This includes a direct link between the slip-road scheme and the Western Orbital and Cambridge to Cambourne Better Bus Journeys Scheme.
The critical linkage is firstly to demonstrate that what happens “on the ground” when a scheme is implemented can directly influence travel behaviour – both causes (i.e. how and why people make decisions to travel more sustainably) and symptoms (e.g. reducing traffic congestion).

Secondly and even more importantly, it is necessary to demonstrate how travel behaviour then leads to positive change for wider policy objectives – in particular economic growth, environmental sustainability and quality of life for communities. Examples of potential links between transport investment and wider policy objectives are outlined in Table 7-2.

<table>
<thead>
<tr>
<th>Wider Benefit</th>
<th>Contribution of Transport Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Growth</td>
<td>• Reducing transport-related costs to businesses.</td>
</tr>
<tr>
<td></td>
<td>• Widening labour markets.</td>
</tr>
<tr>
<td></td>
<td>• Attracting inward investment to an area.</td>
</tr>
<tr>
<td></td>
<td>• Direct employment in the transport industry.</td>
</tr>
<tr>
<td></td>
<td>• Opening up land for employment and housing development.</td>
</tr>
<tr>
<td></td>
<td>• Enabling clustering of businesses in an area (agglomeration).</td>
</tr>
<tr>
<td>Environmental sustainability</td>
<td>• Improving local air quality.</td>
</tr>
<tr>
<td></td>
<td>• Reducing noise.</td>
</tr>
<tr>
<td></td>
<td>• Reducing GHG emissions.</td>
</tr>
<tr>
<td></td>
<td>• Removing traffic from sensitive areas.</td>
</tr>
<tr>
<td>Quality of Life</td>
<td>• Increasing access to a range of services and facilities.</td>
</tr>
<tr>
<td></td>
<td>• Improving safety and security.</td>
</tr>
<tr>
<td></td>
<td>• Promoting healthier living.</td>
</tr>
</tbody>
</table>

### 7.3. Transport and Wider Policy Objectives

#### 7.3.1. Introduction

Any major road corridor has to perform a number of transport and wider policy functions, which need to be clearly addressed by policy objectives.

The M11 J11 performs a number of local and national functions (as set out in Section 4.4). Transport and wider policy objectives which the scheme seeks to address are, therefore, contained in a number of documents which have been reviewed as part of this Strategic Case (Table 7-3).

<table>
<thead>
<tr>
<th>Type of Objective</th>
<th>Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>Cambridgeshire LTP3</td>
</tr>
<tr>
<td></td>
<td>Highways England Road Investment Strategy (RIS)</td>
</tr>
<tr>
<td>Economic</td>
<td>Greater Cambridge and Peterborough Strategic Economic Plan</td>
</tr>
<tr>
<td></td>
<td>Greater Cambridge City Deal</td>
</tr>
<tr>
<td>Spatial Planning</td>
<td>South Cambridgeshire Core Strategy</td>
</tr>
<tr>
<td></td>
<td>Cambridge Core Strategy</td>
</tr>
</tbody>
</table>

#### 7.3.2. Cambridgeshire Local Transport Plan

The CCC LTP3 sets out a 20-year set of policies, transport strategy and delivery plan for transport investment across the county.
The LTP is important for demonstrating how policies and plans for transport will contribute towards the County Council’s vision to create, “Communities where people want to live and work: now and in the future.”

The LTP has five wider policy objectives. Table 7-4 sets out how the public transport infrastructure and services delivered by the M11 Junction 11 bus-only slip-roads scheme can contribute to achieving the LTP wider policy objectives, if future demand is identified, for example in conjunction with the Western Orbital and Cambourne to Cambridge Better Bus Journeys Scheme.

**Table 7-4 LTP Wider Policy Objectives and M11 J11 Bus-only slip-road Scheme Contribution**

<table>
<thead>
<tr>
<th>LTP Wider Policy Objective</th>
<th>Potential future M11 J11 bus-only slip-road scheme contribution</th>
</tr>
</thead>
</table>
| Enabling people to thrive, achieve their potential and improve their quality of life. | • Public transport is an essential aspect of enabling people to travel – especially for work, education and leisure purposes - without reliance on a private car.  
• A greater range and quality of bus services that will enable people to have a wider choice around when and where to travel for a variety of journey purposes. |
| Supporting and protecting vulnerable people. | • Bus-based public transport is a vital service for people who do not have access to a private car.  
• Investment in public transport infrastructure and services will tackle the cycle of decline where greater car use and traffic congestion reduces the attractiveness and commercial viability of bus services. |
| Managing and delivering the growth and development of sustainable communities. | • If higher levels of traffic congestion are to be avoided, bus services will need to play a much stronger role in the accommodation of additional travel demand as a result of new sustainable communities.  
• HQPT services will connect people living in new sustainable communities with the city of Cambridge, which is the main focus of additional employment opportunities. |
| Promoting improved skill levels and economic prosperity across the county, helping people into jobs and encouraging enterprise. | • For people without access to a car, public transport is one of the main alternative options for accessing education and employment opportunities.  
• Better bus services will enable people to access a wider range of education and employment opportunities which would otherwise only be accessible by private car. |
| Meeting the challenges of climate change and enhancing the natural environment. | • The private car is responsible for significant levels of air pollution, noise and GHGs; and increasing levels of traffic and congestion will have serious environmental consequences.  
• Better bus services will provide a more environmentally friendly alternative to mass car travel, as buses are able to transport more people per unit of pollution emitted (especially if the vehicles are modern). |

Source: Objectives Take from the Cambridgeshire LTP3

### 7.3.3. Highways England Road Investment Strategy

The M11 J11 is an important part of the SRN which is managed by Highways England, and the RIS sets out plans for its future development.

The first RIS outlines a long-term programme for motorways and major trunk roads with the stable funding needed to plan ahead. The RIS 1 comprises:

- A long-term vision for England’s motorways and major roads, outlining how we will create smooth, smart and sustainable roads;
• A multi-year investment plan that will be used to improve the network and create better roads for users; and
• High level objectives for the first roads period 2015 to 2020.

The high level objectives, and the potential contribution of the M11 J11 bus-only slip-road scheme are shown in Table 7-5.

Table 7-5  Highways England Strategic Objectives and Bus-based Public Transport Contribution

<table>
<thead>
<tr>
<th>Strategic Objective</th>
<th>Potential future M11 J11 bus-only slip-road scheme contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing capacity and connectivity to support national and local economic activity.</td>
<td>Bus services can provide essential inter-urban connections, which help put more people within reach of a wider range of jobs.</td>
</tr>
<tr>
<td>Supporting and improving journey quality, reliability and safety.</td>
<td>Buses can provide an efficient alternative to car use, especially for longer distance journeys, in particular those using the Western Orbital and Cambourne to Cambridge Better Bus Journeys Scheme. Buses are also a very safe mode of travel.</td>
</tr>
<tr>
<td>Joining our communities and linking effectively to each other.</td>
<td>Buses are able to provide these links, using Trunk Roads as the fast element of the journey and then calling at communities located along the corridor.</td>
</tr>
<tr>
<td>Supporting delivery of environmental goals and the move to a low carbon economy.</td>
<td>If they are well patronised, buses provide a relatively efficient means of moving people per unit of carbon emitted from a vehicle exhaust. If buses services did not exist and everyone had to drive, carbon emissions could increase substantially.</td>
</tr>
</tbody>
</table>

Source: Objectives Taken From Highways England RIS

7.3.4.  Strategic Economic Plan (SEP)

In terms of “Transport Connectivity”, the Greater Cambridgeshire Greater Peterborough Strategic Economic Plan (SEP) sets out a number of objectives. Table 7-6 summarises the relevant SEP objectives and the potential contribution of the M11 J11 bus-only slip-road scheme:

Table 7-6  SEP Objectives and Potential Scheme Contribution

<table>
<thead>
<tr>
<th>SEP Objective</th>
<th>Potential future M11 J11 bus-only slip-road scheme contribution</th>
</tr>
</thead>
</table>
| A transport network fit for an economically vital high growth area.              | • A transport network has to provide the right capacity and connectivity between origins and destinations in a way that makes best use of the available infrastructure.  
• The scheme could help to deliver an integrated an efficient public transport network across the Greater Cambridgeshire area and provide genuine public transport options for a wider range of destinations (especially the development areas on the edge of the city and the new communities in South Cambridgeshire). In particular it will enhance the provision of the Western Orbital and Cambourne to Cambridge Better Bus Journeys Schemes. |
| Smart technology.                                                              | • The highest performing cities have transport networks that are enabled by technology – particularly with respect to information and wireless connectivity at bus stops and on vehicles.  
• The scheme could enable buses to gain priority at the junction and provide information to feed into real time passenger information.  
• The design and implementation of scheme could provide opportunities to include technology facilities that will be value by business users in particular. |
| Work with partners to facilitate improvements to key routes.                   | • In addition to CCC as the Local Transport Authority, there are a number of partners who have a key interest in the improvement of transport routes – including the LEP, Highways England, SCDC, |
SEP Objective | Potential future M11 J11 bus-only slip-road scheme contribution
--- | ---
CaCC, transport operators and user representative groups (e.g. for bus and cycling).  
- The scheme could be planned and designed in partnership with the relevant stakeholders, in particular:  
- **HE**: who are the highway authority for the M11;  
- **Bus operators**: who have the essential task of running the buses that will use the infrastructure;  
- **SCDC and CaCC**: as the planning authorities who will need to take decisions on strategic applications; and  
- **User groups**: who will wish to ensure that infrastructure and services are planned and designed based on evidence of their needs.

Ensure linkage with national transport investment decisions. |  
- It is essential that local and national transport schemes are planned together to deliver a single integrated network to the end user (who does not care about organisational boundaries).  
- The scheme is located on a Trunk Road and so it will support investment priorities that have been identified in the RIS.

Identify scalable interventions that open up access to significant growth locations. |  
- With constrained public sector investment, especially in the short to medium term, there is a need for transport solutions that can be implemented and then “scaled up” if there is evidence of further need and demand.  
- The scheme is scalable because it features a number of options which range from lower through higher cost; and it is also relatively easy to add capacity (in the form of extra services in response to demand) in the bus industry (especially when compared with rail).

The SEP states that in Cambridge and Peterborough, and on a number of the main corridors linking them with neighbouring towns, there is great potential to significantly grow patronage and reduce the demand for new car trips that would otherwise occur. The SEP suggests that major growth at new settlements could achieve very significant levels of bus use if the quality of service is such that it offers a reliable and timely alternative to a car trip. The M11 J11 bus-only slip-roads scheme could directly aim to improve journey times and reliability for up to 6 buses per hour from the Western Orbital and Cambourne to Cambridge Better Bus Journeys Schemes. The evidence from the existing Guided Busway and Park & Ride services has demonstrated that travellers will choose to use the bus when a high quality service is provided.

7.3.5. **Local Plans for South Cambridgeshire and Cambridge**

The Local Plans for the two districts set out a vision, practical objectives and detailed proposals for spatial development - which will both deliver the economic plans and address the resulting travel demand.

### 7.3.5.1. South Cambridgeshire

Table 7-7 summarises the relevant Local Plan objectives and the contribution of the M11 J11 Bus-only slip-road Scheme:

<table>
<thead>
<tr>
<th>Local Plan Objective</th>
<th>Potential future M11 J11 bus-only slip-road scheme contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>To support economic growth by supporting South Cambridgeshire’s position as a world leader in research and technology based industries, research, and education; and supporting the rural economy.</td>
<td></td>
</tr>
</tbody>
</table>
- Economic growth is predicated upon the ability for people to access their place of work by non-car modes and to travel easily / efficiently during the course of their working day.  
- A HQPT system will significantly improve connectivity – by improving journey options and times between housing areas and major employment areas; and between the major employment... |
Local Plan Objective | Potential future M11 J11 bus-only slip-road scheme contribution
--- | ---
To protect the character of South Cambridgeshire, including its built and natural heritage, as well as protecting the Cambridge Green Belt. New development should enhance the area, and protect and enhance biodiversity. | • The built and natural heritage of the area will come under increasing threat from higher levels of air pollution and noise, which are the result of high forecast road traffic.  
• Better public transport services will seek to reduce forecast levels of road traffic by moving people in buses which (if well-used) are a much more environmentally sustainable means of moving large numbers of people.

To provide land for housing in sustainable locations that meets local needs and aspirations, and gives choice about type, size, tenure and cost. | • If housing is to be both economically and environmentally sustainable the travel demand that it generates will need to avoid a large increase in levels of car traffic.  
• Furthermore, housing affordability could be supported, if it is possible to get around without a household having to own and run a large number of cars.  
• Better bus services will provide a viable alternative to driving for commuting, education, personal business and leisure trips into Cambridge from new developments located in the rural hinterland.

To deliver new developments that are high quality and well-designed with distinctive character that reflects their location, and which responds robustly to the challenges of climate change. | • An important aspect of development design is to ensure that bus services are able to move efficiently within areas (in particular avoiding long and circuitous routes) and also gain access to as many people as possible within a walk distance of around 400 metres.  
• Bus infrastructure will be integrated into the design of new developments, especially related to the Southern Fringe and expansion of the Biomedical Campus and will also serve the employment areas of West Cambridge and North West Cambridge.

To maximise potential for journeys to be undertaken by sustainable modes of transport including walking, cycling, bus and train. | • The reason for delivering the scheme is to take advantage of the potential that undoubtedly exists and to ensure that bus-based public transport is a viable and credible alternative.

Source: Objectives Taken From South Cambridgeshire Local Plan

7.3.5.2. Cambridge City

Table 7-8 summarises the relevant Local Plan objectives and the contribution of the M11 J11 Bus-only slip-road Scheme.

Table 7-8 Cambridge Local Plan Objectives and M11 J11 Bus-only slip-road Scheme Contribution

<table>
<thead>
<tr>
<th>Local Plan Objective</th>
<th>Potential future M11 J11 bus-only slip-road scheme contribution</th>
</tr>
</thead>
</table>
| Contribute to the vision of Cambridge as an environmentally sustainable city, where it is easy for people to make a transition to a low carbon lifestyle. This means making best use of energy (including community energy projects), water and other natural resources, securing radical reductions in carbon emissions, minimising environmental impact and being capable of adapting to the impacts of climate change. | • The delivery of significantly better bus services – as part of a wider sustainable mobility plan – will make it much easier for people to choose to live a low-carbon / low-energy lifestyle which does not rely on the private car.  
• A much better choice of efficient and reliable bus services along one of the key transport corridors in Cambridge, will serve the very important development areas in the west and north-west of the city. |
<p>| Meet the housing needs of the city within its sub-region, delivering an appropriate mix of | • If housing is to be both economically and environmentally sustainable the travel demand that it |</p>
<table>
<thead>
<tr>
<th>Local Plan Objective</th>
<th>Potential future M11 J11 bus-only slip-road scheme contribution</th>
</tr>
</thead>
</table>
| housing types, sizes and tenures to meet existing and future needs, including affordable housing. | generates will need to avoid a large increase in levels of car traffic.  
- Furthermore, housing affordability could be supported, if it is possible to get around without a household having to own and run a large number of cars.  
- Better bus services will provide a viable alternative to driving for commuting, education, personal business and leisure trips within Cambridge. |
| Assist the creation and maintenance of inclusive, environmentally sustainable communities. | ● Bus-based public transport is an important part of inclusivity, as it is more likely to be affordable for a larger proportion of the population than car travel (which generally requires purchase and maintenance of a vehicle) and rail (where fares can often be quite high, especially at peak times).  
● Bus infrastructure measures will assist operators to keep bus fares as low as possible by minimising the operating costs associated with traffic congestion delays, and the consequent need to provide additional buses to maintain a specific service headway. |
| Promote and support economic growth in environmentally sustainable and accessible locations, facilitating innovation and supporting Cambridge’s role as a world leader in higher education, research, and knowledge-based industries, while maintaining the quality of life and place that contribute to economic success. | ● Bus-based public transport can promote development in locations which minimise the need to travel, both as part of the daily commute and also during the course of business.  
● Furthermore, economic benefits associated with greater levels of face to face collaboration can be promoted by the use of public transport.  
● Bus services using the M11 J11 will, as part of a wider network for Cambridge, help to link up various employment and research establishments across the city and make travel easy by high quality HQPT. |
| Support Cambridge’s vibrant and thriving centres, with a varied range of shopping facilities in accessible locations that meet the needs of people living, working and studying in, or visiting, the city and the Greater Cambridge Area. | ● Research suggests that retail centres (especially those in traditional city centre locations) receive a very large economic contribution from bus passengers, dispelling the myth that everyone travels by car.  
● Improved bus services running into Cambridge via the M11 J11, from the expanding housing areas to the north and west, will provide a further boost to the retail economy by enabling more people to access the City Centre without a large increase in traffic and congestion. |
| Development located to help minimise the distance people need to travel, and be designed to make it easy for everyone to move around the city and access jobs and services by sustainable modes of transport. | ● Bus-based public transport can – if based on strong radial and orbital routes and high density urban form – promote development in locations which minimise the need to travel, both as part of the daily commute and also during the course of business.  
● Better bus infrastructure and services will encourage development to be located on the Western orbital and corridor, which can become a strong orbital and radial spine which provides sufficient numbers of passengers to support a frequent service. |
| Ensure appropriate and timely provision of environmentally sustainable forms of infrastructure to support the demands of the city, including digital and cultural infrastructure. | ● If constructed as part of major developments, public transport infrastructure is able to support better bus services which can be used (for example) by new residents before their travel patterns have been too firmly set in favour of the private car. |
Local Plan Objective | Potential future M11 J11 bus-only slip-road scheme contribution
--- | ---
• Provision of public transport infrastructure and services as part of both housing and employment developments, and will therefore enable sustainable travel choices to be designed in from the start.

Source: Objectives Taken From Cambridge Local Plan

### 7.4. Transport Strategy Proposals

The M11 J11 and related Western Orbital (and A428 corridors) have a range of transport and spatial functions which, taken together, could generate high demand for travel by private car in particular.

The Transport Strategy for Cambridge and South Cambridgeshire (TSCSC) focuses on the provision of orbital routes to the west of Cambridge, rather than specific interventions on the M11 J11. Full details are provided in the Western Orbital Strategic Case (see accompanying business case).

The TSCSC recognises that, attempting to cater for current and future local travel demand by car will increase congestion in Cambridge and surrounding towns. The TSCSC proposes that travel demand is catered for by:

- **increasing walking, cycling and use of passenger transport** for journeys into and out of Cambridge; and in particular on passenger transport services on main radial corridors to Cambridge and other key destinations.” And “**Orbital bus movements will also be prioritised.** In the short term, development in the northwest of the city will facilitate bus links between Chesterton, Cambridge Science Park and West Cambridge, and onwards to Addenbrooke’s and the Cambridge Biomedical Campus, either through the city centre or on the M11. In the longer term, we will look at options to complete the circuit to the east of the city, linking Cambridge Science Park, Cambridge Airport, Cherry Hinton, Fulbourn, Addenbrooke’s and the Cambridge Biomedical Campus for bus movements.”

The TSCSC highlights a need for orbital capacity on the outskirts of the city, including adjacent to the M11 between Trumpington and Girton. The key Western Orbital route which would assist in increasing this demand up to the M11 J11 is shown in Figure 7-3.

In terms of orbital routes, the TSCSC proposes a number of related measures, through specific policies, outlined below:

**Policy TSCSC 8: Improving bus services.**

**Scope:** “The County Council will work with partners and passenger transport operators to develop an improved and integrated network of High Quality Passenger Transport. The County Council will use existing channels, such as the Quality Bus Partnership to raise standards and monitor service provision.”

**Outline:** “Bus has a role to play in providing a HQPT option on most of the major corridors into Cambridge.”

**Policy TSCSC 9: Access to jobs and services**

**Scope:** “Access to areas of employment and key services will be maximised, particularly by sustainable modes of travel, to:

- Provide a transport network that is efficient and effective;
- Provide good accessibility to services and for businesses; and
- Provide a HQPT and cycle network to routes near major employment, education and service centres.”

**Outline:** “Inbound bus priority measures will be introduced on Madingley Road between the M11 and Queens Road in Cambridge. Between the M11 and A428, options for segregated high quality bus priority will be investigated on the current alignment of the A1303 and on offline alignments. Bus-only links will be provided between Histon Road and Madingley Road as part of the development of the NIAB and North West...
Cambridge sites. An orbital bus service from Cambridge Science Park would be able to travel on to Addenbrooke's and the Cambridge Biomedical Campus by the M11. A demand management option that looks at the Queens Road / Grange Road area might also facilitate such a service travelling through or round the city centre and using the Busway to access the Addenbrooke's area.’

Policy TSCSC 13: Provision of new highway capacity

Scope: “Where there is a requirement for new roads or increased road capacity, these should adhere to the highest possible design standards. Where feasible, pedestrian and cycle facilities will be provided alongside new road infrastructure (citing the Busway facilities as a standard example). The needs of public transport services will be considered in all road schemes, and priority for services should be provided on any new road where there is an expectation of regular bus usage, and an expectation that services reliability and timeliness would otherwise be disadvantaged. This policy applies to new roads delivered by the County Council, new roads that will be passed to the Council through a relevant legal agreement, and those that will remain in third party ownership.”

Outline: “In Cambridge, the need for new highway capacity on the outskirts of the city will be considered in the context of the development of orbital and radial passenger transport and cycle capacity. Radial routes into and out of the city centre are used for cross city car movements, as is the ring road to the east of the city between Addenbrooke’s and Newmarket Road. Road space on many of these routes will be reallocated to buses and cycles, and some routes may be closed to general traffic. Orbital capacity for general traffic further out may be provided to allow cross city movements by car to continue to be made.”

Policy TSCSC 15: Managing travel demand

Scope: “Appropriate measures and interventions will be introduced to manage the demand for general vehicular travel, and reducing through traffic in Cambridge in line with the strategy approach. Further work is proposed to determine the specific priorities which will be consulted on over time with such measures expected to include:

- Reallocation of road space to be used by passenger transport, pedestrians and cyclists;
- Access restrictions for general vehicular traffic; and
- Parking restrictions.”

Outline: “Such an approach would mean that certain trips become less convenient or more costly by car. For example, a current trip to work in the city centre or to Addenbrooke’s can involve parking on street in areas outside the current CPZ. With this approach, such a trip would involve finding a paid parking space in a car park or on-street, or changing the mode of transport used for part or all of the journey. In addition, there are routes where space is limited, and where removing on-street parking would be of significant benefit in smoothing the flow of traffic and removing conflict, particularly between cyclists and other vehicles.”
Figure 7-3 The Western Orbital and M11 J11 Strategy

Source: TSCSC
7.5. Wider High Quality Passenger Transport Vision

The M11 J11 bus-only slip-road scheme is part of an integrated and long term strategy for improving access throughout Cambridge – based around a vision for an integrated and connected High Quality Passenger Transport (HQPT) system.

Compared with the convenience and comfort of the private car, bus-based public transport in particular suffers from a poor image, which is often at odds with the current reality. In order to tackle these perceptions with practical actions, it is therefore important to set out an attractive vision of future travel by bus. The vision for Cambridge is clear in that HQPT along dedicated routes will be a key driver in the ability to deliver more sustainable travel patterns in Greater Cambridge.

7.5.1. Defining HQPT

HQPT can be broadly defined as public transport provision which is “generally perceived, by local politicians and in the media, to be reliable, frequent, good-value, reasonably comfortable (throughout the journey), reasonably fast, operate at convenient times, and to be suitable for most core journeys between key traffic generators (including residential areas) and the town / city centre." 17

The following additional characteristics can define HQPT:

- “Service on core routes will have ‘tram-like’ features: comfortable, fast, frequent;
- There will be a significant degree of bus priority;
- There will be a strong focus on passenger / customer service and on ease of use;
- The system will be efficiently operated, minimizing costs for a specific level of service;
- Services will be well-integrated with each other, and the system as a whole will be well-integrated with other modes;
- The system will be strongly branded; and
- There will be a noticeable amount of public support for the system, perhaps even local pride in it”.

Such a vision for HQPT could range from a significant improvement in the various parts of the traditional fixed route bus transport system – essentially the same service but higher quality and making use of features typical of Bus Rapid Transit (BRT) schemes – through to a radical re-thinking of the whole concept of bus travel, which has (for example) been considered by the likes of Philips (Figure 7-4). It is important to note that HQPT generally does not consist of a mandatory list of features, but instead should be defined by the needs of future passengers and the ability of operators to sustain a commercially viable service.

Figure 7-4 Reimagining the bus service

Source: BBC News 18

The Cambridgeshire guided busway already provides passengers with a model that could be delivered on other corridors leading into the city (Figure 7-5). The busway delivers a high frequency HQPT service with high frequency through the provision of dedicated rights of way, offline busways, priority treatment at junctions and step free access. This type of service supports the vision to provide sustainable alternatives to the private car in the form of HQPT and has already demonstrated an ability to increase the uptake of sustainable travel modes.

Figure 7-5     Vision to Reality: Better Quality Public Transport on the Guided Busway

Source: Photo from Cambridge News

7.5.2. Specific HQPT requirements for Cambridge

In the Cambridge context, future bus developments in the Cambridge area are likely to consider bus as the mode of public transport choice and in that regard a HQPT service is defined in the TSCSC as “One that provides, high quality, low floor/easy access buses, air conditioning, prepaid / electronic ticketing, real time information and branding to encourage patronage.” It also specifies that a HQPT service will provide “at least a 10 minute bus frequency during the peak periods and a 20 minute frequency Inter-peak.” The TSCSC intends to create new HQPT corridors and enhance existing corridors to provide a greater capacity for sustainable travel.

In the Proposed Cambridge Local Plan 2014, ‘Policy 5: Strategic transport infrastructure’ identifies a need to promote sustainable transport and pedestrian and cycle priority. In terms of public transport, the Policy notes a need to ensure new development in Cambridge is linked through High Quality Public Transport (HQPT) routes, frequent services and cycle ways to the city centre, railway station and employment centres. ‘Policy 80: Supporting sustainable access to development’ notes that development on the edge of the city and urban extensions are supported by HQPT linking them to the city centre and employment centres. The Policy notes that for a HQPT system to be successful, it needs to be efficient, reliable and attractive and ‘free from other traffic, where possible, in order for them to deliver on reliability and speed of journey.’

The Proposed South Cambridgeshire Local Plan 2013 is consistent with the Cambridge Local plan in terms of the need for high quality public transport. It makes specific reference to public transport on the A428 with reference to the proposed Bourn Airfield development, noting that significant improvements in public transport would include a segregated bus link between Cambourne to Bourn Airfield and measures to ensure that bus journeys between ‘Caldecote / Highfields and the junction of the A428 and the A1303 is direct and unaffected by any congestion suffered by general traffic.’
Taken together the two Local Plans highlight a requirement for HQPT supported by direct walking and cycling routes and that in order for these new public transport services to offer an attractive alternative to the car, there is a need to ensure that the services are not affected by congestion caused by general traffic.

If combined with another HQPT scheme, such as the Western Orbital, the M11 J11 bus-only slip road could provide a continuous HQPT route on the M11 corridor and into Trumpington Park & Ride and the Biomedical Campus.

7.6. Summary

In terms of HQPT, there is a consistent relationship between the Local Plans, Transport Strategies and the City Deal priorities. As well as defining specific corridor objectives related to new developments, these policies all indicate an aspiration to provide HQPT and walking and cycling improvements in order to offer an alternative to the private car.

Specific considerations in the context of Cambridge are:

- high quality, low floor/easy access buses;
- air conditioning;
- prepaid / electronic ticketing;
- real time information;
- branding;
- at least a 10 minute bus frequency during the peak periods and a 20 minute frequency Inter-peak; and
- attempting to ensure that public transport services are not affected by general traffic.

The primary scheme-specific objective of the M11 J11 bus-only slip-roads scheme is to improve junction performance to accommodate future bus services from the Western Orbital scheme and the Cambourne to Cambridge Better Bus Journeys scheme. This section has identified the potential links between the scheme and wider study area objectives and the aspirations for HQPT.
8. Option Identification and Outline Selection Criteria

8.1. Introduction

For any set of objectives and challenges, there are a series of intervention options for tackling them – which can range in type and scale.

Any process of scheme development must go through a rigorous process of option development as set out in WebTAG (Web Transport Analysis Guidance).

The M11 J11 scheme is following the process outlined by the DfT (Figure 8-1).
8.2. **Option Development Work**

Option development needs to start from “first principles” and should not identify the solution until there has been a comprehensive assessment of the possible interventions necessary to meet objectives.

8.2.1. **Background**

In September 2015 Atkins submitted a feasibility report to Cambridgeshire County Council, which provided an initial assessment of the grounds for a business case for primarily providing stand-alone bus-only slip-roads at this M11 Junction 11. The assessment noted that future bus services are required in order to demonstrate a need and this remains the conclusion of the strategic case until such a time that future bus demand on the southbound slip road is identified.

Further design and development work on other related schemes has since identified that in the future, initially up to 6 buses per hour that are likely to use the Cambourne to Cambridge Better Bus Journeys and Western Orbital infrastructure, could also use the M11 J11 south-bound slip to exit the motorway into the Park & Ride.

The objectives for providing bus-only slip-roads at junction 11 of the M11 have a clear strategic link with the Cambourne to Cambridge Better Bus Journeys and Western Orbital. The scheme aligns with the wider objectives of the City Deal, if it is not standalone:

- To encourage sustainable growth and development and promote the use of sustainable modes of travel, specifically encourage mode shift towards bus travel;
- To help deliver congestion free public transport serving key employment sites;
- To avoid an increase in current congestion levels and public transport journey times; and
- To improve journey time reliability for existing/future buses using these junctions.

Key to the designs were to alleviate any future congestion issues for future bus services by ensuring that they are not affected by congestion caused by general traffic. The feasibility report provided an initial assessment of four high level options using the Department for Transport (DfT) Early Assessment and Sifting Tool (EAST). The four options (A to D) are described below and shown super-imposed on the proposed Southern Fringe development masterplan (Trumpington Meadows) immediately adjacent to the options.

This SOBC has formally assessed four options in terms of ascertaining Value for Money: Option A, Option B, Option C and Option D – See Section 8.2.2.

Subsequent to, and as a result of, the analysis outlined in this SOBC, variations on the alignments for Option C and Option D have been developed, namely Option C (II) and Option D (II) shown in Figures 8.5 and 8.7. These alignment variations are not formally assessed in this Business Case. Further work would be required in order to confirm the costs, benefits, impacts and overall Value for Money of these new options.

8.2.2. **Option Descriptions**

**Option A: Segregated bus-only slip-road created by widening the existing slip-road**

Option A provides a bus-only slip access road from the existing general traffic slip-road from the M11 towards Trumpington Park & Ride. The existing slip-road would be widened to accommodate the extra lane. This option also provides a fully segregated bus-only access to the Park & Ride site.

Under this option, the current layout and operation of the roundabout for general traffic is maintained.

It is assumed that the segregated bus lane would be bus-only and would provide access directly to the Park & Ride site. Appropriate signage would need to be put in place to indicate the bus-only lane.
Figure 8-2  Option A: Segregated bus-only slip-road created by widening the existing slip-road
Option B: Bus-only slip created by widening the existing slip-road

Option B provides a bus-only access route parallel to the existing off-slip and bypasses the existing traffic signals at the end of the slip-road. The existing slip-road would be widened to accommodate the extra lane. The bus-only access route then continues onto the dedicated Park & Ride traffic lane beyond the junction.

It is assumed that the segregated bus lane would be bus-only and would provide access to the dedicated Park & Ride traffic lane. There is, however, potential for this to be made an all-traffic lane to the Park & Ride. Appropriate signage would need to be put in place to indicate the bus-only lane.

**Figure 8-3** Option B: Bus-only slip created by widening the existing slip-road
Option C: Bus-only slip-road leaving the M11 prior to the existing agricultural bridge and crossing existing land to Trumpington Park & Ride

Option C provides a bus-only slip-road leaving the M11 prior to the existing agricultural bridge for buses travelling southbound on the M11. The segregated bus-only lane could continue to the Park & Ride site. The design of Option C has followed an iterative process with review of the relevant design standards. The design extends the off-slip at Junction 11 for all traffic to the north of the agricultural bridge, with a bus-only slip-road branching from the extended off-slip.

Further assessment would be required on the widening of the agricultural bridge or a new structure to accommodate a two lane slip-road at the location of the existing agricultural bridge. Further work would need to consider appropriate signage to indicate the bus-only lane.

Figure 8-4 Option C: Bus-only slip-road leaving the M11 prior to the existing agricultural bridge and crossing existing agricultural land to Trumpington Park & Ride
**Option C (II):**

Subsequent to the analysis undertaken for this SOBC, refinements were made to Option C. This variation is very similar to Option C, but with a smaller corner radius. Buses would have to travel at a lower speed as a result.

Note that this option has not been assessed as part of this SOBC and it is presented for information on ongoing option development. Further work is required to ascertain the overall costs, benefits, impacts and value for money for this option.

**Figure 8-5**  Option C (II): Bus-only slip-road leaving the M11 prior to the existing agricultural bridge and crossing existing agricultural land to Trumpington Park & Ride
Option D: Bus-only slip-road leaving the M11 prior to the existing agricultural bridge and following the alignment of the disused railway line to Trumpington Park & Ride

Option D involves provision of a bus-only slip-road which follows the alignment of the disused railway line to the east of the M11. The bus-only slip-road leaves the M11 close to the location of the disused railway line and then follows the railway line alignment to meet the northern boundary of the existing Trumpington Park & Ride site.

The proposed design for Option D was reviewed against the relevant design standards to reduce the tightness of the turn on the slip-road where possible. This design would need to be discussed further with Highways England were this option to be progressed in terms of layout and signage.

Figure 8-6  Option D: Bus-only slip-road leaving the M11 prior to the existing agricultural bridge and following the alignment of the disused railway line to Trumpington Park & Ride
Option D (II):

Subsequent to the analysis undertaken for this SOBC, refinements were made to Option D. Option D (II) travels along an existing agricultural track, with entry to the development and park and ride further to the south than option D.

Note that this option has not been assessed as part of this SOBC and it is presented for information on ongoing option refinement. Further work is required to ascertain the overall costs, benefits, impacts and value for money for this option.

Figure 8-7  Option D (II):
8.2.3. Option Costs

Indicative out-turn costings have been provided for each option (Figure 8-1): Out-turn cost estimates are the estimated costs which will actually be incurred at the time of expenditure, taking into account the full impacts of construction inflation, with no discounting, market price adjustment or removal of background inflation as has been applied in the Economic Case. Costs are not presented for the post-assessment variations, Option C (II) and Option D (II).

The table below provides a breakdown of out-turn costs for each option.

Table 8-1 Breakdown of Out-turn Costs for each Option

<table>
<thead>
<tr>
<th>Item</th>
<th>Option A Cost (000’s)</th>
<th>Option B Cost (000’s)</th>
<th>Option C Cost (000’s)</th>
<th>Option D Cost (000’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>£3,750</td>
<td>£1,421</td>
<td>£13,283</td>
<td>£10,022</td>
</tr>
</tbody>
</table>

These indicative costs will be refined in future stages at the option specifications are further refined. Further details on costs are provided in the Financial Case and Economic Case.

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9. Beneficiaries

9.1. Introduction

Transport schemes are not simply about building new infrastructure or providing better services. Ultimately they are about meeting people’s needs, in a way that is sustainable and does not have undesirable consequences for others.

The various options for the M11 Junction 11 bus-only slip-road scheme (in conjunction with the Cambourne to Cambridge Better Bus Journeys Scheme and Western Orbital scheme) will aim to meet the needs of a broad cross-section of beneficiaries. This chapter provides an outline assessment of the groups of people who will benefit from implementation of the scheme.

The assessment of the various benefits to different users forms the basis of the Economic Case.

9.2. Business Travellers

Business travellers are people who use their vehicle during the course of their working day – and can be sub-divided into car, van and Heavy Goods Vehicle (HGV).

Business travellers represent a hugely important segment of beneficiaries because their travel activity makes a direct contribution to the wider economy – especially through the exchange of ideas / information and the physical movement of goods. If business travellers are not able to undertake journeys or experience delays in doing so, then there are consequential direct and indirect costs to the economy. This can either be through activities that do not take place or additional costs for activities that do. For this reason, economists consider that business travellers have a high value of time.

The primary benefit of the scheme options for business travellers will be journey time savings and better reliability as a result of the reduction of traffic congestion. As greater numbers of people switch to public transport, the relative space-efficiency of the bus will mean a reduction in the forecast numbers of cars on the road. In turn, fewer cars means lower levels of traffic congestion and delays.

Traditionally, bus services have not played a large role in business travel as they are often considered to be either too slow or simply not able to provide the necessary connectivity at all. However there is no necessary reason why this situation cannot be addressed, especially if there is potential demand within an urban area for movement between different employment areas for the purposes of collaboration.

9.3. Commuters

Commuters are people who travel from home to their place of employment or education on a regular (often daily) basis.

Commuters generally are the most numerous group of transport network users, with the result that demand tends to be highest in the ‘traditional’ weekday morning and evening peak hours (generally 0800 to 0900) and (1700 to 1800). Greater flexibility of working patterns, coupled with a wider spread of employment hours (especially at weekends), means that demand for commuting is also taking place at other times of the day and week.

Where scheme options increase the range of direct bus services from residential to employment areas (for example by linking the Western Orbital to Trumpington Park & Ride / the Biomedical Campus), a likely benefit to commuters is to increase the potential journey options available by other modes. So where a car might have previously been essential, a new bus route provides a greater degree of choice for car drivers (irrespective of whether this choices is actually taken up). For people of working age who do not have access to a car, this benefit is likely to be much more significant as it opens up employment opportunities that may have been impossible before.
As with business travellers, there will also be journey time savings associated with reductions in forecast traffic and congestion if there is mode switch to the bus. The extent of these benefits will depend on the potentially attractiveness of the service if journey times and reliability are competitive with the private car.

9.4. People Without Access to a Car

Even though it is often assumed that everyone has access to a car, there are still a significant number of people who rely on other modes – especially public transport.

Whilst perhaps slightly less the case in Cambridge, people without access to a car are often the lower income members of society, for example the young and elderly. This means that such people completely rely on bus services for a whole range of journey purposes – including employment, education, shopping and personal business (in particular in relation to medical appointments). A lack of any viable bus service means a reduction in choice, especially in comparison to people who have access to a car.

Where existing frequencies are either very low or non-existent, improvements to bus services will be of particular benefit to people without access to a car – for example where they enable people to get to and from time-dependent journey purposes (e.g. jobs which have fixed start and finish times). Where already higher frequency services are improved still further, the additional “marginal” benefit to people without a car may be less significant.

9.5. Local Communities

Local communities describe the places where people live – typically villages or defined areas within towns and cities.

Bus services can make communities more attractive places to live because of the additional accessibility that they offer – both for people who have access to a car and for those who don’t.

There is also a potential local traffic reduction benefit if bus services are able to encourage people to leave their car at home. This can be the result of travel choices of residents within the area (i.e. less people driving from an origin within the community) and those from elsewhere (i.e. less people driving through other communities). Irrespective of its source, less traffic travelling within communities has benefits in terms of better air quality, lower levels of noise and fewer accidents.

9.6. Businesses, Research Institutions and the Wider Economy

Economies rely on transport systems to bring people together to create economic value.

Modern businesses and economies are increasingly reliant on people working together in concentrated areas or “clusters” of activity. Traditionally these clusters (or “agglomerations”) have formed around compact urban centres (so-called “Central Business Districts”) but increasingly they are spreading out across wider urban areas. The key economic facet of agglomerations is that they enable businesses to trade and collaborate with one another – for example as part of complex supply chains or through sharing ideas for new products and services – without the need to travel long distances and incur resulting costs. Educational institutions are increasingly contributing to this economic growth as a result of their cutting edge research, and they also represent an additional source of travel demand.

Because of their relative density, agglomerations attract significant travel demand especially by private car. In the medium to longer term, the resulting traffic congestion from this very dense development can make economic areas less attractive because of the delays and financial costs of access. But on the flip side they can also provide a market for mass public transport.

Better public transport services – both bus and rail – can make a significant contribution to economic performance of agglomeration areas by enabling many more people to gain access than would be physically possible if everyone drove their own car. Collectively, the businesses and research institutions in the agglomeration area benefit from the fact that there are more people working there – as they can trade, exchange ideas and collaborate more intensively. Public transport services also benefit agglomeration economies in other ways – for example by widening pools of labour and encouraging inward investment.
10. Performance of Options

Scheme-specific objectives provide the performance metrics against which the options are assessed, both for their “strategic fit” to policies and in terms of their direct economic benefits.

10.1. Initial assessment of strategic fit – EAST Assessment

The Early Assessment and Sifting Tool (EAST) review process is a high-level and early-stage DfT decision support tool and has been developed to summarise and present evidence on options in a clear and consistent format. EAST was, therefore, used as the base analysis of options for City Deal schemes within Cambridgeshire. The tool does not make recommendations, but is used to:

- Refine options by highlighting adverse/unanticipated consequences;
- Compare options across modes and areas;
- Filter the number of options and discount non-runners; and
- Identify key uncertainties in the analysis or areas where effort should focus.

The EAST assessment was undertaken by three independent assessors and then agreed at a collaborative workshop with CCC Officers. The findings from the EAST assessment that was undertaken are presented below. The assessment noted no transport need for all options if delivered standalone and the assessment, therefore, also considered the likely need should bus demand be identified in the future.

10.1.1. Option A

**Segregated bus-only slip-road created by widening of the existing M11 off-slip. Provides fully segregated bus-only access to the Park & Ride site. Some flexibility of alignment to the east of Junction 11, point of exit from M11 is fixed.**

The EAST review indicated that Option A could be considered to have a minor ‘scale of impact’ but with a good fit with both Government and wider objectives. On the assumption that bus routes were to use the bus-only slip-road in the future, the benefit to services in terms of journey time savings or improved reliability would be dependent on whether the Western Orbital scheme is implemented to ensure that buses do not experience congestion on the M11 carriageway.

The assessment indicated that Option A could potentially offer transport economic (journey time saving) benefits over the private car were it to be used by bus routes in the future. Social benefits could be derived from more people having access to bus services and a small reduction in carbon emissions could be derived from buses spending less time queueing on the Junction 11 off-slip. The level of impact on the local environment was considered to be low, as despite the required land take, there is likely be limited noise or air quality impacts due to the existence of the current slip-road and the current assumption that there will be 6 buses per hour using the slip-road in the future.

Option A was considered to be relatively acceptable to the public due to its lower cost and it is not predicted that considerable risk would be involved with its construction.

10.1.2. Option B

**Bus-only slip-road parallel to the existing off slip and bypasses existing traffic signals at the end of the slip-road. The existing slip-road would be widened to accommodate the extra lane. The bus-only slip-road then continues onto the dedicated Park & Ride traffic lane beyond the junction on the A1309.**

The EAST review of this option was similar to that of Option A, however the scheme is lower cost and is likely to have a lower impact on the local environment as a result of the lower levels of land take required.
The risks were considered to be lower related to land acquisition and ownership. Due to the lower level of change from the existing layout (compared to Option A), this option was considered to be more publically acceptable than Option A.

On the assumption that bus routes were to use the bus-only slip-road in the future, the benefit to services in terms of journey time savings or improved reliability would be dependent on whether the Western Orbital scheme is implemented to ensure that buses do not experience congestion on the M11 carriageway.

10.1.3. Option C

*Bus-only slip-road leaving the M11 starting before the existing agricultural accommodation bridge* (for buses travelling southbound on the M11). It is likely this option will require widening of the span of the existing agricultural accommodation bridge. The segregated bus-only lane could continue to the Park & Ride alongside the A1309.

The EAST review indicated that Option C could have a medium-high ‘scale of impact’ as well as a good fit with both Government and wider objectives. On the assumption that bus routes were to use the bus-only slip-road in the future the benefit to those buses in terms of journey time savings or improved reliability were considered to be greater than for Option A/B as buses leave the M11 earlier. On the assumption that bus routes were to use the bus-only slip-road in the future, the benefit to services in terms of journey time savings or improved reliability would be dependent on whether the Western Orbital scheme is implemented to ensure that buses do not experience congestion on the M11 carriageway.

Social benefits were considered to be derived from more people having accesses to bus services. A small reduction in carbon emissions was considered to be derived from buses spending less time queueing on the Junction 11 off-slip and on the M11 carriageway. There may be a medium level of impact on the local environment due to the greater level of land take and visual and noise impacts away from any existing alignment and for a greater distance than some other options.

Option C was considered to be likely to have a higher level of opposition from some members of the public due to the relatively high cost of the scheme compared with the likely perceived economic and social benefits. The scheme would also involve land take and land owners may object.

Option C was considered to be relatively high cost and more likely to generate risk during its construction.

10.1.4. Option D

*Bus-only slip-lane leaving the M11 prior to the existing agricultural bridge and joining the alignment of a disused railway line to access the rear of Trumpington Park & Ride.*

Option D was considered to be similar to Option C in terms of scale of impact, economic benefit and carbon emissions.

Option D was also considered to be relatively high cost and more likely to generate risk during its construction. Option D was not considered to be flexible as its point of departure from the M11 is fixed and use of the disused railway line fixes the route between the M11 and Trumpington Park & Ride.

10.1.5. Summary

The EAST process is a useful early stage tool for reviewing options, in this case for the provision of bus-only slip-road at Junction 11 of the M11. It prompts assessors to review the benefits of the scheme across a whole range of factors and identifies benefits and constraints which may not have otherwise been considered.

Further investigation is required to consider likely the costs, benefits and value for money presented by each scheme option. See the Economic Case for a full summary.

10.2. Comparison of Options

A high level (generally qualitative) comparison of each option is presented in Table 10-1. Additional metrics are presented in the Economic Case. Further assessment is required to assess performance against objectives.
### Table 10-1 Comparison of scheme options

<table>
<thead>
<tr>
<th>Description</th>
<th>Option A</th>
<th>Option B</th>
<th>Option C</th>
<th>Option D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of new bus-only slip-road from existing M11 junction 11 southbound off-slip, continuing onto Park &amp; Ride site as bus-only route running parallel to Hauxton Road and the Trumpington Meadows access road at its junction with Addenbrookes Way.</td>
<td>Introduction of new traffic signal bypass lane from existing M11 junction 11 southbound off-slip at its junction with the A10. Beyond the junction the buses will merge with park &amp; ride traffic within dedicated nearside lane and continue onto Park &amp; Ride site using the existing infrastructure on Hauxton Road.</td>
<td>Introduction of new bus-only slip-road from an extended M11 junction 11 southbound off-slip, continuing onto Park &amp; Ride site as bus-only route running parallel to extended slip and Hauxton Road and crossing the Trumpington Meadows access road at its junction with Addenbrookes Way.</td>
<td>Introduction of new bus-only slip-road from the existing M11 southbound carriageway prior to the existing River Cam crossing, following the alignment of the dismantled railway line onto the Park &amp; Ride site, with a new bridge crossing the River Cam.</td>
<td></td>
</tr>
<tr>
<td>Outturn costs(^{20})</td>
<td>£3.8m</td>
<td>£1.4m</td>
<td>£13.3m</td>
<td>£10.0m</td>
</tr>
<tr>
<td>3rd Party Funding</td>
<td></td>
<td></td>
<td></td>
<td>TBC</td>
</tr>
<tr>
<td>Construction Risk</td>
<td>Sub-standard design currently proposed to accommodate bus-only off-slip, low land acquisition risk.</td>
<td>Low land acquisition risk.</td>
<td>Low land acquisition risk, alterations to existing agricultural bridge to enable access over extended off-slip-road and alignment of bus-only route adjacent or through Trumpington Meadows development.</td>
<td>Low land acquisition risk, new structure over River Cam and alignment of bus-only route adjacent or through Trumpington Meadows development.</td>
</tr>
<tr>
<td>Construction Traffic Impacts</td>
<td>Localised disruption to traffic where traffic management is present on off-slip during construction.</td>
<td>Localised disruption to traffic where traffic management is present on off-slip during construction.</td>
<td>Disruption to traffic where traffic management is present.</td>
<td>Disruption to traffic where traffic management is present.</td>
</tr>
<tr>
<td>Policy Fit</td>
<td>Good fit in general, but the scheme is dependent on bus demand from other City Deal HQPT schemes. As a standalone scheme there will be no demand for the slip-roads.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefit to Existing Bus Routes</td>
<td>None as no existing bus routes use the junction.</td>
<td>Minor JT and reliability benefit.</td>
<td>JT and reliability benefit greater than A/B. Further investigation to compare C/D.</td>
<td>JT and reliability benefit greater than A/B. Further investigation to compare C/D.</td>
</tr>
<tr>
<td>Benefit to Assumed Bus Routes</td>
<td>Minor JT and reliability benefit.</td>
<td>Minor JT and reliability benefit.</td>
<td>JT and reliability benefit greater than A/B. Further investigation to compare C/D.</td>
<td>JT and reliability benefit greater than A/B. Further investigation to compare C/D.</td>
</tr>
<tr>
<td>Highway Impacts</td>
<td>Unlikely to cause significant highway impacts, however further assessment is ongoing. Some highway benefits as a result of mode shift from private car to bus.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average JT per PCU vs DM</td>
<td>Further work ongoing.</td>
<td>Further work ongoing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Delay per PCU vs DM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monetised Time Benefits</td>
<td>Unlikely to cause significant highway impacts, however further assessment is ongoing. Further work is ongoing to assess potential PT benefits.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue Impact</td>
<td>These impacts are dependent on mode shift from highway to bus and are being investigated with further work.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety Impact</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>The scheme could reduce queuing and so cut carbon emissions. Mode shift from the private car to future bus services is possible if bus journeys are sufficiently attractive in terms of journey time and reliability. Options that require more land take will have a greater impact on the environment. Offline options will have a greater visual and noise impact.</td>
<td></td>
<td></td>
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</tbody>
</table>

\(^{20}\) Full details on costs are provided in the Economic Case and Financial Case.
11. Conclusions

There are currently no existing or planned local bus routes that exit southbound at the M11 Junction 11 to Trumpington Park & Ride and the Biomedical Campus. As a result, there is no transport need and no strategic case for investment in a southbound bus-only slip-road as a stand-alone scheme, unless future bus routes use the junction, met by financially sustainable bus services.

The GCCD’s mandate is to “help Greater Cambridge to maintain and grow its status as a prosperous economic area” and toward achieving the following outcomes in support of economic growth:

- Accelerating delivery of over 33,500 new homes on a combination of major sites and rural exception sites in and around the city;
- Delivering 45,000 new jobs, via a number of employment growth sites identified and in development around Cambridge to build on the city’s world leading science research business credentials; and
- Improving transport infrastructure to support this housing and employment growth while retaining the high quality of life in the region.

Atkins was commissioned by the City Deal Partners to produce a Strategic Outline Business Case (SOBC) for the M11 Junction 11 bus-only slip-road scheme. The SOBC will be submitted to the Greater Cambridge City Deal (GCCD) Board for approval to proceed to a single option design. The aim of this Strategic Case is to set the evidence that demonstrates the need for a transport scheme.

To date, the Greater Cambridge area has an exceptionally successful story to tell and for this to continue economic growth is dependent on investing in physical infrastructure capacity that addresses key issues such as housing shortages and a congested transport network. This investment must be in line with the vision, whilst also providing clear evidence that new infrastructure is able to meet the relevant City Deal objectives and deliver Value for Money.

The Cambridge and South Cambridgeshire Local Plans, and the TSCSC, present a clear and distinct overall vision of ensuring that growth takes place in a sensitive and sustainable manner and that development offers opportunities to all of its citizens. New development will promote the use of sustainable modes of transport and should seek to facilitate the infrastructure required to support growth. The transport system will encourage sustainable modes and will be centred on high quality “dedicated passenger transport routes with fast and frequent links to and from key destinations”. The vision indicates that car use will continue in the future, but that car trips will be on routes away from buses and cyclists.

Junction 11 of the M11 is identified as having ‘severe capacity issues’. Traffic queues on the southbound slip and along Hauxton Road, particularly in the morning peak. This queueing traffic on the M11 Junction 11 southbound slip-road will have an impact on any future bus journey times for services exiting at the junction.

As a standalone scheme, that no current bus routes use, there is no rationale for investment and as a result the scheme will not meet any of the City Deal objectives as the infrastructure will be redundant and not solve a transport problem.

While there is no current scheme-relevant bus demand and no transport need or case for investment, congestion could have an adverse impact on any future services. Future housing and business development, in particular at the Biomedical Campus, will lead to additional pressure on the already congested junction, particularly at peak times when people are travelling to work. In addition, with public transport provision to the West and North of Cambridge not offering a viable alternative to the private car, there is an opportunity to implement new HQPT provision to encourage mode shift to the bus, in line with wider objectives.

Four scheme options have been developed to ensure that any future buses do not experience delay or reliability issues caused by general congestion at the Junction:

- Option A: Existing slip-road retained then fully segregated off-line but adjacent bus-only lane at the junction with access to the Park & Ride at the next junction;
- **Option B:** Existing slip-road retained then bus-only lane at the junction created parallel to the slip-road through widening, bypassing the existing traffic signals, with access to the Park & Ride at the next junction;

- **Option C:** The design extends the off-slip at Junction 11 for all traffic to the north of the agricultural bridge, with a segregated bus-only slip-road branching from the extended off-slip, crossing existing agricultural land and continuing to the Park & Ride site; and

- **Option D:** A bus-only slip-road leaves the M11 close to the location of the disused railway line and then follows the railway line alignment to meet the northern boundary of the existing Park & Ride site.

The subsequent Option C (II) and Option D (II) alignment variations are not formally assessed in this Business Case. Further work would be required in order to confirm the costs, benefits, impacts and overall Value for Money of these new options.

This strategic case has identified that there is no current transport need for investment and has also presented the potential rationale for consideration of bus-only slip-road at M11 J11 to give priority to bus services that will meet future bus demand from the Western Orbital bus corridor and wider demand from the A428 Western Corridor (from the Cambourne to Cambridge Better Bus Journeys scheme). Specifically it is expected that the M11 J11 bus-only slip-road could directly enable future bus services using the Western Orbital route to bypass any congestion and facilitate fast and reliable journey times from the M11 to Trumpington Park & Ride and the Cambridge Biomedical Campus.

With the junction currently congested at peak times, the bus-only slip-road scheme could directly address future congestion issues at the junction and on Hauxton Road, which would delay future bus services exiting the junction. This could enable any future buses using the Western Orbital to run on a bus-priority route for the entirety of the journey, potentially making the services more attractive to current users of private car, encouraging modal shift.

Further work on the Western Orbital and Cambourne to Cambridge Better Bus Journeys Scheme is likely to inform future stages of the M11 Junction 11 bus-only slip road scheme business case in terms of identifying potential demand and subsequently identifying a transport need.
Appendix A. Cambridge Southern Fringe Development