Colchester Rapid Transit

Essex County Council

Strategic Outline Business Case

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Colchester Rapid Transit

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Contents

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Executive Summary

Background to the Project

Jacobs has been appointed by Essex County Council (ECC) to undertake a Rapid Transit study for East Colchester.

The key objectives for the study were to:

- Define and model up to four rapid transit route options;
- Determine the potential patronage of the rapid transit options;
- Develop an outline business case, if appropriate, for the most appropriate option; and
- Summarise the results in an Appraisal Report and present to stakeholders.

In addressing these objectives, the brief asked for three elements to be considered:

- a Rapid Transit System that could either be tram or bus based;
- a new Park and Ride Site to the east of Colchester in Tendring District; and
- a new Railway Station to serve the University.

The Strategic Case

East Colchester is an area which has undergone extensive change and regeneration over many years. The current Colchester Local Plan (2008-10) allocated 2,600 new dwellings for the area, and some 36,000 m^2 of office type commercial development – most of this at the Knowledge Gateway on University of Essex land.

Colchester Borough and Tendring District are co-operating on the potential for a 6,000 dwelling development on land between the A133 and the A120 to the north east of the University. Development of this scale would include some employment opportunities but if travel-to-work patterns remain the same, Colchester will provide most of their employment opportunities.

The University of Essex expects to grow in size with 15,000 students and 4,000 staff by 2020. This is in addition to the development at the Knowledge Gateway. The University wishes to attract businesses which complement its academic courses and allows students to develop future businesses locally and in turn support the future growth and standing of both the University and the town.

Further growth is expected also in the Tendring peninsula. The Tendring Strategic Housing Market assessment suggests that 10,960 dwellings are required in the period 2013 to 2029. This could include some or all of the dwellings identified for the land to the north of the University.

In the absence of a significant intervention in the transport system of East Colchester, all these developments will result in significant additional road congestion in the area. There would also be a loss of impetus and lack of confidence by developers in the East Colchester development sites. The impact could be a delay to construction, significantly damaging to the current momentum and jeopardising the ability to meet strategic housing targets for Essex.

Such intervention is consistent with national, regional and local policies.

The Economic Case

A considerable amount of technical work and stakeholder consultation was undertaken to develop and define a shortlist of schemes for appraisal. Two main network options have been identified as shown in Figure 1 and Figure 2, referred to as Network options C and D respectively.

Figure 1 : Network C Schematic

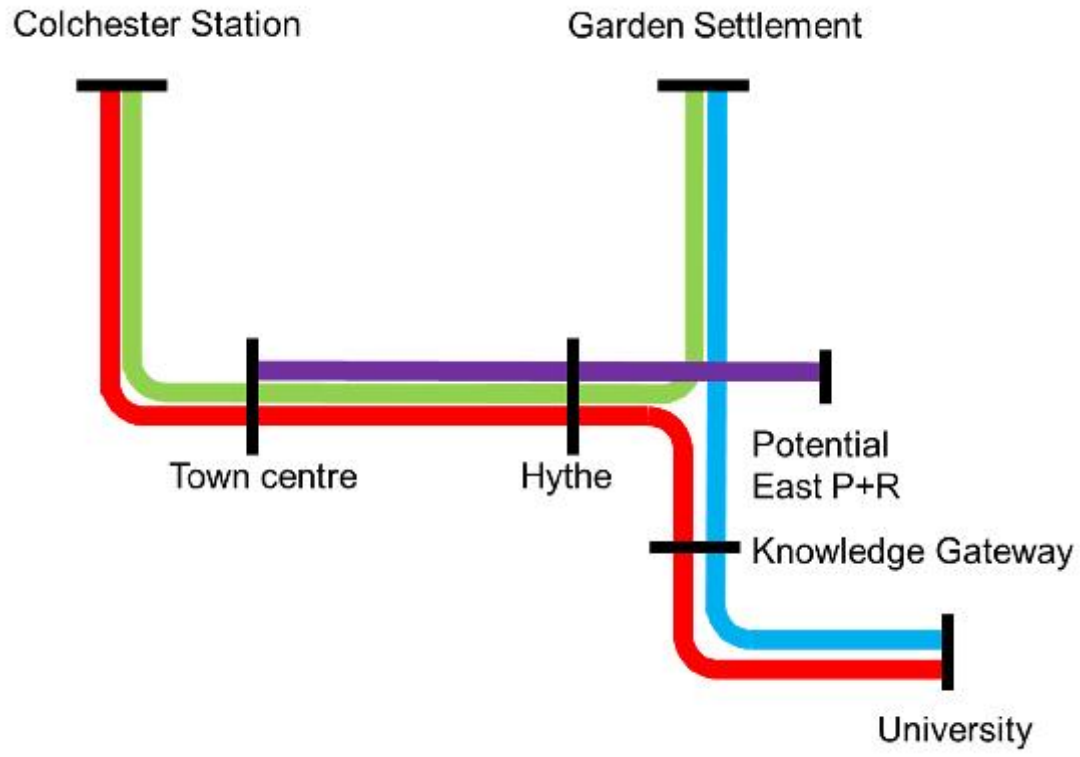
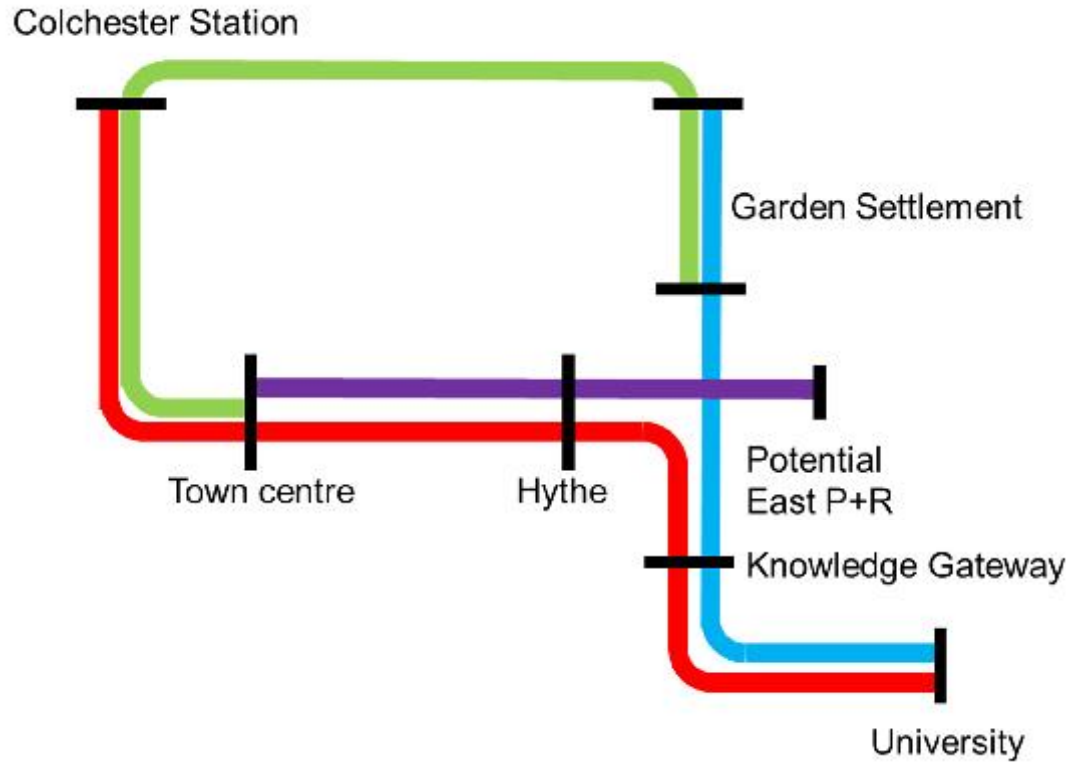


Figure 2 : Network D Schematic



We shortlisted four route and network options for further appraisal in consultation with members of the East Colchester Working Group. All these involve a route network to serve Colchester station, Colchester Town, the Knowledge Gateway, the University and the Garden Settlement as well as a park and ride site on the A133. They differ by the corridor chosen for achieving the connection between the east Colchester and Colchester town centre:

- Option 1: East Hill/Greenstead Road;
- Option 2: Takeover of the rail corridor to Colchester Town;
- Option 3: alignment via Military Road; and
- Option 4: connection from Garden Settlement to Colchester town centre via A120.

Takeover of the rail corridor to Colchester Town would enable diversion of existing services to a new interchange between rail and Rapid Transit at The Hythe.

In general it was assumed that all options would be implemented as bus-based rapid transit systems. In addition, option 2 was appraised as a tram-based scheme, so we refer to option 2B (bus) and option 2T (tram) respectively in the remainder of this report.

A high level demand forecasting model has been set up in line with available resources and required timescales. This has been developed in parallel with highway model for the Colchester Local Plan support.

The modelling has been undertaken for a single forecast year, 2032. Overall levels of demand were derived from the land use analysis undertaken for the local plan development modelling which identified three main development scenarios plus a “no growth” and “maximum growth” scenario. For the purposes of the rapid transit modelling, we used Scenario 1, with development focussed to the east and west. This is thought to be a realistic growth scenario for the East Colchester area.

The resulting demand forecasts from the modelling based on the above forecasting assumptions are summarised in Table 1.

Table 1 : Demand Forecast Summary: 2032 Development Scenario 1

	Option 1 East Hill	Option 2B Rail Corridor	Option 3 Military Rd	Option 4 A120	Option 2T Rail Corridor (Tram)
AM peak h Rapid Transit trips	1,200	1,300	800	1,000	2,200
AM peak h Rapid Transit Pax kms	4,300	5,000	3,400	3,900	8,100
Annual Rapid Transit trips (m)	2.8	3.1	2.0	2.4	5.2
Average trip length (kms)	3.7	3.9	4.0	4.0	3.7
Annual Rapid Transit revenue (£m)	£60m	£65m	£43m	£50m	£109m
Annual incremental PT revenue (£m)	£48m	£50m	£34m	£41m	£92m

The appraisal results for the five scheme options are summarised in Table 2 to Table 4.Table 2Table 2 : Appraisal Summary: Costs and Revenues (PV, 2010 prices)

	Option 1	Option 2B	Option 3	Option 4	Option 2T
Capital costs	-£52m	-£84m	-£55m	-£65m	-£287m
Operating and maintenance costs	-£79m	-£81m	-£90m	-£94m	-£238m
Total costs	**-£131m**	**-£164m**	**-£145m**	**-£159m**	**-£525m**
Net incremental revenue	**£48m**	**£50m**	**£34m**	**£41m**	**£92m**
Total Financial Effect	**-£83m**	**-£115m**	**-£110m**	**-£117m**	**-£433m**

Table 3 : Appraisal Summary: Social Benefits (PV, 2010 prices)

	Option 1	Option 2B	Option 3	Option 4	Option 2T
Time savings, business users	£6m	£6m	£5m	£5m	£10m
Time savings, commuting	£54m	£58m	£42m	£49m	£93m
Time savings, other users	£59m	£63m	£46m	£53m	£101m
Road operating cost savings	£4m	£4m	£3m	£3m	£9m
Road decongestion	£3m	£4m	£2m	£3m	£7m
Accidents	£8m	£9m	£5m	£7m	£19m
Noise, air quality and greenhouse gas[1]	£0m	£0m	£0m	£0m	£0m
Total Social Benefits	**£134m**	**£144m**	**£103m**	**£119m**	**£239m**

Table 4 : Appraisal Summary: NPV and Benefit/Cost Ratio

	Option 1	Option 2B	Option 3	Option 4	Option 2T
PV of project costs	£131m	£164m	£145m	£159m	£525m
PV of net revenue	£48m	£50m	£34m	£41m	£92m
Present Value of Costs (PVC)	**£83m**	**£115m**	**£110m**	**£117m**	**£433m**
PV of social benefits	£134m	£144m	£103m	£120m	£239m
PV of indirect taxation impact	£-2m	£-3m	£-2m	£-2m	£-6m
Present Value of Benefits (PVB)	**£132m**	**£141m**	**£101m**	**£118m**	**£234m**
Net Present Value (NPV=PVB-PVC)	**£48m**	**£26m**	**-£9m**	**£0m**	**-£199m**
Benefit/Cost Ratio (BCR=PVB/PVC)	**1.58**	**1.23**	**0.91**	**1.00**	**0.54**

[1] Values lost in rounding

The Financial Case

High level outline capital costs for the different scheme options have been derived using a unit cost analysis applied to the scheme elements required by each of the options.

The resulting overall operating cost estimate is summarised in Table 5.4.

Table.5 : Operating and Maintenance Costs

	Option 1	Option 2B	Option 3	Option 4	Option 2T
Capital Cost Estimate	**29.8**	**48.0**	**31.3**	**37.3**	**164.6**
Annual operating cost (£m)	**2.76**	**2.73**	**3.19**	**3.27**	**9.40**
Annual busway maintenance cost (£m)	**0.18**	**0.27**	**0.21**	**0.24**	**-** [2]

If a successful case for the scheme can be made by Essex County Council, then there may be a reasonable expectation of some funding from the Department for Transport.

However, it is likely that funding will be derived from a range of sources and given the uncertainties over most potential funding sources, it is important to continue to make the case for the project, develop funding applications for appropriate funds and work towards contribution agreements with developers under s106 and s278.

The Commercial Case

At this stage of the project, it is only possible to provide a very high level view of the Commercial Case.

The project would be promoted by Essex County Council as the Highway and Transport Authority for Colchester, with the support of Colchester Borough Council as the local authority. A wide range of other stakeholders would need to support the project.

It is too early in the project to define a firm procurement strategy. It is likely that a Design & Construct procurement route will deliver the project in the timeliest manner and provide the benefits of early stage contractor involvement.

Essex County Council would be the likely contractual party for the construction phase of the project. However, for the railway elements of works, it is expected that the construction stage would be led by Network Rail, who are experienced in rail construction projects. The proposed scheme represents a relatively small project close to existing railway track, and would be managed within Network Rail's standard procedures.

For BRT options, it would be most efficient if an existing bus operator who is active in Essex was contracted to provide the services, with Essex County Council retaining the responsibility for maintaining the on-street infrastructure. For tram options, a dedicated operational company would need to be set up who may also assume responsibility for the maintenance of the on-street infrastructure.

Any rail assets would continue to be maintained by Network Rail, though station maintenance at Hythe may be contracted to the current franchise operator.

[2] Operating cost per tram km includes permanent way maintenance

The Management Case

As with the Commercial Case, it is only possible to provide a very high level view of the Management Case at this stage of the project.

Essex County Council is the likely promoter of the scheme, working with key stakeholders such as Colchester Borough Council, Network Rail and local developers.

The route taken to obtaining planning consent for the scheme will depend on the nature of the project. A tram scheme would require a Transport and Works Act Order (TWAO) application but it may be possible to pursue bus-based solutions through a simpler route. It may be possible to obtain consent for some of the bus infrastructure requirements (at least within, or adjacent to the Garden Settlement) as part of the consents process for the development.

Railway infrastructure works at Hythe Station could potentially be implemented under Permitted Development if no land-take is involved but would require a TWAO if they involve compulsory purchase of land. This TWAO would most likely be pursued by Network Rail. Before a TWAO submission, there would be a need for discussions and negotiations with DfT and the TOC to agree a contract change for any changes to service patterns involving Colchester Town, Hythe and Colchester stations.

The closure of the railway line to Colchester Town as required for option 2 would require statutory procedures as specified in the Railways Act 2005. In practice, the assessment of closure proposals required by the 2005 Act uses an approach to transport appraisal based on the New Approach to Appraisal (NATA) and so covers the five criteria specified in NATA used in assessing investment proposals. Thus the investment case for conversion would also have to demonstrate that the replacement services represented better value for money than the existing rail service.

An indicative delivery programme for the full scheme is outlined in Table 6.

Table 6 : Indicative Delivery Programme

Heading	Date
Confirmation of preferred option	2016
Refinement of business case	2017
Public consultation	2017/18
Outline funding agreements	2018
Development of full business case	2019
Outline design	2019
Further public and stakeholder consultation	2019
ECC decision to proceed with the project	2019
Start of Consents process (including TWAO if required)	2020
Consent obtained	2021
Design and Construct tender process	2021
Detailed design	2021/22
Construction phase	2022-2024
Testing and Commissioning	2024
Scheme Opening	2025

Conclusions and Recommendations

Based on the project costing, demand forecasting and economic appraisal, Option 1 performs best in terms of affordability, Net Present Value (NPV) and Benefit/Cost Ratio (BCR). With a BCR of 1.58, this project would be classified as “medium value for money” in the DfT value for money categorisation.

However, Option 2 generates the highest benefits and largest amount of revenue. Implemented as a bus scheme, this option generates a positive NPV and a BCR above 1 (though not as positive as option 1). As a tram, the option generates significantly higher benefits and revenues but the increase is not sufficient to offset the substantial additional costs. Option 2 also has better potential for onward connections to the west.

Options 3 and 4 do not perform well.

These conclusions remain robust under most of the sensitivity tests undertaken.

Our recommendation is to continue to develop the case for the scheme based on a bus-based route network using the alignment put forward under Option 1, while exploring further how a later upgrade to Option 2 could be achieved. The need to tie in development in Marks Tey to the centre of Colchester could add justification to a strong, dedicated, east-west through corridor facilitated by Option 2. Additional development around Langham would strengthen the case for improving the bus priority corridor from the north Park and Ride site via Colchester Station to the town centre.

1. Introduction

1.1 Background

Jacobs has been appointed by Essex County Council (ECC) to undertake a Rapid Transit study for East Colchester. The work was undertaken concurrently with transport model development in support of the emerging Local Plan using the Colchester Area SATURN model.

Key stakeholders in the study include ECC, Colchester Borough Council (CBC) and Tendring District Council (TDC). The study brief was provided by CBC.

1.2 Study objectives

The brief highlights that the Councils aspire to an innovative solution which is of high quality, promotes the new development, makes a statement and has a significant impact on travel choice. It specifies that the system should make best use of both land and financial resources and be compatible with the approach of sustainable "Garden Settlement" development. It should also have the potential to grow and the potential to attract and stimulate growth.

The key objectives for the study were to:

- Define and model up to four rapid transit route options;
- Determine the potential patronage of the rapid transit options;
- Develop an outline business case, if appropriate, for the most appropriate option; and
- Summarise the results in an Appraisal Report and present to stakeholders.

In addressing these objectives, the brief asked for three elements to be considered:

- a Rapid Transit System that could either be tram or bus based;
- a new Park and Ride Site to the east of Colchester in Tendring District; and
- a new Railway Station to serve the University.

1.3 Local context

Colchester is a historic market town in Essex with a population of 122,000 (2011 census). The local authority district (Colchester Borough) is estimated to have a population of 180,000.

Colchester lies some 80 km northeast of London and has good connections to the capital via the A12 trunk road and the Great Eastern rail line.

In common with other districts in the south east of England, there is considerable pressure on housing supply in Colchester and in order to meet government housing targets, there are ambitious targets for residential developments to the east and west of the existing town, at East Colchester and Marks Tey.

East Colchester is the focus of the current study.

1.4 Purpose of this report

The purpose of this report is to document the option development and selection for the appraisal of Rapid Transit options for East Colchester and to present a strategic outline business case for the scheme.

1.5 Report structure

The Department for Transport's (DfT) guidance document on business case development for transport projects of January 2013 describes the "five cases" approach to demonstrate whether schemes:

- are supported by a robust case for change that fits with wider public policy objectives - the 'strategic case';
- demonstrate value for money – the 'economic case';
- are commercially viable – the 'commercial case';
- are financially affordable – the 'financial case'; and
- are achievable – the 'management case'.

The remainder of this document follows that structure to present the five cases.

However, as a considerable amount of technical work and stakeholder consultation was undertaken to develop and define a shortlist of schemes for appraisal, we have pulled the option development out as a separate chapter to allow clearer presentation of this aspect of work. This has been interjected between the chapters on the Strategic Case and the Economic Case and covers:

- Identification of an appropriate transport scheme;
- Possible modes and infrastructure options;
- Route options between the town centre and Hythe;
- Selection of options taken forward for further analysis; and
- University Links.

There are two appendices to this report. Appendix A contains full DfT appraisal tables and appendix B lists the documents consulted in the course of producing this business case.

2. The Strategic Case

2.1 Statement of problems

2.1.1 Current situation

East Colchester is an area which has undergone extensive change and regeneration over many years. There has been a move away from port activities in the area – typically the delivery of materials such as aggregates, timber and grain. As manufacturing has moved out, residential and service sector industries have moved in.

In 1964, the University of Essex opened on its own campus site, to the east of Colchester. To the north of the Hythe Quay area, the large Greenstead housing estate was constructed in the 1970s. The transport demands of the area, continued population growth in Colchester and Tendring, and increased access to the car, have put increasing demands on the road infrastructure in east Colchester.

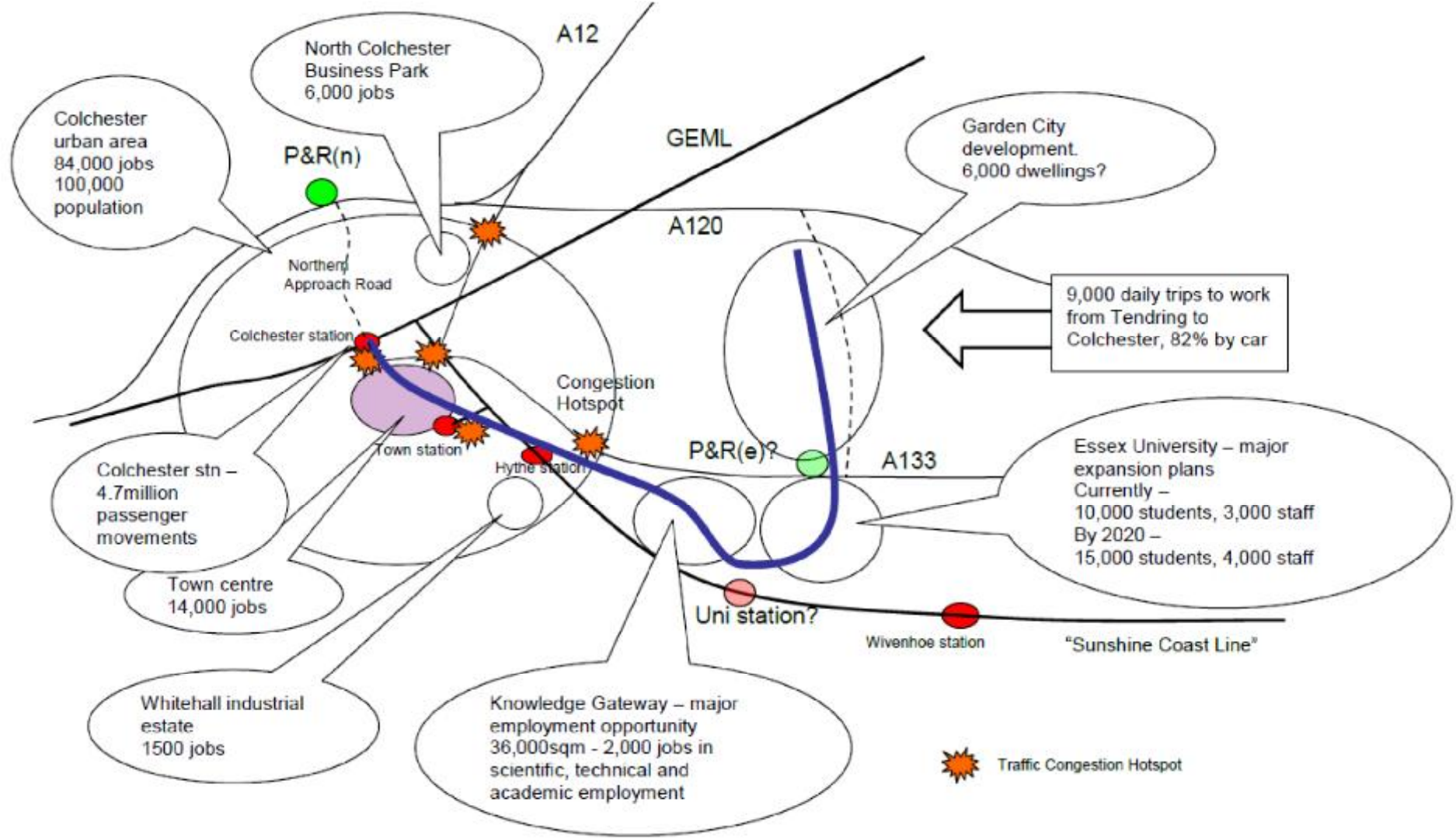
As regeneration of the area takes place, and with the continued expansion plans of the University, there is expected to be more people living, working and studying in the area with a range of different travel demands. The last major piece of road infrastructure delivered in the area was the A134 Colne Causeway, crossing the railway and the River Colne. This was opened in 1996 with funding from development. To improve rail services in the area, the Hythe station was improved and the platforms lengthened to allow for 12 car trains.

The current Colchester Local Plan (2008-10) allocated 2,600 new dwellings for the area, and some 36,000 m^2 of office type commercial development – most of this at the Knowledge Gateway on University of Essex land. A new The Colne Harbour Masterplan was prepared and adopted in 2008. The University has an aspiration for a new railway station to serve the new development in the area and act as a catalyst for inward investment. This was included as part of the University's Knowledge Gateway proposal. In 2001, consultants undertook a demand study for a station in the area. Land was set aside for a new station, but due to the high cost of moving railway infrastructure the development was not viable if the station continued to be included as part of the development. As a consequence The Hythe station in the Colne Harbour area was upgraded in 2009 to allow more trains to stop.

2.1.2 Impacts of not changing

In addition to the existing pressures on the transport links in the area, Figure 2.1 shows the development, the growth opportunities, the congestion hot spots and the major road and rail infrastructure from the east.

Figure 2.1 : Development, Growth Opportunities, Congestion and Infrastructure in East Colchester



The dashed lines show a potential road link between the A133 and the A120. The second is the Northern Approaches Route bus way from the northern A12 junction 28 park and ride site to the town centre. The park and ride site opened in spring 2015.

Colchester Borough and Tendring District are co-operating on the potential for a 6,000 dwelling development on land between the A133 and the A120 to the north east of the University. Development of this scale would include some employment opportunities but if travel-to-work patterns remain the same, Colchester will provide most of their employment opportunities. All of Tendring (with the exception of Clacton) is part of the Colchester Travel to Work Area.

The University expects to grow in size with 15,000 students and 4,000 staff by 2020. There is the 36,000m^2 Knowledge Gateway where land is available for employment. The University wishes to attract businesses which complement its academic courses and allows students to develop future businesses locally and in turn support the future growth and standing of both the University and the town.

Further growth is expected also in the Tendring peninsula. The Tendring Strategic Housing Market assessment suggests that 10,960 dwellings are required in the period 2013 to 2029. This could include some or all of the dwellings identified for the land to the north of the University.

The Colne Harbour regeneration is well underway with new accommodation and employment taking place.

In the absence of a significant intervention in the transport system of East Colchester, all these developments will result in significant additional road congestion in the area. There would also be a loss of impetus and lack of confidence by developers in the East Colchester development sites. The impact could be a delay to construction, significantly damaging to the current momentum and jeopardising the ability to meet strategic housing targets for Essex.

2.2 Policy context

2.2.1 National policy

National Planning Policy Framework

The Department for Communities and Local Government published its National Planning Policy Framework in March 2012. This sets out the Government's planning policies for England and how these are expected to be applied. It is focussed on sustainable development and sets out the Government's view of what sustainable development in England means in practice for the planning system.

It highlights three dimensions to sustainable development and outlines the need for the planning system to perform a number of roles:

- *an economic role – contributing to building a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure;*
- *a social role – supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high quality built environment, with accessible local services that reflect the community's needs and support its health, social and cultural well-being; and*
- *an environmental role – contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy.*

Under "promoting sustainable transport" it highlights that *transport policies have an important role to play in facilitating sustainable development but also in contributing to wider sustainability and health objectives. Smarter use of technologies can reduce the need to travel. The transport system needs to be balanced in favour of sustainable transport modes, giving people a real choice about how they travel. However, the*

Government recognises that different policies and measures will be required in different communities and opportunities to maximise sustainable transport solutions will vary from urban to rural areas.

It goes on to say that -

Encouragement should be given to solutions which support reductions in greenhouse gas emissions and reduce congestion. 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.

Local authorities should work with neighbouring authorities and transport providers to develop strategies for the provision of viable infrastructure necessary to support sustainable development….

All developments that generate significant amounts of movement should be supported by a Transport Statement or Transport Assessment. Plans and decisions should take account of whether:

- *the 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. Development should only be prevented or refused on transport grounds where the residual cumulative impacts of development are severe.*

Laying the Foundations: A Housing Strategy for England

In November 2011, the Department for Communities and Local Government published a housing strategy which aims to increase the country's housing supply at a national level. It recognises that demand has exceeded supply in recent years which has had an adverse impact on affordability. This is particularly acute in London and the South East. The strategy makes the case for a thriving, active but stable housing market and highlights the need to encourage new house building.

2.2.2 Regional planning policy

Local Transport Plan for Essex

Essex County Council published "Essex Transport Strategy: The Local Transport Plan for Essex" in June 2011.

The document gives the following relevant transport priorities for the Haven Gateway:

- *Providing the transport improvements needed to accommodate housing and employment growth in a sustainable way;*
- *Tackling congestion within Colchester (including the provision of Park & Ride facilities);*
- *Improving the availability, reliability and punctuality of local bus service; and*
- *Improving journeys for commuters travelling to London from Colchester and Braintree; particularly by improving access to railway stations and improving facilities for passengers.*

2.2.3 Local planning policy

Colchester Core Strategy

The Colchester Core Strategy under the Local Development Framework was adopted in December 2008 and selected policies were revised in July 2014.

The document gives the following objectives of relevance to development and transport in East Colchester:

- *Sustainable Development.*
  - *Focus new development at sustainable locations to support existing communities, local businesses, sustainable transport and promote urban regeneration to protect greenfield land.*
  - *Provide the necessary community facilities and infrastructure to support new and existing communities.*
  - *Provide excellent and accessible health, education, culture and leisure facilities to meet the needs of Colchester's growing community.*
  - *Promote active and healthy lifestyles and strive for excellence in education and culture.*
  - *Reduce the Borough's carbon footprint and respond to the effects of climate change.*
- *Centres and Employment*
  - *Create a prestigious regional centre and a vibrant network of district and local centres that stimulate economic activity and provide residents' needs at accessible locations.*
  - *Provide for a balance of new homes and jobs to support economic prosperity of our growing community and reduce the need to travel outside the Borough for employment.*
- *Housing*
  - *Provide high quality and affordable housing at accessible locations to accommodate our growing community.*
  - *Provide a range of different types of new housing to meet the diverse needs of the whole community.*
- *Accessibility and Transportation*
  - *Focus development at accessible locations which support public transport, walking and cycling, and reduce the need to travel.*
  - *Develop Colchester as a Regional Transport Node, improving transport connections and gateways within the Borough and to the wider region.*
  - *Provide excellent public transportation, walking and cycling connections between centres, communities and their needs.*
  - *Improve the strategic road network and manage traffic and parking demand.*

The document identifies a number of growth areas. Under "East Growth Area", it states:

The Hythe area is a former commercial harbour which includes some rundown and underused industrial land. Together with the University of Essex and New Town, this eastern area of Colchester has entered a period of significant growth. The area provides good access to Hythe Station, University of Essex and the Town Centre, but is constrained by limited transport infrastructure and flooding issues.

East Colchester is an established Regeneration Area that seeks to deliver sustainable, mixed use neighbourhoods oriented towards the River Colne and which respect the historic character of the area as the location of the early port. Over the plan period the East Growth Area provides capacity to accommodate at least 2,600 new homes, including over 1,500 homes that have already been completed or permitted. Once local traffic and flooding issues are resolved, then additional development will be encouraged at this highly accessible location. The regeneration of this area therefore needs to be supported by improvements to transport infrastructure, flood mitigation and open space.

2.3 Scheme objectives

While different stakeholders will have different objectives for the scheme, the following set of overarching objectives should underlie the business case:

- To support sustainable local economic activity;
- To reduce local congestion;
- To make best use of existing infrastructure providing improved public transport accessibility;
- To provide maximum value for money against its whole of life costs in accordance with WebTAG;
- To deliver the scheme in a way that supports the delivery of the Government's transport policy objectives;
- Any detrimental environmental effects shall be offset by mitigation measures where technically feasible and economic to do so, taking account of costs, availability of funding and statutory obligations; and
- Current design standards, Guidance and Safety Governance should be adhered to.

2.4 Stakeholders

In addition to Essex County Council, a number of stakeholders have an interest in the development of rapid transit for East Colchester. An overview of relevant external stakeholders is given below.

- Colchester Borough Council;
- Tendring Borough Council;
- Network Rail;
- Abellio Greater Anglia;
- Local bus operators;
- Department for Transport;
- Environment Agency;
- Homes and Communities Agency;
- Utilities;
- Statutory bodies; and
- Emergency services.

Of these, the local councils and the Homes and Communities Agency have been involved in the project development thus far. All remaining stakeholders will need to be engaged in the ongoing scheme development.

3. Option Development

3.1 Background

A considerable amount of technical work and stakeholder consultation was undertaken to develop and define a shortlist of schemes for appraisal. While the option development is conventionally presented as part of the Economic Case, we have pulled it out as a separate chapter here to allow clearer presentation of this body of work.

3.2 Route selection considerations

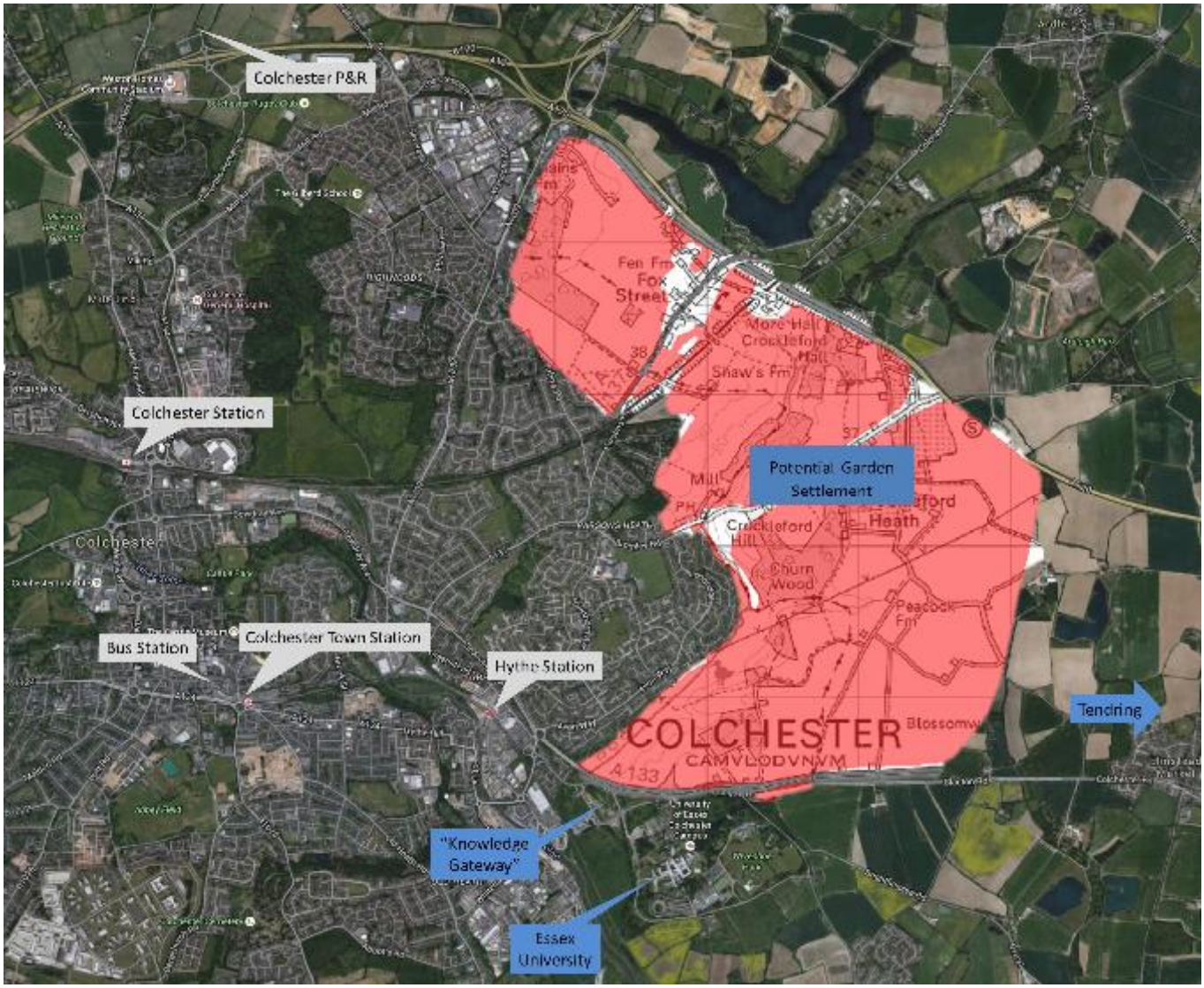
3.2.1 Key transport nodes and demand objectives

The key existing transport nodes of relevance to East Colchester are Colchester and Colchester Town Station, Colchester Bus Station and Hythe Station. There is also a new park and ride facility to the north of Colchester on the A120 as outlined in Figure 3.1.

Figure 3.1 : Key Transport Nodes

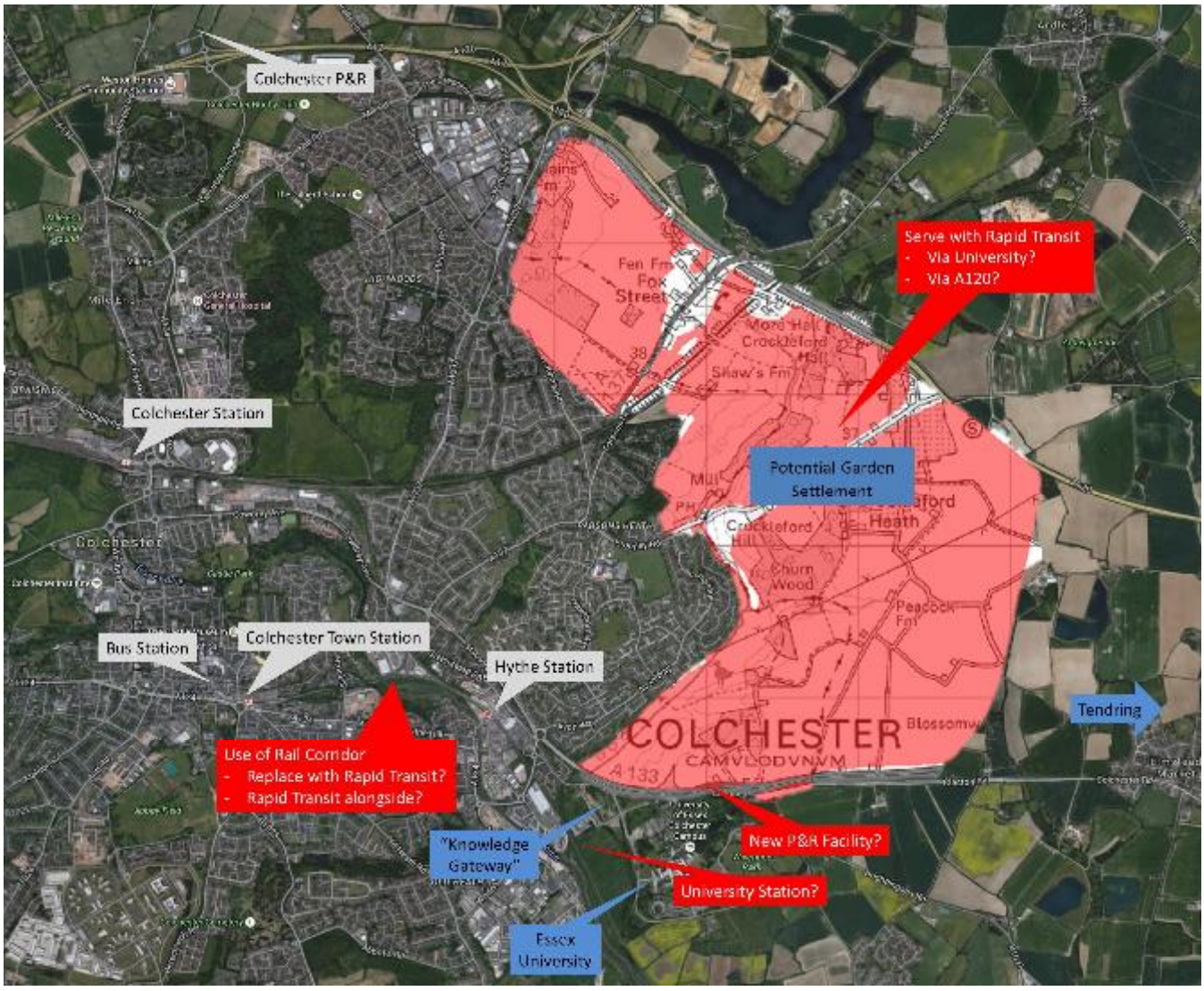
The main demand generators for consideration by this study are the Garden Settlement development site, the University of Essex and the associated “Knowledge Gateway”, as well as demand for travel to Colchester from Tendring District, as illustrated in Figure 3.2.

Figure 3.2 : Main Demand Generators



Possible elements of transport interventions are overlaid in Figure 3.3. The aim of the rapid transit scheme would be to serve these demand objectives and connect them with the key transport nodes in Colchester. Additional transport interventions could include a new rail station at Essex University and an additional Park and Ride site to the east of Colchester to serve demand from Tendring district and beyond.

Figure 3.3 : Possible Scheme Elements



3.2.2 Location of the East Colchester Park & Ride

There are two strategic location options for a park and ride facility in East Colchester:

- On the A120; or
- On the A133.

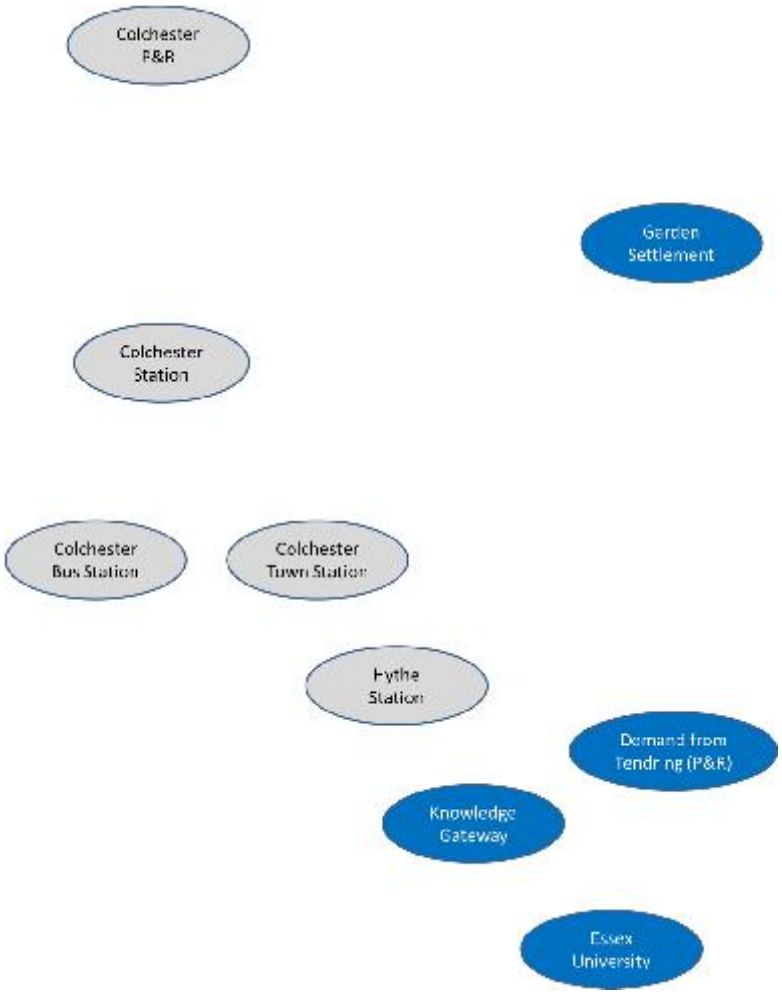
The aim of the facility is to capture demand from the relatively dispersed communities of Tendring District. Demand from the north and north-east of the district already has good access via A120/A12 to the existing Park and Ride facility to the north of Colchester. We therefore assume that an additional facility in East Colchester should be aimed at serving the A133 corridor from Clacton to Colchester

The most likely location would therefore be on the A133 in the vicinity of the University.

3.2.3 Key connections

The above key nodes and traffic objectives can be simplified to a schematic diagram, as shown in Figure 3.4.

Figure 3.4 : Key Nodes and Traffic Objectives - Schematic



The challenge is to find the most effective way of connecting these. In creating these connections, we have made the following assumptions:

- The Garden Settlement, Knowledge Gateway, Essex University and the P&R facility in the east should be connected to Colchester Town Centre (Colchester Town Station and Colchester Bus Station) as well as Colchester Station.
- It would be desirable if Hythe station could be served along the way.
- It would be desirable to connect the Garden Settlement to the Knowledge Gateway and the University in addition to Colchester Town Centre.
- There is no need to connect the existing Colchester Park and Ride facility to the north of the town as that fulfils a separate function and serves a different market.
- There is no need to connect the Garden Settlement with the new Park and Ride facility in the east.

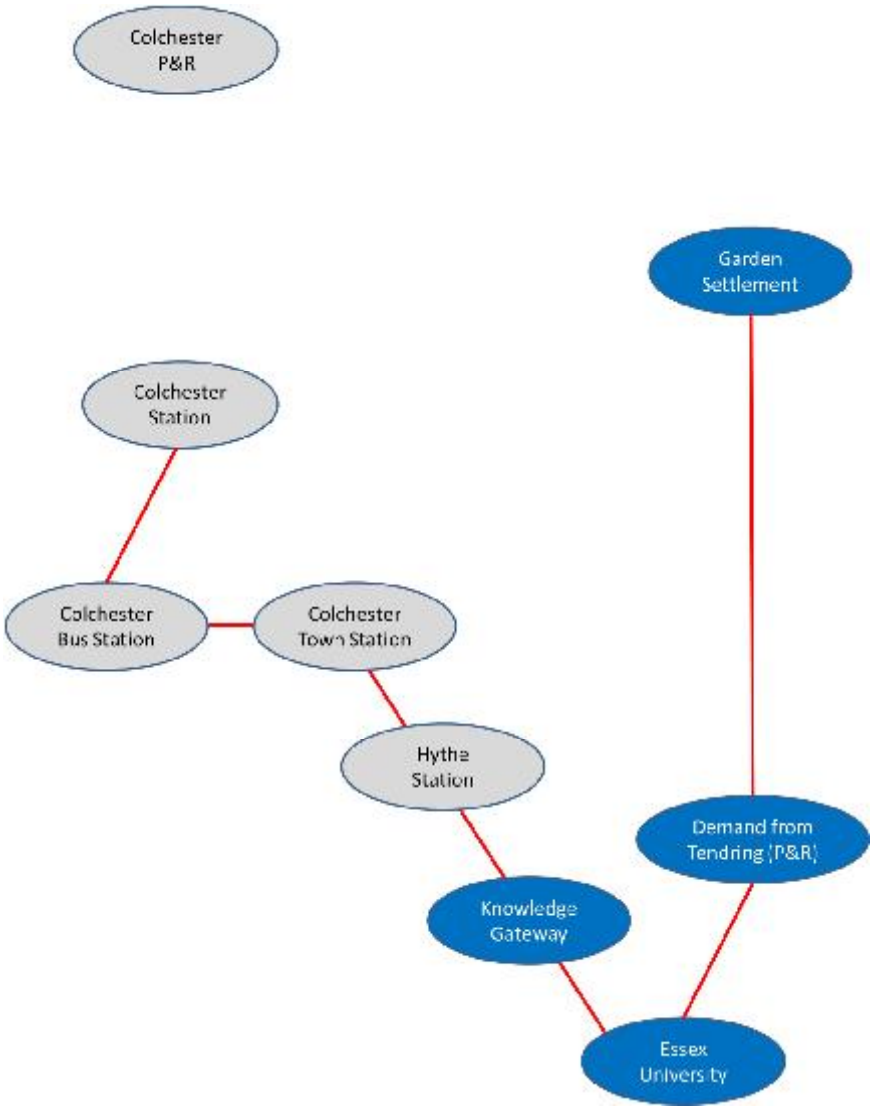
3.2.4 Development of high-level route networks

Using these principles, we have used an iterative process to devise high level route networks which can then be used to generate options for evaluation.

Network Option A: one route

Figure 3.5 shows a network serving all traffic objectives with one route.

Figure 3.5 : Network Option A – One Route



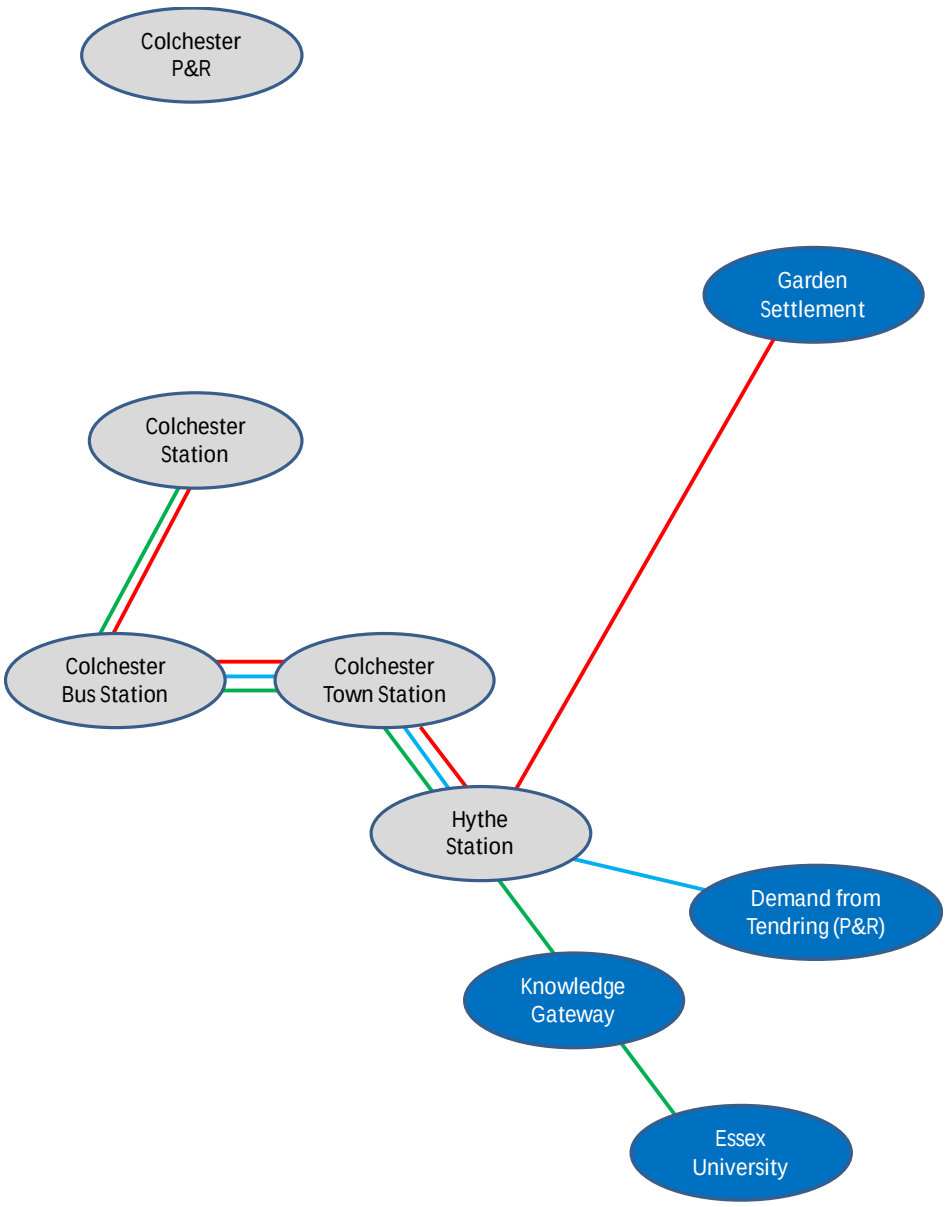
While this network meets all the required connections, routing all traffic via both the new P+R and the University introduces an unnecessary link between the Garden Settlement and the new park and Ride facility, and adds a significant detour for through passengers between the Garden Settlement, Park and Ride and the Town Centre.

Network option B: three routes

Figure 3.6 shows a network serving all traffic objectives with three separate routes.

This network includes a core section between Colchester Station and Hythe, with three separate routes serving the Garden Settlement, the new Park and Ride facility, and the University.

Figure 3.6 : Network option B: Three diverging routes



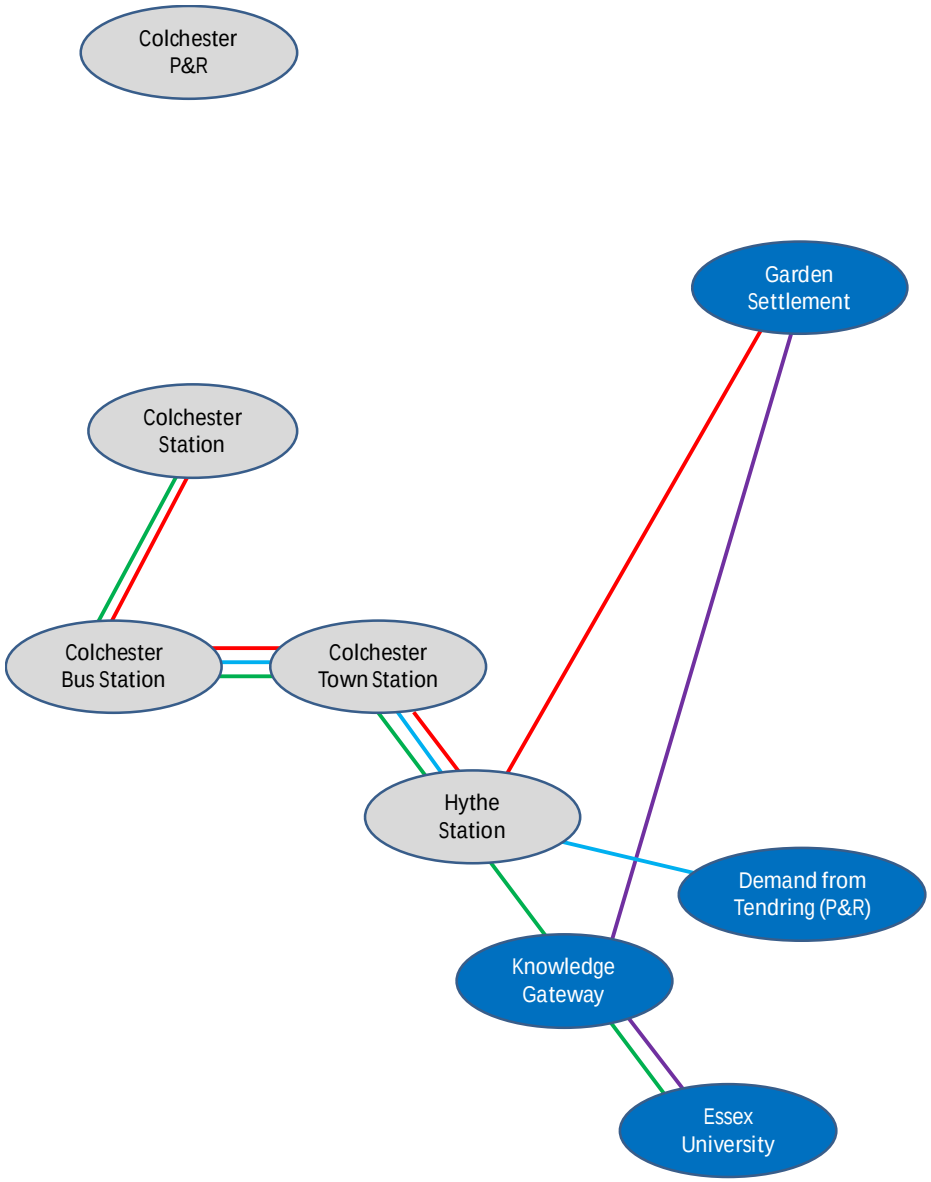
This network meets all required connections to the Town Centre and Colchester station, and delivers shorter and faster connections from the Garden Settlement and the new Park and Ride facility.

However, it does not provide the desirable connection between the Garden Settlement and the University.

Network option C: Additional route between Garden Settlement and University

Figure 3.7 shows a network serving all traffic objectives and all desirable connections with three separate routes.

Figure 3.7 : Network Option C: Additional route between Garden Settlement and University

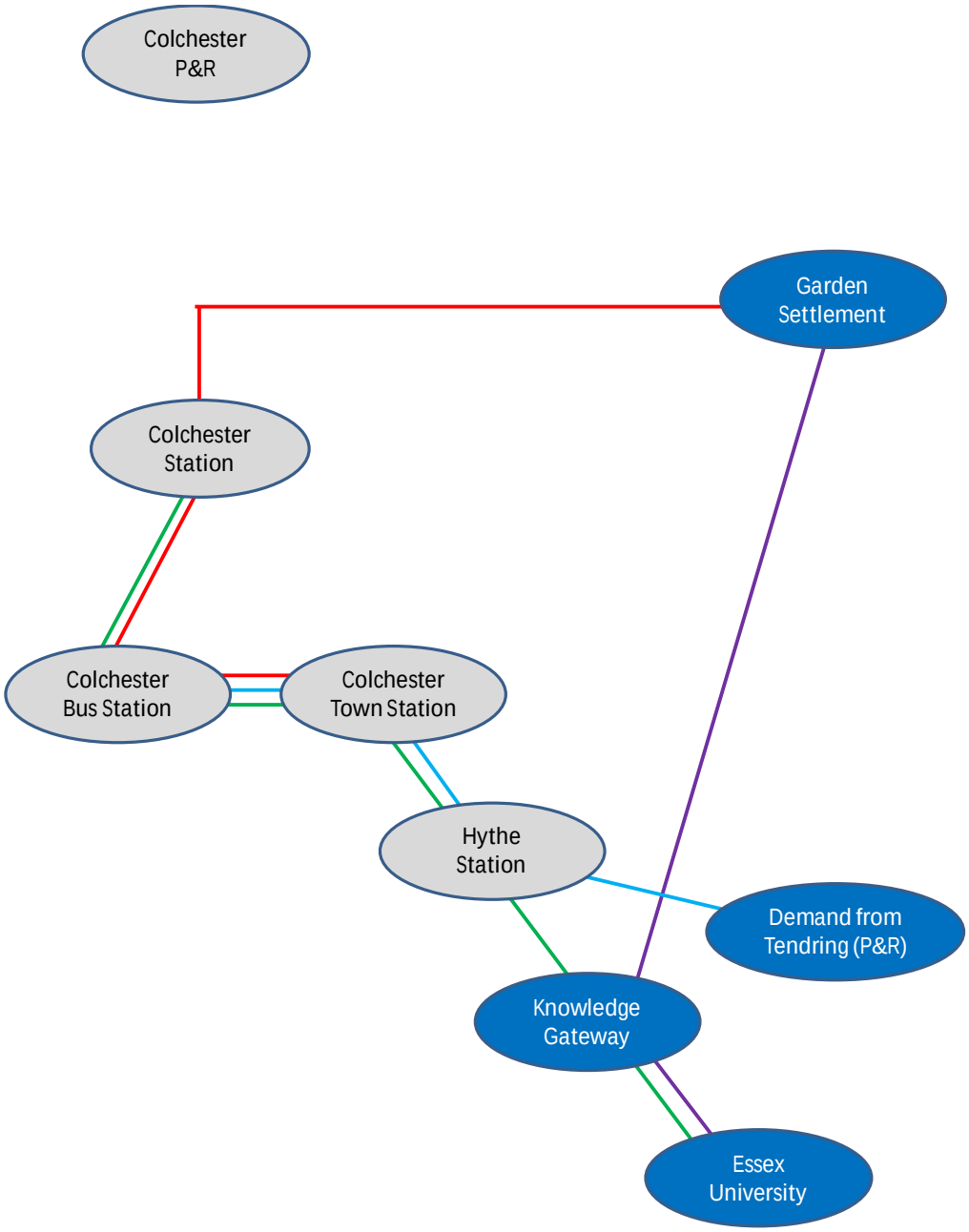


This network enhances network option C with the addition of a direct route between the Garden Settlement and the University.

Network option D: Alternative alignment between Garden Settlement and Town Centre

Figure 3.8 shows an alternative alignment for the Garden Settlement service, using the A120 around the north of Colchester.

Figure 3.8 : Network Option D: Connection via the A120



This network is an alternative to network option C, with the service between the Garden Settlement and the Town Centre routed via the A120/A12. This could be potentially attractive in terms of journey times compared with existing road links between Hythe and the Town centre.

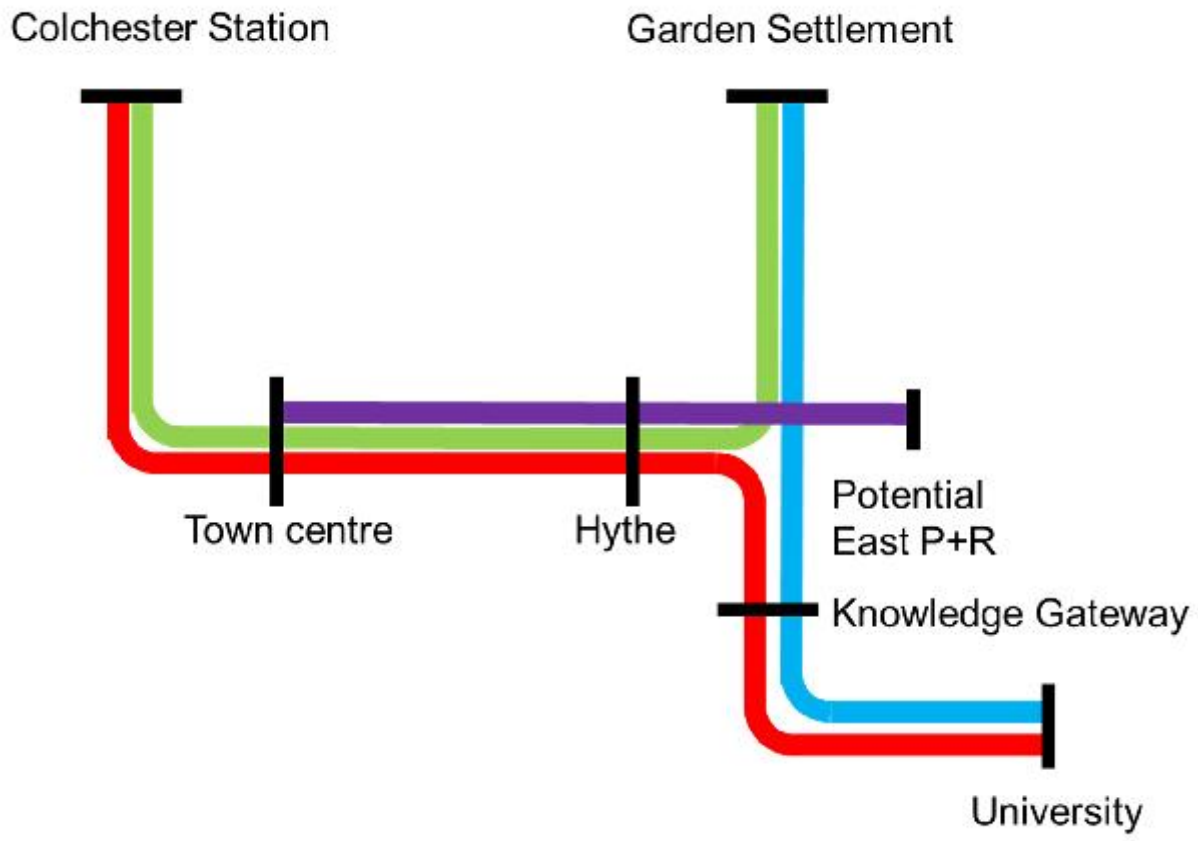
A high level assessment of the merits of these network options suggests:

- Serving all traffic objectives with one route is efficient in terms of infrastructure and operating requirements. However, end to end journey times (and in particular times between the Garden Settlement and Town Centre) are likely to be unattractive.
- Using three separate routes with a common corridor out of town to serve the University area, new Park and Ride facility, and the Garden Settlement separately delivers shorter and faster connections from the Town centre to the Garden Settlement and the new Park and Ride facility
- Addition of a direct link between the Garden Settlement and the University provides a desirable connection without interchange.
- A northern alignment via the A120/A12 may offer faster transits, particularly between the Garden Settlement and Colchester Station.

3.2.5 Preferred networks

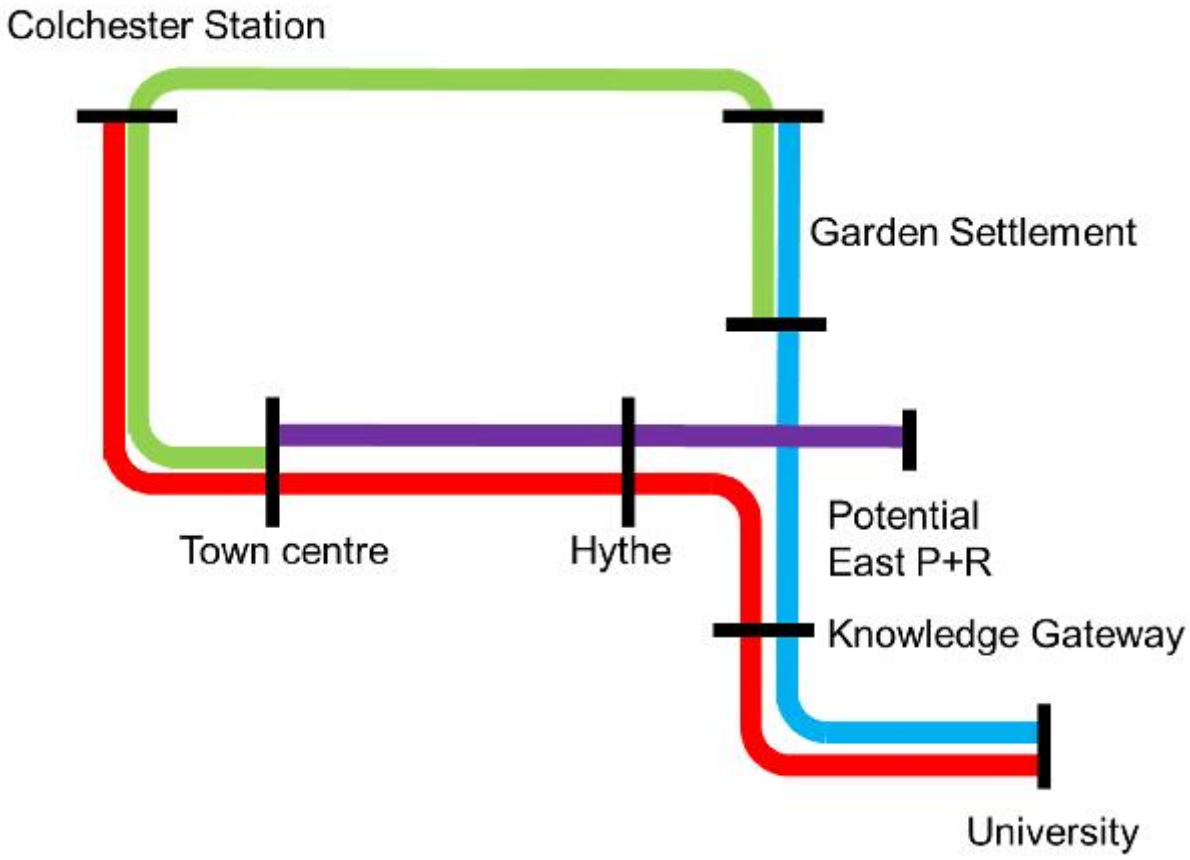
Network option C offers the best connections with all routes serving the town centre running via the eastern corridor. This is shown in schematic form in Figure 3.9

Figure 3.9 : Network C Schematic



Network D offers a similar set of connections but with an alternative route between the Garden Settlement and the town centre via Colchester station. This is shown in schematic form in Figure 3.10

Figure 3.10 : Network D Schematic



These therefore form the two main network options taken forward.

3.3 Possible modes and infrastructure options

There are three main modes which could be used to deliver Rapid Transit services:

- Conventional bus
- Guided bus
- Tram/light rail

A further option for tram-train operation, with shared use of the Colchester Town branch, is not within the remit of this report, but could be considered in a supplementary study if desired.

Both conventional and guided buses could, in principle, be configured as trolley buses[3], with the possibility of short non-wired sections of route operated using battery power.

Each of these modes has specific requirements for steering and guidance as summarised in Table 3.1:

[3] A trolley bus is a rubber-tyred electric bus that draws power from overhead wires (generally suspended from roadside posts) using spring-loaded trolley poles. In contrast to a tram it does not need to be guided by fixed tracks and within the restrictions imposed by the wiring it can use road space more flexibly than a tram. However, as with a tram, its routeing and range are restricted by the provision of the wiring infrastructure.

Table 3.1 : Requirements for steering and guidance

	Conventional bus	Guided bus	Tram
Steering	Steered by the driver	Can be steered by the driver on non- guided sections	Cannot be steered by the driver
Use of guidance infrastructure	Do not require specialised infrastructure for guidance	Require specialised infrastructure when operating in guided mode	Require rails to be in place throughout the entire route network including terminals and depots.

However, there are important differences between the guidance systems used for trams and guided buses as outlined in Table 3.2. This has important consequences for the space required for the guideway, use by other modes, and the introduction and enhancement of networks.

Table 3.2 : Key differences between guidance systems for guided buses and trams

	Guided bus networks	Tram networks
Space required for guided sections	The guided sections require new or re-used alignments, or exclusive use of road space	Can potentially use existing roads shared with other traffic (subject to sufficient clearances and allowing for disruption during construction).
Use of guided sections by other modes	Guided sections cannot be used by any other mode	Tram track can be laid within surfaces used by other road modes
Network introduction and expansion	Can be introduced progressively, with a mixture of guided and non-guided sections	Must be introduced line by line with all necessary track in place before trams can operate

In practice, the infrastructure which will potentially be used by the rapid transit network, can be categorised as described in Table 3.3.

Table 3.3 : Infrastructure usage and characteristics

Usage of infrastructure	Characteristics
Shared use	Different modes use the same infrastructure without restrictions
Segregation	Different modes use the same infrastructure but part is reserved for specific modes (e.g. bus lanes)
Dedication	Use of the infrastructure is restricted to specific modes, for example by specialised features - other modes cannot use it

The type of usage generally varies depending on whether infrastructure is currently existing or new construction.

- Where existing roads are used, the default is shared use, with segregation possible where space is available

- New construction, or repurposing of existing infrastructure, is required for dedicated use, but may also be provided for segregated use.

Different types of vehicle either require, or can be operated on, different types of infrastructure as summarised in Table 3.4.

Table 3.4 : Infrastructure requirements of different vehicle types

	Conventional bus	Guided bus	Tram
Vehicle types	Any bus	Requires buses with added guide wheels	Captive dedicated fleet
Use on shared infrastructure	Yes	Yes - unguided	Yes - on urban roads
Use on segregated infrastructure	Yes	Yes - unguided	Yes
Use on dedicated infrastructure	Yes	Required when guided	Yes
Rail level crossings	OK	OK- unguided	Requires grade separation
Cost	Low	Medium	High
Vehicle owners	Bus operators	Bus operators	System operator
Operator access	Any operator	Can restrict operators using guideway	Single operator
Staged introduction	No problems	Buses can use existing roads prior to opening of guideway	All infrastructure must be in place before route opens
Route extension	No problems	Additional routes can use guideway for part of journey	Infrastructure must be in place before extension opens
Street presence	Poor	Better on guided sections	Good
Key LA involvement	Tendering Quality contracts	Provision of infrastructure	Specification and procurement

Conventional bus operation offers the greatest flexibility to existing and potential operators, as they need not acquire, modify or dedicate specific vehicles to comply with the usage characteristics of the infrastructure.

Guided bus operation is commonly associated with the introduction of new vehicles, but retrofitting of existing vehicles is relatively simple and affordable.

Tram fleets must be dedicated and are captive to the system. Changes to the overall fleet must be planned and procured well ahead of implementation

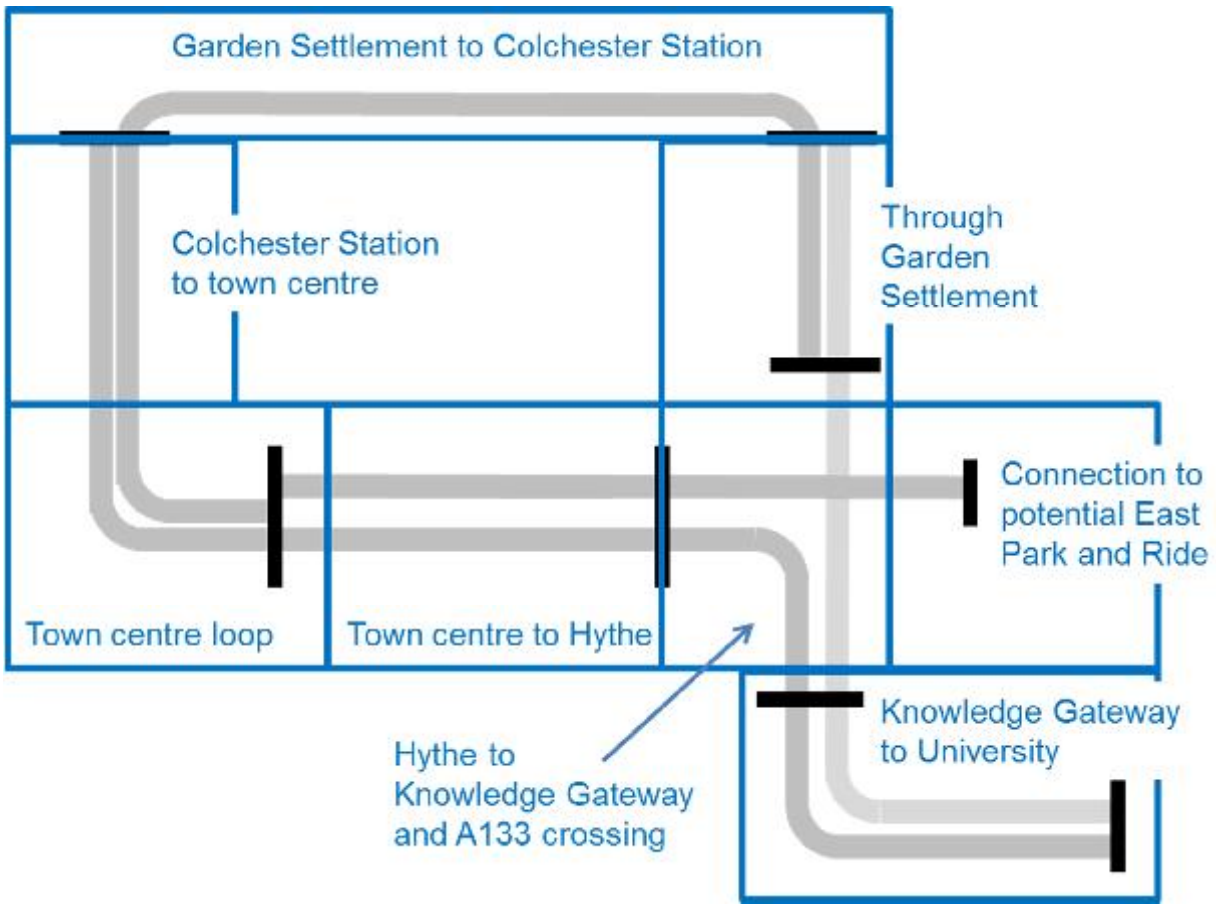
3.4 Characteristics of route sections

3.4.1 Route section splits

The overall route network proposed in Network Options C and D can be split into eight route sections as detailed in Figure 3.11

The route section between the Garden Settlement and Colchester Station is only used in Network Option D. All other sections are common to both Network Options C and D.

Figure 3.11 : Route sections



The characteristics of these route sections, together with proposed use by Rapid Transit infrastructure, are considered in Table 3.5 below.

Table 3.5 : Route section characteristics with proposed rapid Transit infrastructure

Route section	Characteristics	Proposed Rapid Transit infrastructure
Colchester station to town centre	Current route already has partial segregation Limited space for new infrastructure	Existing roads and bus priority measures
Town centre loop	Limited scope for new segregation Limited space for new infrastructure	Existing roads
Town centre to Hythe	Existing roads are significant constraint with limited scope for new segregation and limited space for new infrastructure	Five sub-options considered. New alignment preferred *See detailed comments in section below*
Hythe to Knowledge Gateway and A133 crossing	Existing roads are lightly used with bus gates already in place. Some scope for priority at junctions.	Additional segregation with new dedicated road crossings *See detailed comments in section belowbelow*
Knowledge Gateway to University	Existing roads are lightly used with bus gates already in place.	Existing roads
Connection to potential East P+R	Currently greenfield site	New segregated connection will be required which could be built to Rapid Transit specifications
Through Garden Settlement	Currently greenfield site	New dedicated alignment will be required which could be built to Rapid Transit specifications
Garden Settlement Via A120/A12 to Colchester Station (Network Option D only)	Segregation on existing roads unlikely as would severely impact on capacity	Either existing roads or new dedicated alignment, depending on mode.

Colchester station to town centre

Rapid Transit services will use existing bus facilities on the north side of Colchester station, and existing bus routes to the town centre via Station Road and North Hill.

Rapid Transit services will circulate the town centre and serve the bus station using existing bus routes.

Town centre to Hythe

There are a number of alternative routes into Colchester from the east, following three different corridors:

- Corridor 1: Along East Hill and East Street and Greenstead Road;
- Corridor 2: Using the A134, Hythe Hill; and
- Corridor 3: Following Military Road/Old Heath Road from the south.

Hythe to Knowledge Gateway, A133 P+R and Garden Settlement

Between Hythe and Elmstead Road, the precise routing for Rapid Transit services will depend on the route option between the town centre and Hythe, together with any plans for the relocation and/or redevelopment of Hythe station.

The exact routing in Hythe may also vary by specific mode as a rail crossing is required.

Conventional and guided buses can potentially cross at grade using the existing level crossing, joining the existing bus route at the junction with Greenstead Road.

If the Rapid Transit route follows Greenstead Road, there is potentially space to build a dedicated signal-controlled at grade crossing with the A134 Colne Causeway to avoid the A133 roundabouts and provide a direct link into Elmstead Road and the current bus route.

However, trolley buses and trams would require a grade separated crossing to avoid conflicts with the railway electrification systems. The existing bridge on Colne Causeway could potentially be used, with access via Hawkins Road; however, this would reduce road capacity and trams may be delayed by congestion at during peak hours. Alternatively a dedicated rapid transit bridge may be considered, though there may be constraints on the location of the approach ramps and the configuration of the access to the Tesco car park and the crossing of Colne Causeway

Further east along Elmstead Road, junctions will be required to give linkages between the University, P+R and Garden Settlement branches, together with a dedicated crossing of Clingoe Hill. An indicative layout is shown in Figure 3.26

Figure 3.12 : Possible crossing points for A134

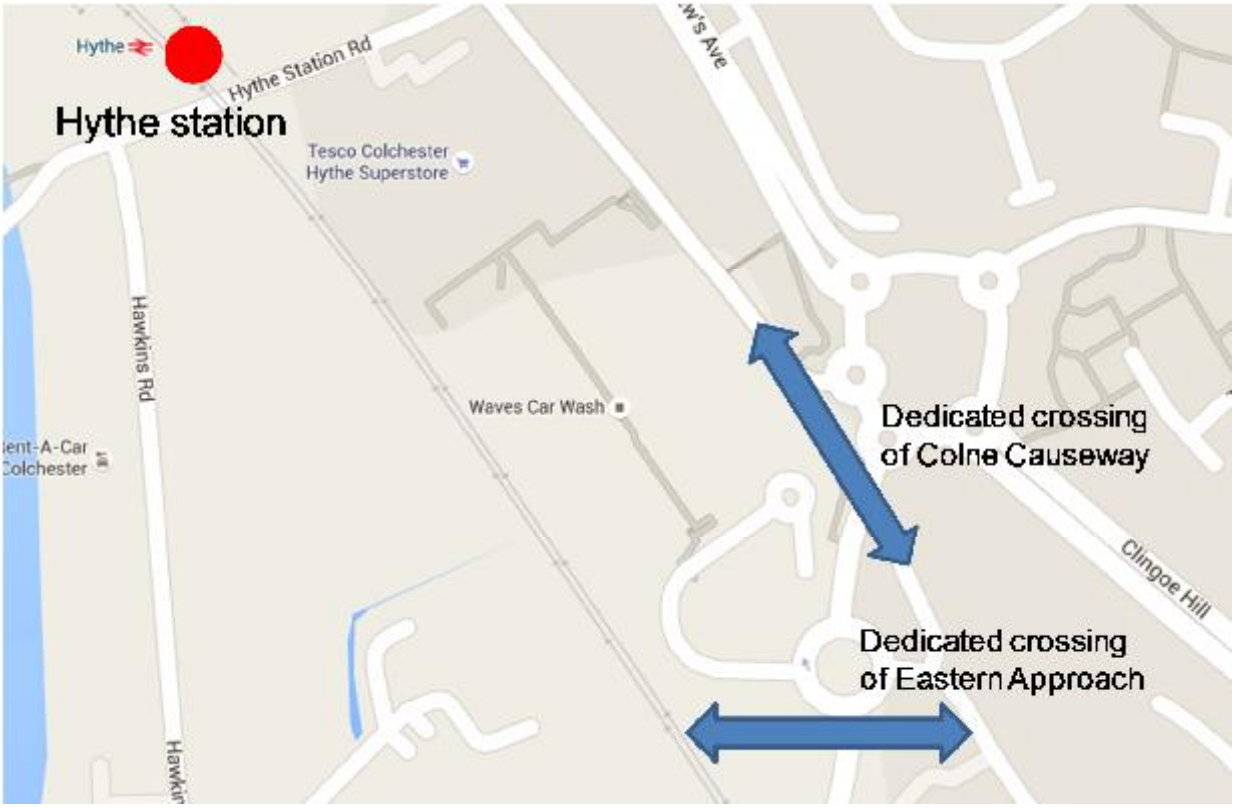
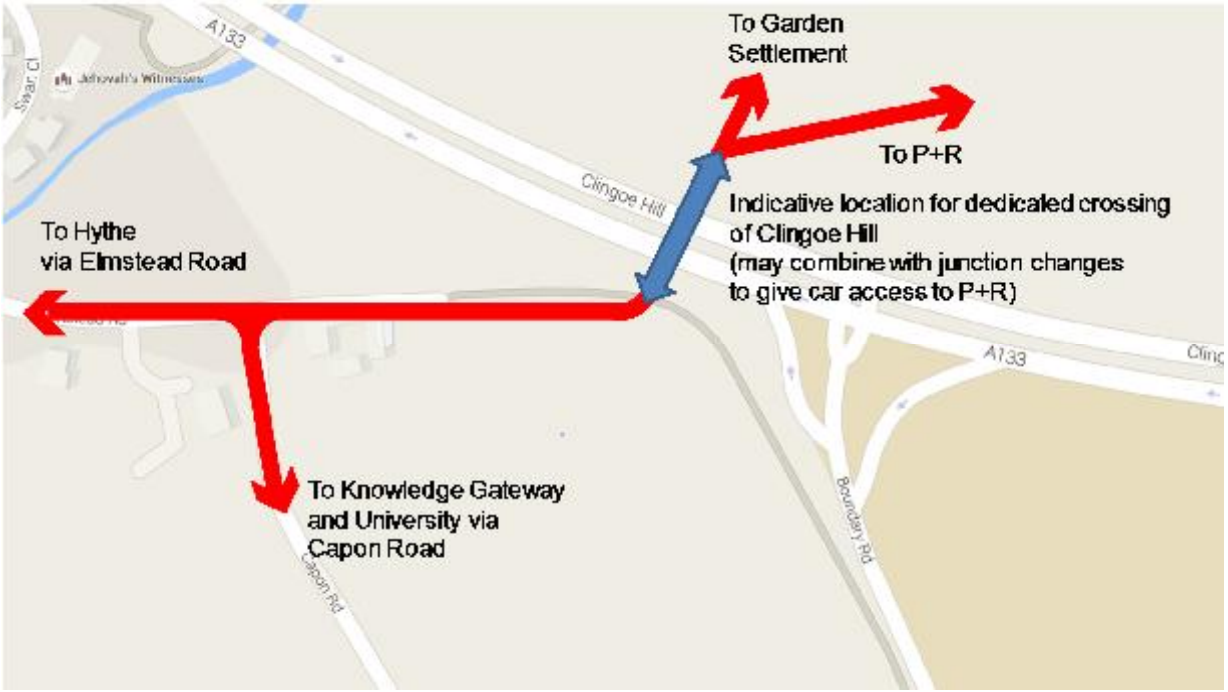


Figure 3.13 : Indicative route in vicinity of Knowledge Gateway and across A133



The Rapid Transit route to the University will follow Elmstead Road and Capon Road, with stops as for existing bus routes on or adjacent to Capon Road.

The routes to the P+R site and the Garden Settlement will require a dedicated crossing point on Clingoe Hill. The precise location will depend on the layout of the P+R site and the masterplan for the Garden Settlement.

It will also be necessary to provide car access to the P+R site, thus the Rapid Transit crossing could form part of a comprehensive remodelling of the existing Knowledge Gateway Interchange.

Knowledge Gateway to University

Existing bus route via Boundary road or adjacent parallel reserved track. It is assumed that stops will be as for existing bus routes adjacent to entrances 2, 3 and 4; and that Rapid Transit services would terminate in the vicinity of entrance 2.

Route within the Garden Settlement

The working assumption is that this will be a dedicated traffic free alignment through the Garden Settlement, which will not necessarily follow the road layout, but may be associated with pedestrian and cycle routes.

For options 1-3, terminating facilities will be required at the northern end of the Rapid Transit route

For option 4, it is assumed that the Rapid Transit route will continue to an interchange with the A120 on the northern edge of the new development. Depending on the organisation of and possible interworking of services, terminating facilities will potentially be required at both the northern and southern ends of the Rapid Transit route.

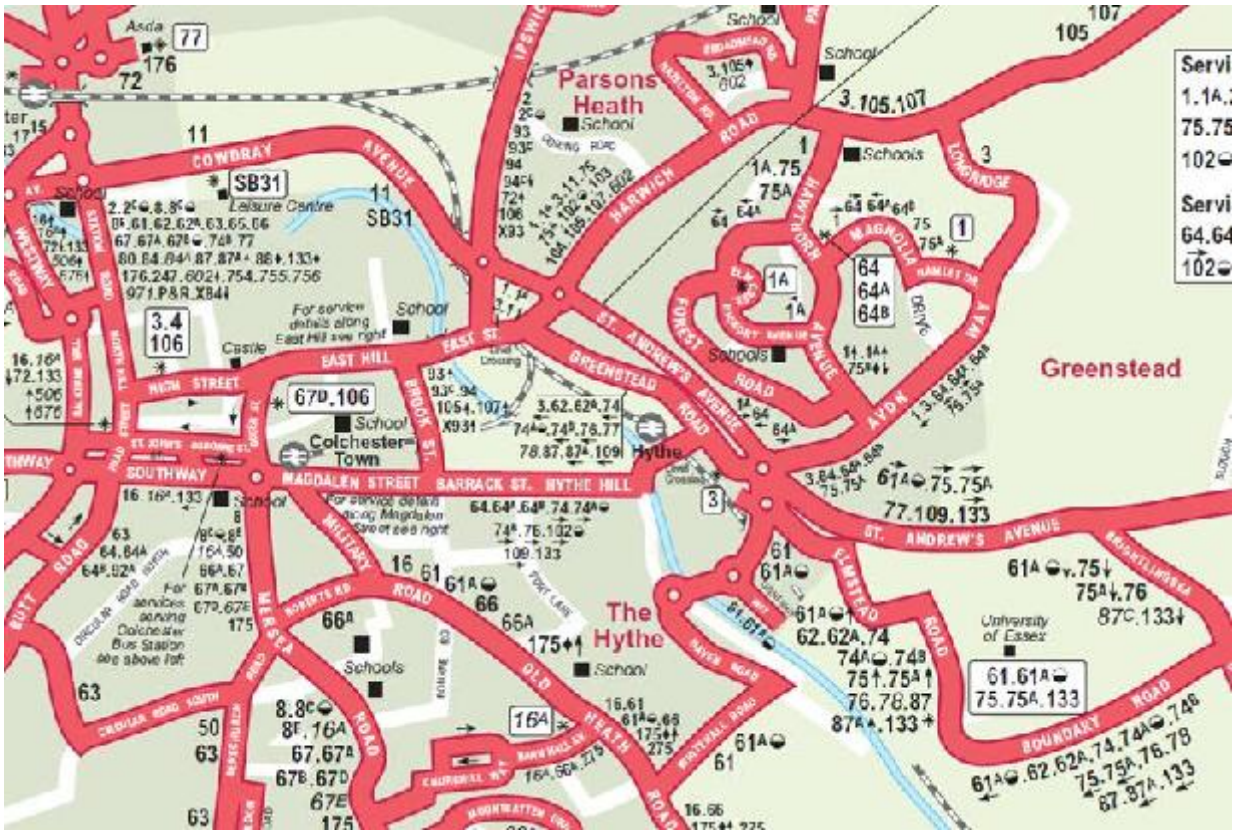
3.4.2 Route options between the town centre and Hythe

Finding a suitable route into town from the east is a particular challenge.

Existing bus services follow a number of corridors into Colchester from the east as shown in Figure 3.14:

- Corridor 1: Along East Hill and East Street and Greenstead Road;
- Corridor 2: Using the A134, Hythe Hill; and
- Corridor 3: Following Military Road/Old Heath Road from the south.

Figure 3.14 : Existing Bus Routes in East Colchester



In addition, the following, more ambitious route options were considered:

- Corridor 4: Creating a new bus corridor alongside the existing rail corridor into Colchester Town;
- Corridor 5: Taking over the existing rail corridor between the Hythe and Colchester Town; and
- Corridor 6: Creating a new bus corridor via Military Road and Recreation Road with a new link road to Colne Causeway.

An initial high level assessment of these options suggests the following:

Corridor 1: East Street, East Hill and Greenstead Road

The route along East Hill/High Street would appear to be relatively uncongested. Existing bus priority measures within the town centre give relatively easy access to Colchester Town station and the bus station. At the eastern end, East Street crosses the main railway line to Clacton at grade, which introduces a degree of unpredictability to journey times. Figure 3.15 illustrates traffic conditions on East Hill during a weekday afternoon.

Figure 3.15 : View from East Hill eastbound

Corridor 2: A134 Hythe Hill

The A134 (Figure 3.16 and Figure 3.17) is a relatively narrow road with on-street parking and gets heavily congested at times. At the eastern end options include following the “u-bend” in the A134 alignment which would not serve Hythe Station, or using the more direct route via Hythe station (Figure 3.18). This would again involve a level crossing (Figure 3.19).

Figure 3.16 : A134 looking west

Figure 3.17 : A134 looking east

Figure 3.18 : A134 corridor eastern options

Figure 3.19 : Level Crossing at Hythe Station

Corridor 3: Military Road, Old Heath Road

A routeing via Military Road/Old Heath Road (Figure 3.20) would be largely unaffected by parking and would avoid some of the town centre congestion. However, as a connection to the University area, it would be a relatively indirect route. Hythe station could not be served with this alignment.

Figure 3.20 : Military Road

Corridor 4: New bus corridor adjacent to Colchester Town branch

A previous high level feasibility study by Mouchel has established that a guided bus route could potentially be built adjacent to the railway.

Construction of a bus route would require the reconstruction of the Brook Street overbridge and the Ernulph Walk footbridge to accommodate the guideway, and a new bridge across the River Colne. Depending on clearances between the guideway and the existing line it would also be necessary to relocate some existing overhead line equipment and signalling facilities.

Figure 3.21 : Railway Corridor to Colchester Town

Corridor 5: Use of Colchester Town Branch by rapid transit

Taking over the railway corridor by a rapid transit scheme could be a more cost-effective option than building new infrastructure parallel to a relatively lightly-used asset. Subject to survey, existing bridges may be suitable for re-use. The line is currently electrified, thus, subject to survey, it is possible that clearances through bridges could accommodate double-deck buses. However, tie-in to the road network at the eastern end would require some parallel infrastructure to the north-west of Hythe station.

Takeover of the rail alignment also opens up the possibility of an additional road connection into East Street in the vicinity of the level crossing. This has not been considered further in the context of this study, but could enable a wider range of services from the eastern side of the Town to use the busway.

There would be resistance against the loss of a rail corridor from a number of influential stakeholders; however, reorganisation of the existing train service could enable the development of a new interchange facility between rail and rapid transit at Hythe,

Corridor 6: New bus corridor via Military Road and Recreation Road with a new link road to Colne Causeway

This is a variation on Corridor 3, following Military Road out of town but then turning into Recreation Road (Figure 3.22). Recreation road ends at a piece of scrubland, where a footpath continues across to Colne Causeway (Figure 3.23). Providing a new link road across could create an attractive bus route option. However, use of this mainly residential road for buses would require the removal of parking and the creation of the new link road is likely to generate local opposition.

Figure 3.22 : Recreation Road looking west

Figure 3.23 : End of Recreation Road looking east

3.5 Selection of options taken forward for further analysis

3.5.1 Preferred networks

Network option C offers the best connections with all routes serving the town centre running via the eastern corridor. Network D offers a similar set of connections but with an alternative route between the Garden Settlement and the town centre via Colchester station. These therefore form the two main options taken forward.

3.5.2 Route sections and corridors

The proposed network options comprise a number of route sections, many of which are common to more than one option.

- All networks require careful consideration of options for the core route section between the Town Centre and Hythe.
- All networks require a dedicated crossing of the A133 Clingoe Hill to access the P+R site and the Garden Settlement. This would be:
  - Adjacent to the B1028 junction for network A, or
  - Adjacent to the Knowledge Centre Interchange for networks B, C and D

Table 3.6 : Route sections and corridors

	Network options			
Route section/corridor	**A**	**B**	**C**	**D**
Garden Settlement to Colchester station				
Colchester station to Town centre				
Town centre to Hythe				
Hythe to Knowledge Gateway/A133 crossing				
Knowledge Gateway to University				
University to A133 P+R and Garden Settlement				
A133 Crossing to new A133 P+R				
A133 crossing through Garden settlement				

Garden settlement to Colchester Station

With regard to the northern route option, the choice is relatively clear. Within the Garden Settlement, the route should seek to penetrate the residential areas as far as possible. Depending on the new road layout within and new connections to the A120 in the north, the route would follow the A120/A12 corridor for about 3 miles and then drop into Colchester from the north, following the existing bus priority route used by other bus services and the Colchester Park and Ride scheme as outlined in Figure 3.24.

Colchester station to town centre

Rapid Transit services would use existing bus facilities on the north side of Colchester station, and existing bus routes to the town centre via Station Road and North Hill as outlined in Figure 3.24

Rapid Transit services would circulate the town centre and serve the bus station using existing bus routes.

Figure 3.24 : Colchester Park & Ride – route into town

Hythe to Knowledge Gateway, and A133 crossing

Between Hythe and Elmstead Road, the precise routing for rapid transit services will depend on the route option between the town centre and Hythe, together with any plans for the relocation and/or redevelopment of Hythe station.

The exact routing in Hythe may also vary by specific mode. If a rail crossing is required, conventional and guided buses can potentially cross at grade; however, trolley buses and light rail will require a grade separated crossing to avoid conflicts between the electrification systems.

If the rapid transit route follows Greenstead Road, there is potentially space to build a dedicated signal-controlled at grade crossing with the A134 Colne Causeway to avoid the A133 roundabouts and provide a direct link into Elmstead Road and the current bus route.

However, if the rapid transit link continues adjacent to the rail line south of Hythe station, a dedicated crossing with the A134 Eastern Approach will be required, probably associated with remodelling of the roundabout and access to the Tesco car park.

Further east along Elmstead Road, junctions will be required to give linkages between the University, P+R and Garden Settlement branches, together with a dedicated crossing of Clingoe Hill. An indicative layout is shown in Figure 3.26

Figure 3.25 : Possible crossing points for A134

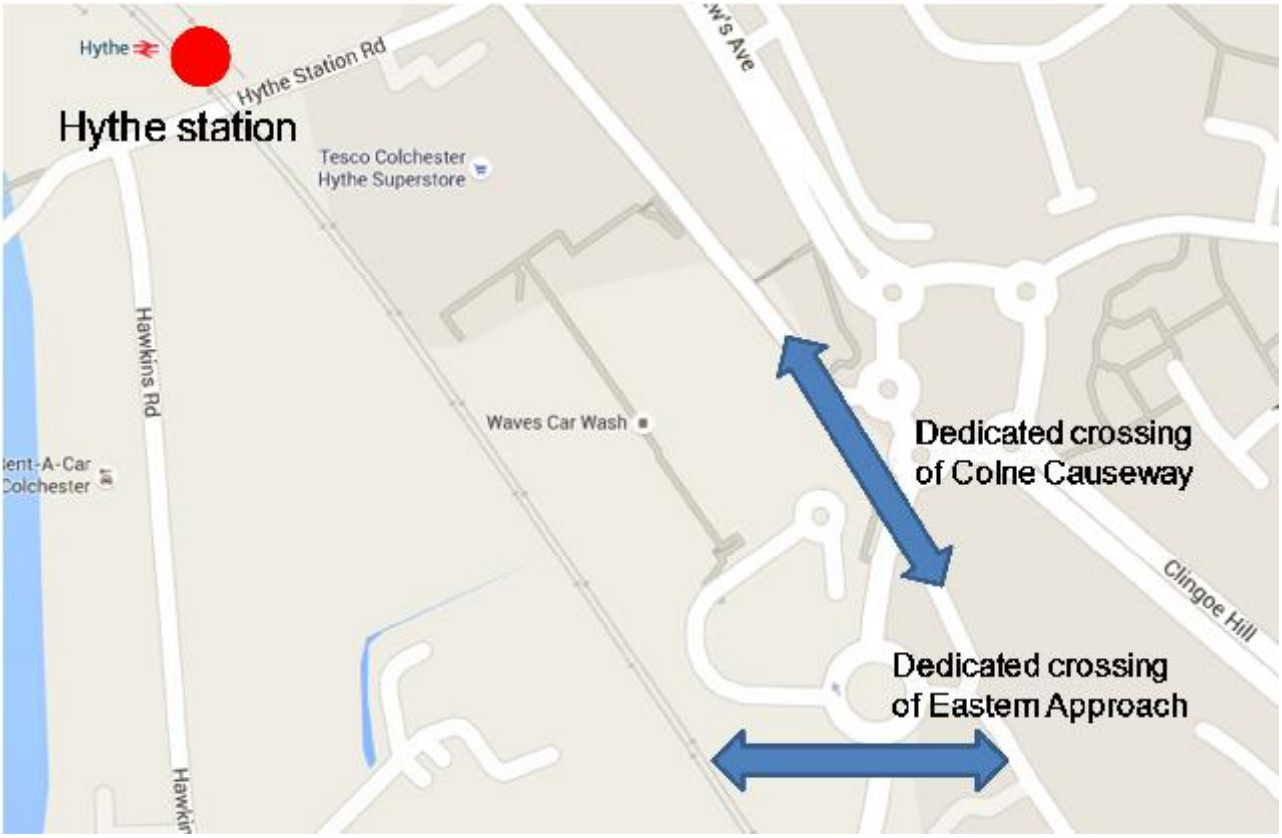
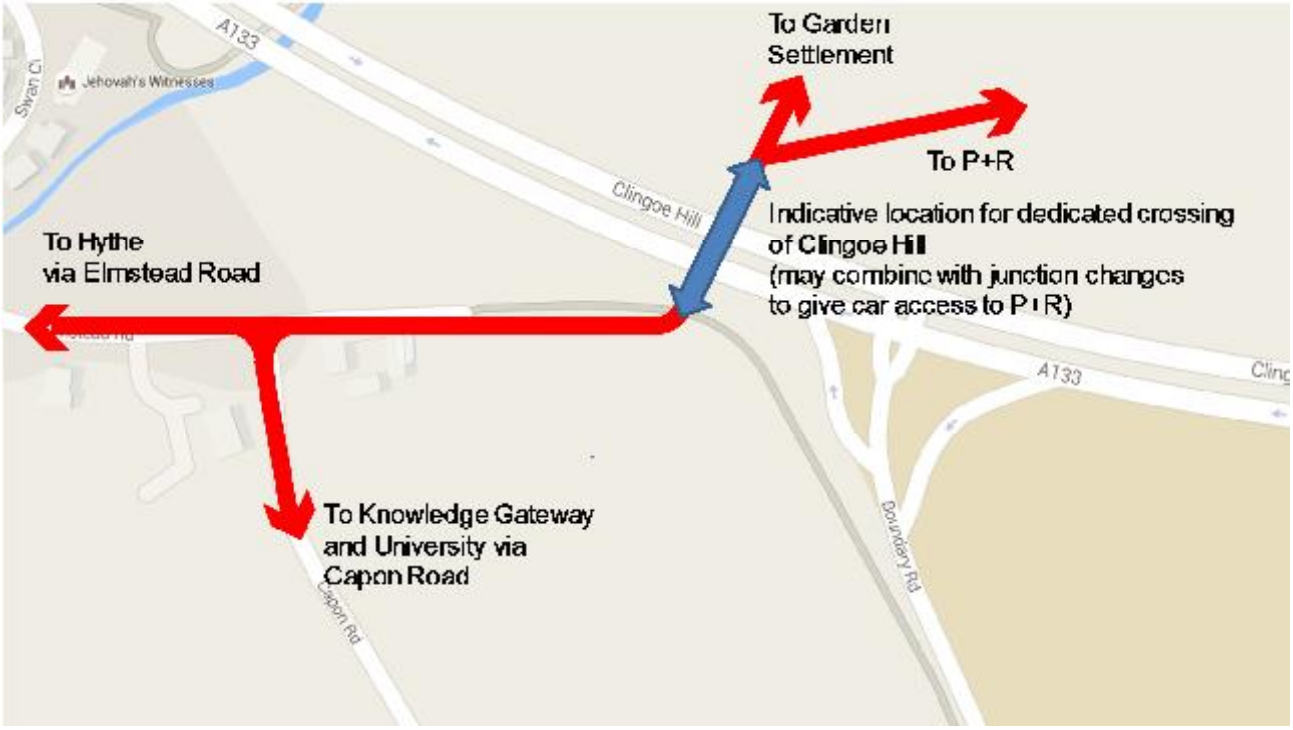


Figure 3.26 : Indicative route in vicinity of Knowledge Gateway and across A133



The rapid transit route to the University will follow Elmstead Road and Capon Road, with stops as for existing bus routes on or adjacent to Capon Road.

The routes to the P+R site and the Garden Settlement will require a dedicated crossing point on Clingoe Hill. The precise location will depend on the layout of the P+R site and the masterplan for the Garden Settlement.

It will also be necessary to provide car access to the P+R site, thus the Rapid Transit crossing could form part of a comprehensive remodelling of the existing Knowledge Gateway Interchange.

Knowledge Gateway to University

The rapid transit route would follow the existing bus route via Capon Road and Boundary road, or an adjacent parallel reserved track. It is assumed that stops will be as for existing bus routes adjacent to entrances 2, 3 and 4; and that rapid transit services would terminate in the vicinity of entrance 2, except for network A where they would continue along (or adjacent to) Boundary Road.

The local layout is illustrated in Figure 3.27.

Figure 3.27 : Essex University Campus Layout

University to A133 Park and Ride and Garden Settlement (Network A only)

The route would continue along (or adjacent to) Boundary Road to the East Gate.

Depending on the mode selected, it may then follow the B1028 to a dedicated crossing point on the A133 Clingoe Hill. The B1028 is outside the University grounds, and if a dedicated alignment was required, new construction would be necessary, either within the University grounds, or on the north-eastern side of the road.

Once on the northern side of the A133, the working assumption is that this will be a dedicated traffic free alignment, possibly associated with the revised road layout necessary for vehicle access, to enable the rapid transit route to serve the Park and Ride site and continue to the Garden Settlement as detailed below.

Routes within the Garden Settlement (vary by option)

The working assumption is that these will be dedicated traffic free alignments through the Garden Settlement, which will not necessarily follow the road layout, but may be associated with pedestrian and cycle routes.

For route networks 1-3, terminating facilities will be required at the northern end of the Rapid Transit route.

For route network 4, it is assumed that the Rapid Transit route will continue to a new interchange with the A120 on the northern edge of the new development. Depending on the organisation of and possible interworking of services, terminating facilities will potentially be required at both the northern and southern ends of the Rapid Transit route.

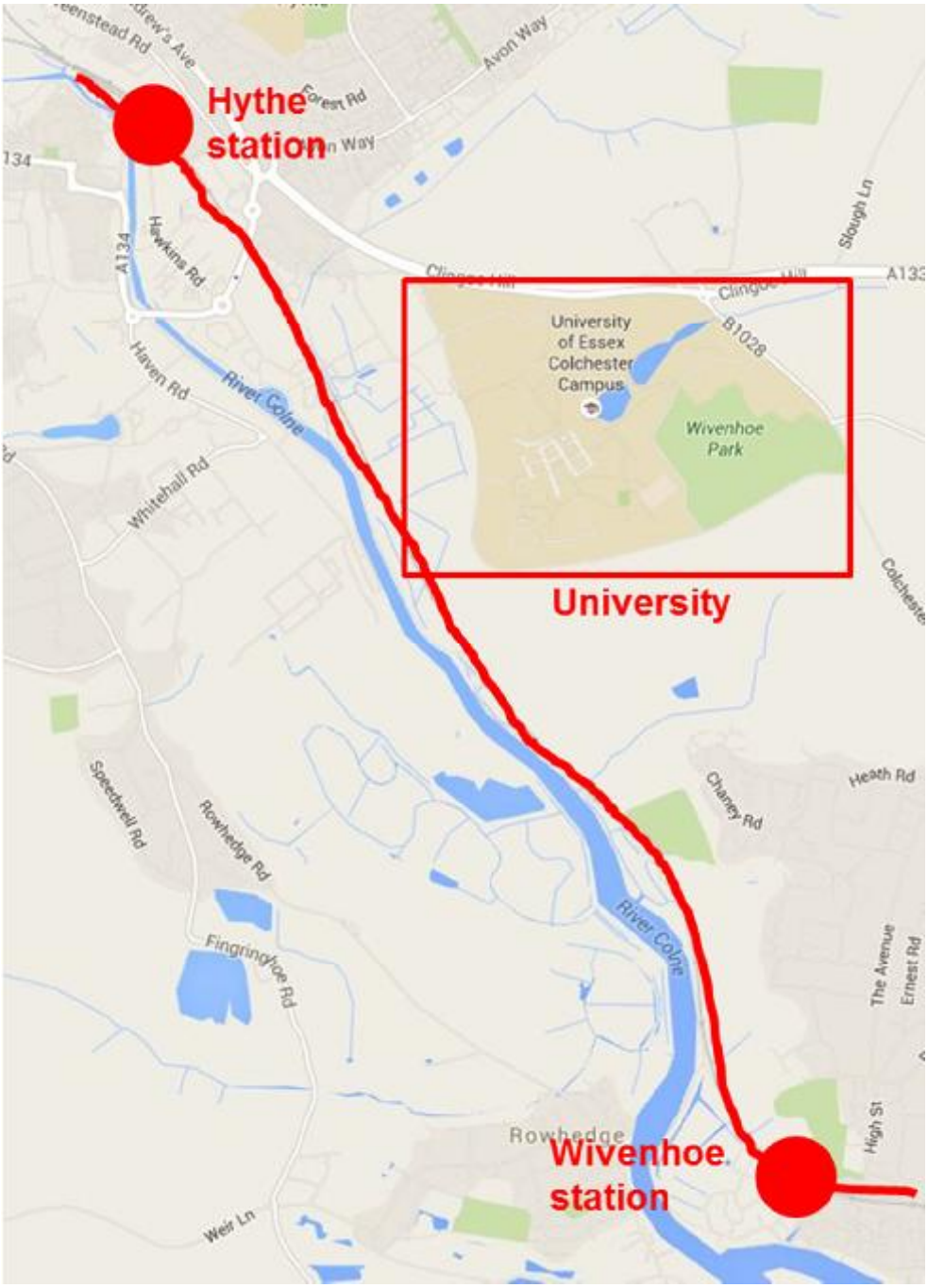
3.6 University links

3.6.1 Background

As part of this Study, Jacobs has also been asked to consider options for serving the University of Essex, including a possible new station.

The University of Essex is not directly served by rail; however, a rail line passes immediately to the west of the campus.

Figure 3.28 :Rail line past University and adjacent stations



3.6.2 Current links to the University

Bus links to the University

A number of local and longer-distance bus services serve the University.

Buses circulate via Capon Road and Boundary Road, serving the Knowledge Gateway. There are three stops on Boundary Road adjacent to the campus. Most campus buildings and facilities are within about 300 metres from a bus stop.

Vehicle barriers on Capon Road and Boundary Road restrict non-authorised vehicles from through running, thus bus services are able to move freely within the University boundaries.

Nearest rail links

Current options for rail access to the University are poor:

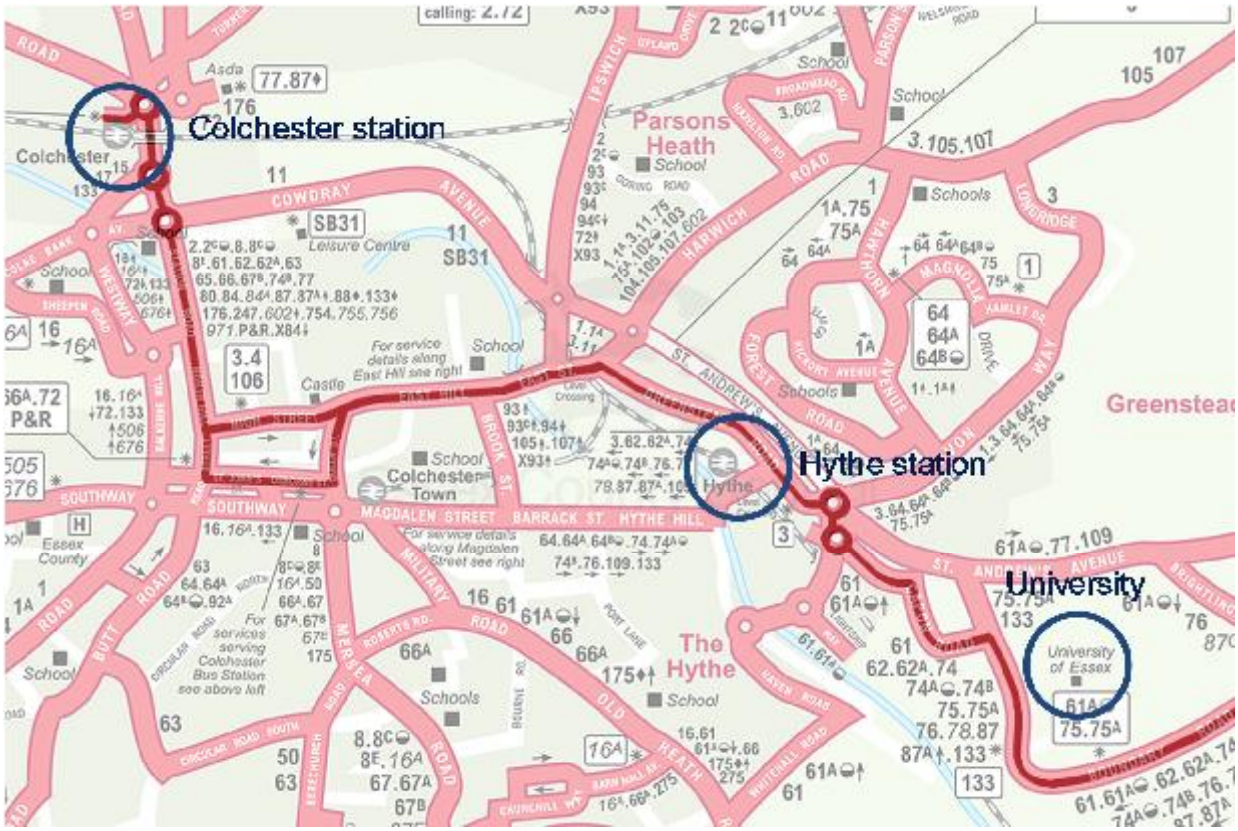
- Colchester station is on the Great Eastern Main Line.
  It has an off-peak service of 5tph to London and 3tph to Ipswich.
  However, the bus link between the station and the University via the town centre is relatively slow and subject to traffic congestion.
- Colchester Town has a less frequent rail service, with only 1 tph to London plus local services to Colchester and Walton-on-the-Naze. Bus links to the University follow a longer route via Military Road.
- Hythe station has a poor rail service. Although relatively short the bus link is currently not an attractive option, as not all routes serve the stops nearest the station, and the nearest stop served by all routes are on located on Greenstead Road.
- Wivenhoe station is some 3km by road from the station, and is served 2tph including 1tph to London.

Colchester

The main rail station serving Colchester is located to the north of the town centre, with frequent services to London, Ipswich and Norwich.

The bus link between the station and the University runs via the town centre and is scheduled to take approximately 30 minutes. Although there are bus priority measures on roads between Colchester station and the town centre, road links to the east of Colchester are subject to congestion.

Figure 3.29 : Bus route 62 between Colchester and Hythe stations and University of Essex



Hythe

The nearest station to the University campus is Hythe. This is served by hourly trains between Colchester and Walton-on-the-Naze which run via Colchester Town. The journey time between Colchester and Hythe is approximately 15 minutes including reversal at Colchester Town. Additional services, including some through trains to and from London, run during the peaks.

The bus link from stops on Greenstead Road to the University is scheduled to take around 8 minutes. This route has to negotiate the roundabouts on the A133 at St Andrews Avenue/Clingoe Hill, but otherwise runs via the vehicle gates on Capon Road and Boundary Road.

3.6.3 A new station for the university

Key considerations

The rail line between Colchester and Clacton runs immediately to the west of the University campus. A new station on this line could potentially offer improved rail links to the University. However, it is important to consider:

- Accessibility between a new station and the campus facilities, including the Knowledge Gateway
- Whether the station would serve other transport objectives
- Potential train services at the new stations

Accessibility between the station and campus

An indicative location for a new station would be to the west of Entrance 3, with access via a continuation of the link from the bus stops on Boundary Road via Valley Road to Square 1. The rail line is approximately 250 metres from the road at this point.

Figure 3.30 : Indicative station site

Thus the walk time from the nearest point at a possible station to the bus stops on Boundary Road would be approximately 4 minutes, which would be in addition to the current walk time from the bus stops to points within the campus. However, as noted above, the campus is also served by other bus stops thus the every part of the campus is nearer to a bus stop and some significantly so.

Assuming direct pedestrian access, the Knowledge Gateway would be about 500 metres walk, or around 8 minutes from the new station. This compares with existing bus stops located on Capon Road.

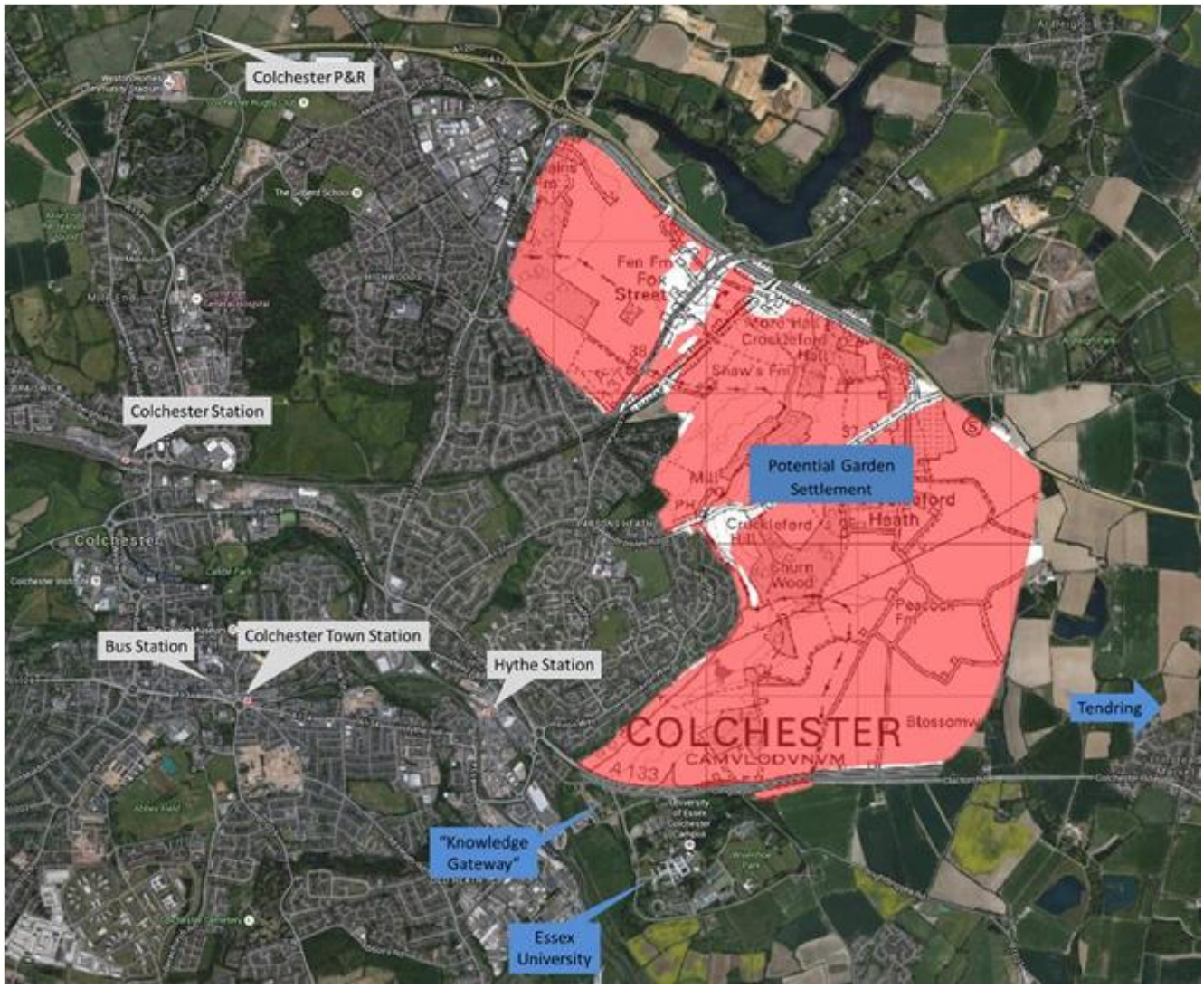
A station site further north could potentially offer better access to the Knowledge Gateway, but considerably longer walk times to sites on the main campus.

A station site further south could be located closer to Boundary Road, but would be further from the main campus and current bus stops, with direct pedestrian access lengthened by the configuration of South Courts.

Serving other demand generators

A new station to the west of the campus would not serve other local demand generators.

Figure 3.31 : Key demand generators



The key demand generators identified in this Study include:

- The proposed Garden Settlement to the east of Colchester north of the A133
- A proposed Park and Ride site north of the A133 for traffic from Tendring,
- The University of Essex
- The Knowledge Gateway

A new station would only serve the University and Knowledge Gateway. It would not be well located to serve the Garden Settlement, and there are already controls on Boundary Road to exclude non-University traffic.

To the west of the rail line is the River Colne with little opportunity to increase passenger demand from that side due to lack of river crossings and low level of employment directly to the west of the river.

3.6.4 Current train services

The basic service on the line between Colchester and Thorpe-le-Soken is part of the East Anglia franchise and is currently as follows:

- 1 tph local service Colchester to Walton-on-the-Naze via Colchester Town

- 1 tph through service to London to Clacton

The basic service specification for the new East Anglia franchise is unchanged, and any intentions by potential operators for improvement are as yet unknown.

Figure 3.32 : Current rail services

These services are timed close together to give cross-platform interchange between the local and through services at Thorpe-le-Soken.

Additional services operate during peak hours.

Both of these services could potentially serve a new station; however, Network Rail and train operators are not keen to make additional station stops on existing services if:

- The cost of the additional stop is less than the anticipated revenue gain
- The traffic at the new stations is mainly abstracted from adjacent stations
- The potential benefits of the additional stop are less than the disbenefits to current through passengers
- The new station is close to existing stations
- There is insufficient line capacity for an additional stop, or it would potentially add delay to existing services
- It would require additional rolling stock and/or traincrew due to reduction in turnround times or broken links with other services within the diagrams.

This may also mean that calls at a new station are made in place of station calls elsewhere.

The line past the University is not especially busy, but the turnround times, particularly for the local service at Colchester, are tight. The operator will wish to maintain the connections at Thorpe-le-Soken, and it is likely that Wivenhoe will remain the more attractive stop for the London – Clacton services.

Significantly greater justification is required for completely new services, and it is unlikely that this would be possible by serving the University alone.

Thus even if a station were to be provided, possible scenarios might be as shown in Table 3.7.

Table 3.7 : Possible rail service scenarios for a new station

Scenario	Services at University
Best case	Both services call (total of 2 tph), so • 2 tph to Colchester (though timed approximately 10 minutes apart) • 1 tph to London
Possible case 1	Only the Clacton service calls (total of 1 tph), so. • 1 tph to Colchester • 1 tph to London
Possible case 2	Only the local service calls (total of 1 tph), so. • 1 tph to Colchester • No through trains to London
Worst case	Limited peak services only

Given that the two services are timed so that there is interchange at Thorpe-le-Soken, even the "best case" scenario delivers a much worse service for the University than is available either at the main Colchester station or Colchester Town.

3.6.5 Summary

- Linkages between a new station and the campus would be significantly longer than from existing bus stops
- A new station would only serve the specific transport demand from the University and Knowledge Gateway, and not other transport demand from the east side of Colchester.
- Even if both existing hourly train services stop at a new station, there would only be 1tph to London and the overall service is much worse than at the main Colchester stations

3.7 Option selection summary

3.7.1 Developing a new network

The overall aim of developing a possible Rapid Transit Network to serve the eastern side of Colchester, was to develop options that provide high quality links between Colchester station, the Town Centre, and:

- The proposed Garden Settlement to the east of Colchester north of the A133;
- A proposed Park and Ride site north of the A133 for traffic from Tendring;
- The University of Essex; and
- The Knowledge Gateway.

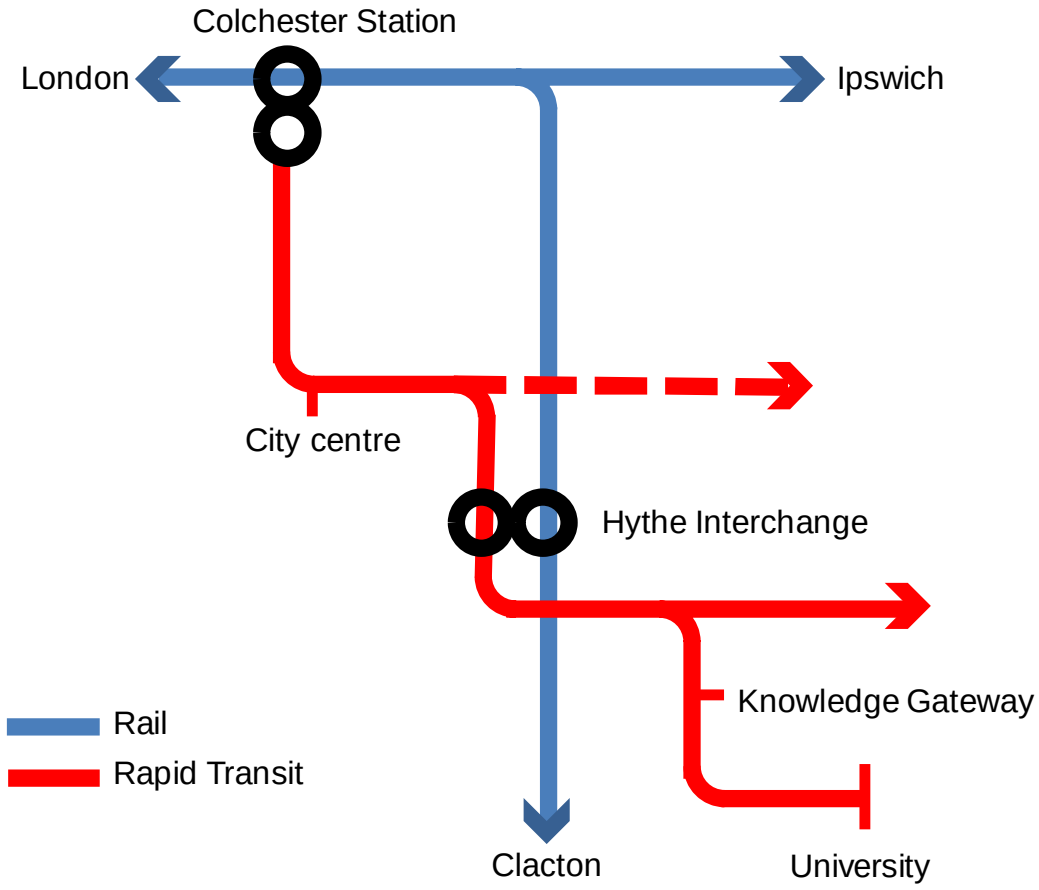
Within the University, current thinking is that the Rapid Transit route would use, or parallel, Capon Road and Boundary Road and serve similar stops to the current bus routes.

A key link for all the routes under consideration is the eastern corridor from the town centre. The road network is congested, and the existing heavy rail line to Colchester Town could offer an alternative.

3.7.2 Hythe interchange

One option under consideration is to take over the existing heavy rail line to Colchester Town for Rapid Transit.

Figure 3.33 : Possible Rapid Transit network taking over existing rai line to Colchester Town



However, this would necessitate changes to the existing rail services.

One option being considered would be diversion of the existing rail services from Colchester Town to serve a new transport interchange with the Rapid Transit at Hythe. This could potentially be achieved within existing timetabled resources, and could deliver the following service pattern:

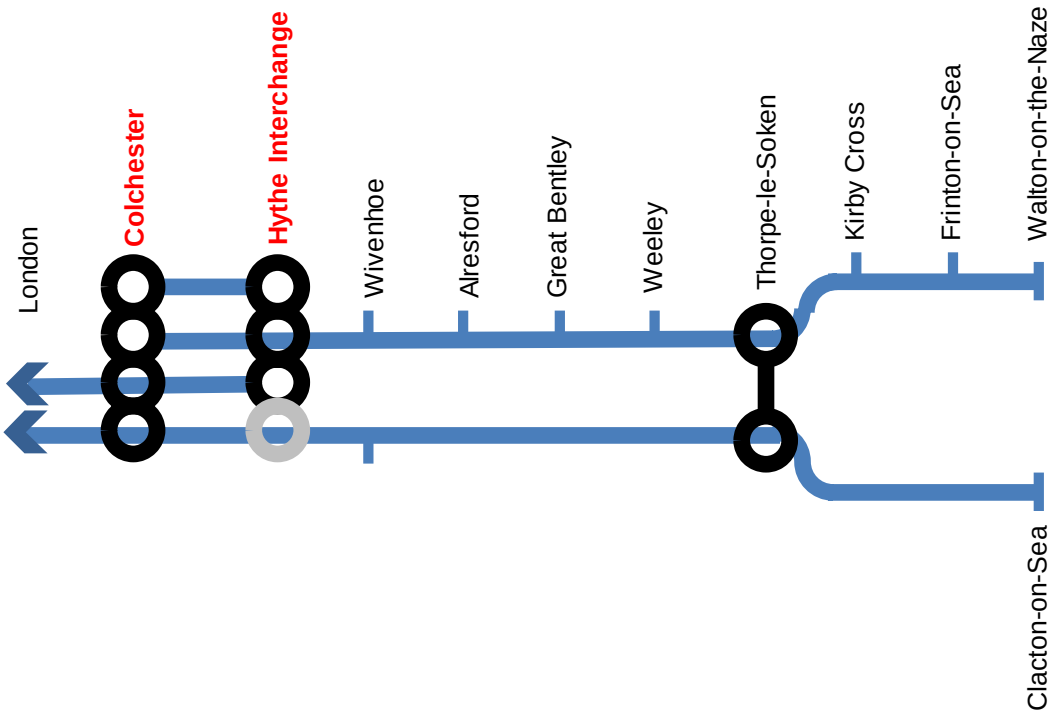
- 1.tph Colchester- Hythe – all stations to Walton-on-the-Naze (current service)
- 1 tph London – Colchester – Hythe (existing Colchester Town service diverted)
- 1 tph (potential) London – Colchester – Hythe (additional stop on existing Clacton service)
- 1. tph (potential) Colchester – Hythe shuttle (diversion of existing Colchester Town service)

Some swapping of paths may be necessary to achieve more even service intervals.

A key factor favouring development of a transport interchange at Hythe is the greater potential catchment area in comparison with a new station at the University. The proposed Rapid Transit links to the southern part of the Garden settlement (and to the proposed Park and Ride site on the A133) would be routed via Hythe Interchange which, with improved links to Colchester and stations to London, could become a transport hub for the eastern side of Colchester and reduce traffic levels on the already congested road links.

These improved interchange opportunities would strengthen the case for an additional stop on the London-Clacton service giving a total of 2 tph to London. It is unlikely that such a stop would be justifiable without good interchange potential.

Figure 3.34 : Possible train services at Hythe Interchange



3.7.3 Connections into the University

A dedicated or prioritised connection for the Rapid Transit route from Hythe station into Elmstead Road, together with the possible relocation of Hythe station south of the level crossing would offer an effective link between the Hythe Interchange and the University via the Knowledge Gateway.

Use of the rail corridor via Colchester Town would give a faster journey between the University and the town centre.

Improvements to Cowdray Avenue could also offer a potential Rapid Transit route between Hythe Interchange and Colchester station.

3.7.4 Conclusions

- Current options for rail access to the University are poor:
- Bus services provide good connectivity within the campus, but links into the town centre and to Colchester station are slow.
- However, a new station adjacent to the University would have poorer connectivity within the campus than the bus network, and a relatively poor train service.
- The Colchester Rapid Transit project includes the University and Knowledge Centre as key nodes and is intended to improve connections with the rail network and town centre.
- Conversion of the rail corridor into Colchester Town to a Rapid Transit link and the development of a new interchange hub at Hythe would offer significantly improved rail connections to the University.
- Improvements to Cowdray Avenue could also offer a potential Rapid Transit route between the University, Hythe and Colchester station.

3.8 Shortlisted options for appraisal

Based on the option development and shortlisting process outlined in this section, we shortlisted four route and network options for further appraisal in consultation with members of the East Colchester Working Group. All these involve a route network to serve Colchester station, Colchester Town, the Knowledge Gateway, the University and the Garden Settlement as well as a park and ride site on the A133 as shown in Figure 3.9 and Figure 3.10. They differ by the corridor chosen for achieving the connection between the east Colchester and Colchester town centre:

- Option 1: East Hill/Greenstead Road;
- Option 2: Takeover of the rail corridor to Colchester Town;
- Option 3: alignment via Military Road; and
- Option 4: connection from Garden Settlement to Colchester town centre via A120.

In general it was assumed that all options would be implemented as bus-based rapid transit systems. In addition, option 2 was appraised as a tram-based scheme, so we refer to option 2B (bus) and option 2T (tram) respectively in the remainder of this report.

4. The Economic Case

4.1 Background

Government has the objective to "support sustainable economic activity and get good value for money". The degree to which a rapid transit scheme for East Colchester achieves or contributes to this objective has been assessed in terms of Public Accounts and Transport Economic Efficiency.

In the Public Accounts appraisal, only "Cost to Government" are shown as a cost. It is too early to decide who should bear the costs of land, infrastructure, rolling stock and operation and who receives the revenues. This appraisal currently assumes all costs are borne by, and revenues accrue to, Government.

The scheme costs used in this appraisal are set out in the subsequent chapter on the financial case.

The Transport Economic Efficiency appraisal requires the calculation of User Benefits. Scheme capital costs are assumed to be incurred in the years immediately preceding the scheme opening. Annual operating costs are assumed to be constant and are incurred from scheme opening to the end of the appraisal period.

4.2 Demand forecasting methodology

A high level demand forecasting model has been set up in line with available resources and required timescales. This has been developed in parallel with highway model for the Colchester Local Plan support.

We have used the network structure from the SATURN-based highway model to provide an EMME-based background network for bus services and have coded all existing bus services of relevance to East Colchester into the model. We have superimposed on this the rail links and services, focussing on Colchester, Colchester Town and Hythe stations, with links to destinations further afield.

No existing bus patronage data was available to us. However, we did obtain a University travel survey that provided detailed mode split information for university employees and students, based on a good sample size of 835 employees and 1,196 students. We have used the data from the University together with highway and public transport generalised costs for travel to and from the University to calibrate a logit-based mode choice model. The mode choice model also provides demand estimates for Park and Ride.

We developed an assignment process using standard parameters as suggested in WebTAG including weighting of wait and walk times and the use of a boarding penalty.

Once the base model set-up was calibrated, we overlaid the Rapid Transit options on the network as a separate mode. Standard public transport services (including the bus rapid transit options) were implemented with a boarding penalty of 5 minutes. To simulate the perception of higher quality for tram (ride quality, stop environment, superior reliability), the tram services were coded without a boarding penalty. This provides an indicative forecast of potential tram demand only.

The availability of data, together with the sparsity of Public Transport demand for certain O-D movements did not allow a formal validation exercise to be undertaken. However, we have undertaken some realism testing, comparing the results against available data and have undertaken a sense check of forecasts and demand patterns. This included reviews of trip patterns (for example concentration of public transport trips in relation to public transport accessibility) as well as model responses such as implied elasticities of the logit model.

We have also benchmarked the resulting patronage forecasts against patronage levels at other rapid transit schemes.

4.3 Forecasting and appraisal assumptions

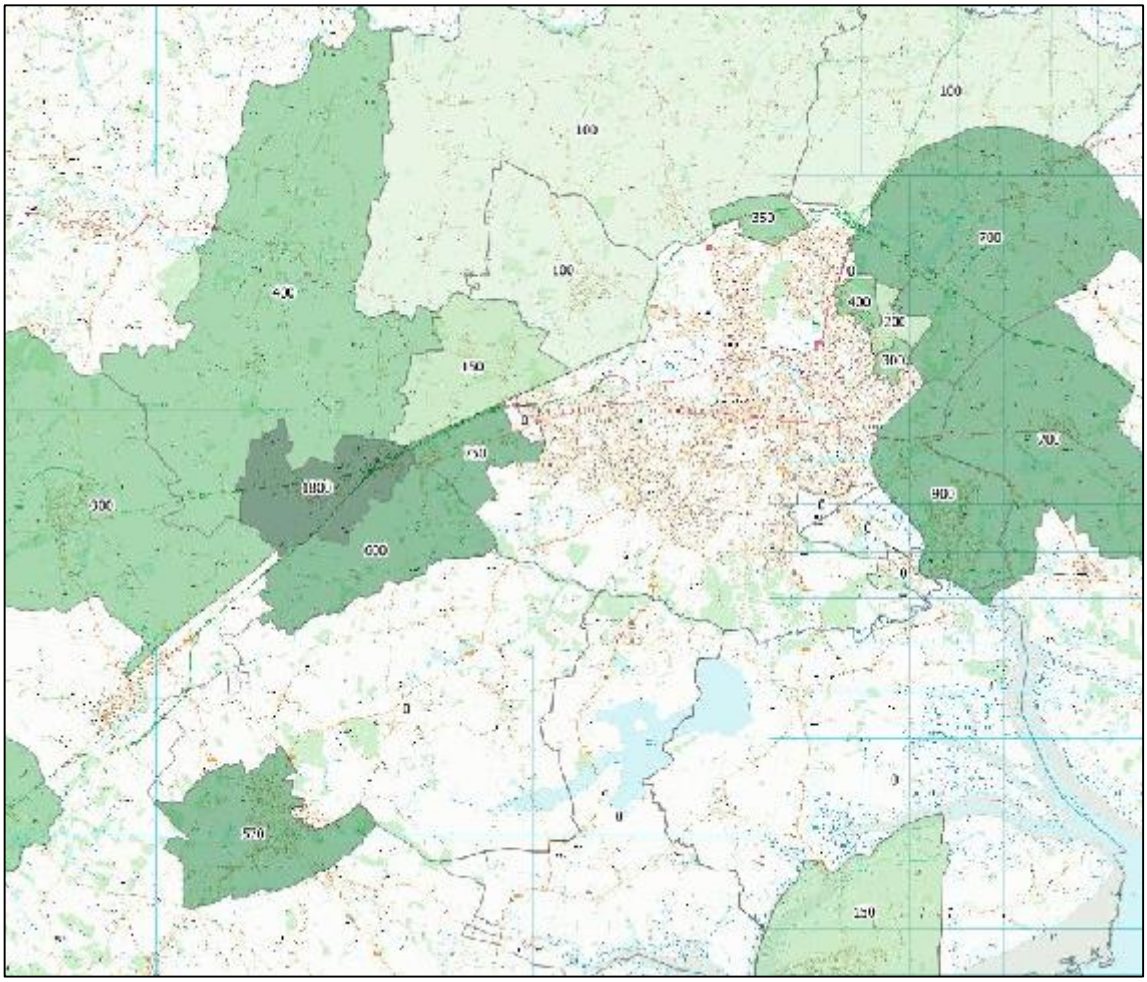
4.3.1 Land use

The modelling has been undertaken for a single forecast year, 2032. Overall levels of demand were derived from the land use analysis undertaken for the local plan development modelling which identified three main development scenarios plus a “no growth” and “maximum growth” scenario.

For the purposes of the rapid transit modelling, we used Scenario 1, with development focussed to the east and west. This is thought to be a realistic growth scenario for the East Colchester area.

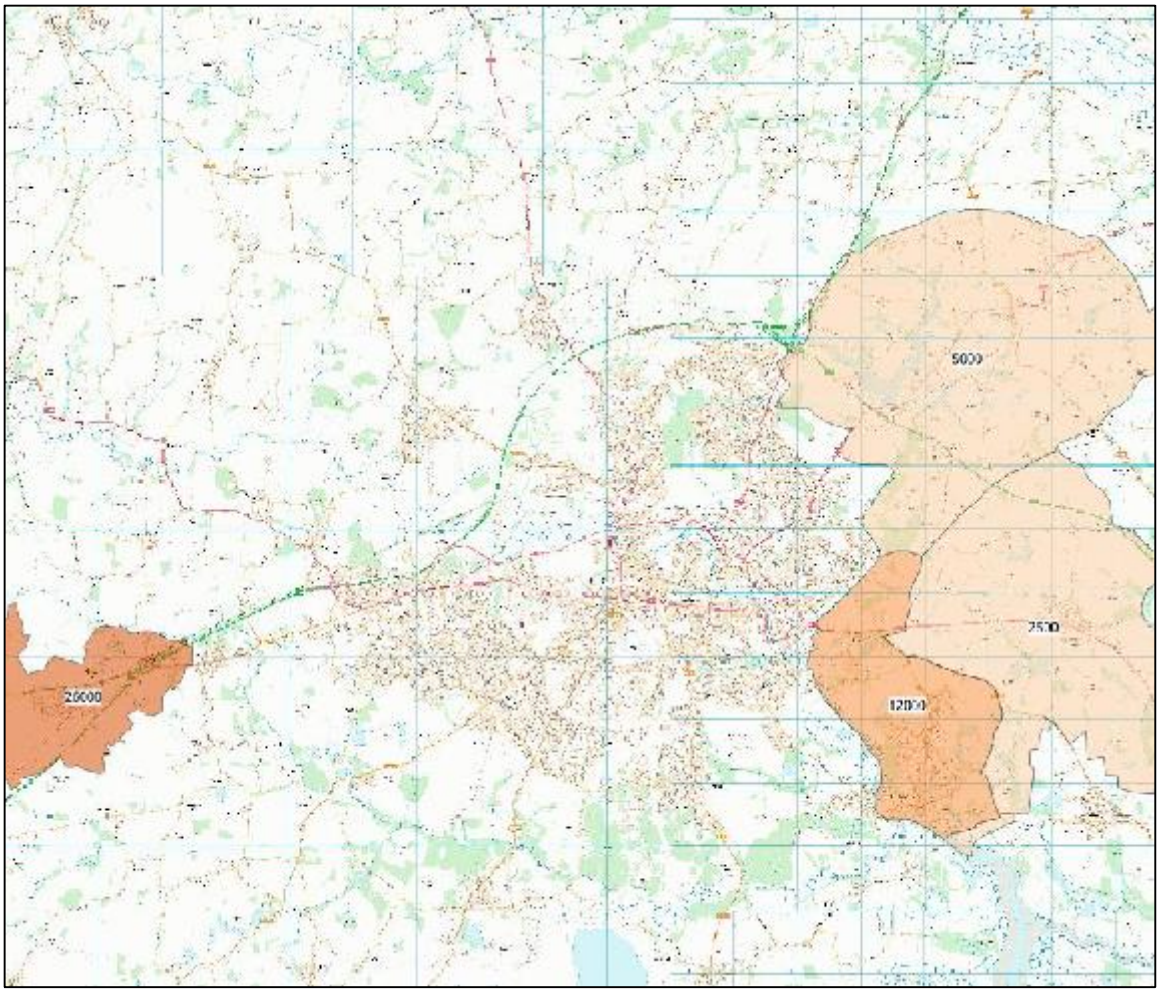
Scenario 1 has significant local plan development to the east and west of the borough in addition to the committed and Local Development Framework (LDF) development. This development scenario was devised by Colchester Borough Council, who provided the project team with development locations on a model zoning basis. The amount of housing development assumed in this scenario, is illustrated in Figure 4.1.

Figure 4.1 : Scenario 1 housing totals by model zone



Similarly, the amount of employment and retail development per zone, given in terms of square metres of GFA, is illustrated in Figure 4.2.

Figure 4.2 : Scenario 1 employment and retail totals (m² GFA) by model zone



Total local plan development is therefore 8,570 houses, 40,000m^2 GFA of employment and 5,500m^2 GFA of retail. Details in the highway model development report[4].

4.3.2 Appraisal parameters

The key assumptions used in the appraisal are based on latest (November 2014) WebTAG Guidance at the time of undertaking the appraisal. An update to certain TAG units has been issued in December 2015. Updates included recommended values for calculating vehicle operating costs, economic growth assumptions. These would not have a material impact on the case presented here. The Department for Transport has also published for consultation new research on values of time. It is expected that these will feed into updated guidance in April 2016.

All cost estimates include adjustments for risk and optimism bias and are reported in millions of pounds in real 2010 prices in the market price unit of account[5].

Values of time for different journey purposes and journey purpose splits are taken directly from the WebTAG databook (Tables A1.3.2 and A1.3.4).

A summary of the key appraisal assumptions and parameters is given in Table 4.1.

[4] Colchester Local Plan Modelling Support, Transport Planning, draft 24/11/15

[5] Both public and private sector providers perceive costs in the factor cost unit of account so all costs are converted using the indirect tax adjustment factor.

Table 4.1 : Appraisal Parameters

Parameter	Assumption	Source
Appraisal Base Year for costs and discounting	2010	WebTAG
Appraisal Period	From 2010 to 60 years after scheme opening	WebTAG
Opening Year	2025	Scheme Assumption
Discount factor	3.5% until year 30 3.0% from year 31	WebTAG
Optimism Bias Uplift, Capital Costs	66%	WebTAG
Optimism Bias Uplift, Maintenance Costs	66%	WebTAG
Optimism Bias Uplift, Operating Costs	41%	WebTAG
Capital Cost Phasing	2021 10% 2022 30% 2023 30% 2024 30%	Consultant's estimate
Market Price Uplift	1.19	WebTAG
Annualisation Factors - Demand and revenue - Operating costs - Road decongestion benefits	 2,400 6,552 1,200	 Consultant's estimate[6] Consultant's estimate[7] Consultant's estimate[8]
Average Revenue per trip in 2010	£0.82	DfT bus statistics[9]
Real Growth in Fares	0.6% pa	Based on DfT bus statistics, Table BUS0402a, extrapolated after 2015
Value of time and VoT Growth	As per databook	WebTAG table A1.3.2 (PSV)[10]
Trip Purpose Split	As per databook	WebTAG table A1.3.4 (Light Rail)[11]
Benefits and Revenue build-up	35% in year 1 70% in year 2 90% in year 3 100% in year 4	Consultant's estimate
Demand growth prior to first modelling year	3% pa	Consultant's estimate
Demand growth after final modelling year	0% pa	Consultant's estimate
Marginal External Costs included	Infrastructure cost saving Accident Local air quality Noise Greenhouse gases Indirect taxation	Calculated using WebTAG MECC methodology

[6] Peak period is twice the peak hour, two peak periods a day, daily demand is twice the peak period demand, a weekend is equivalent to one week day (2x2x2x300)
[7] 18 hours a day for 364 days a year (18*364)
[8] Peak period is twice the peak hour, two peak periods a day, a weekend is equivalent to one week day (2x2x300)
[9] Table BUS0402a, for English non-metropolitan areas. Values factored using data from Table BUS0501a to allow for passenger fare receipt as proportion of total operating revenue
[10] WebTAG provides values of time for PSV (Bus) passengers, Rail and Underground but not light rail. PSV was thought to be the most appropriate value.
[11] In contrast to values of time, WebTAG provides a separate set of purpose splits for light rail, with higher proportions of Business and Commuting trip purposes compared with bus. Given the expected profile of new residents in the Garden Settlement, we felt it was appropriate to use these.

4.4 Demand and revenue forecasts

The resulting demand forecasts from the modelling based on the above forecasting assumptions are summarised in Table 4.2

Table 4.2 : Demand Forecast Summary: 2032 Development Scenario 1

	Option 1	Option 2B	Option 3	Option 4	Option 2T
AM peak h Rapid Transit trips	1,200	1,300	800	1,000	2,200
AM peak h Rapid Transit Pax kms	4,300	5,000	3,400	3,900	8,100
Annual Rapid Transit trips (m)	2.8	3.1	2.0	2.4	5.2
Average trip length (kms)	3.7	3.9	4.0	4.0	3.7
Annual Rapid Transit revenue (£m)	£60m	£65m	£43m	£50m	£109m
Annual incremental PT revenue (£m)	£48m	£50m	£34m	£41m	£92m

The assigned passenger flows for the five scheme options are shown graphically in Figure 4.3 to Figure 4.7.

Figure 4.3 : Option 1 Assigned Demand (AM Peak Peak Hour)

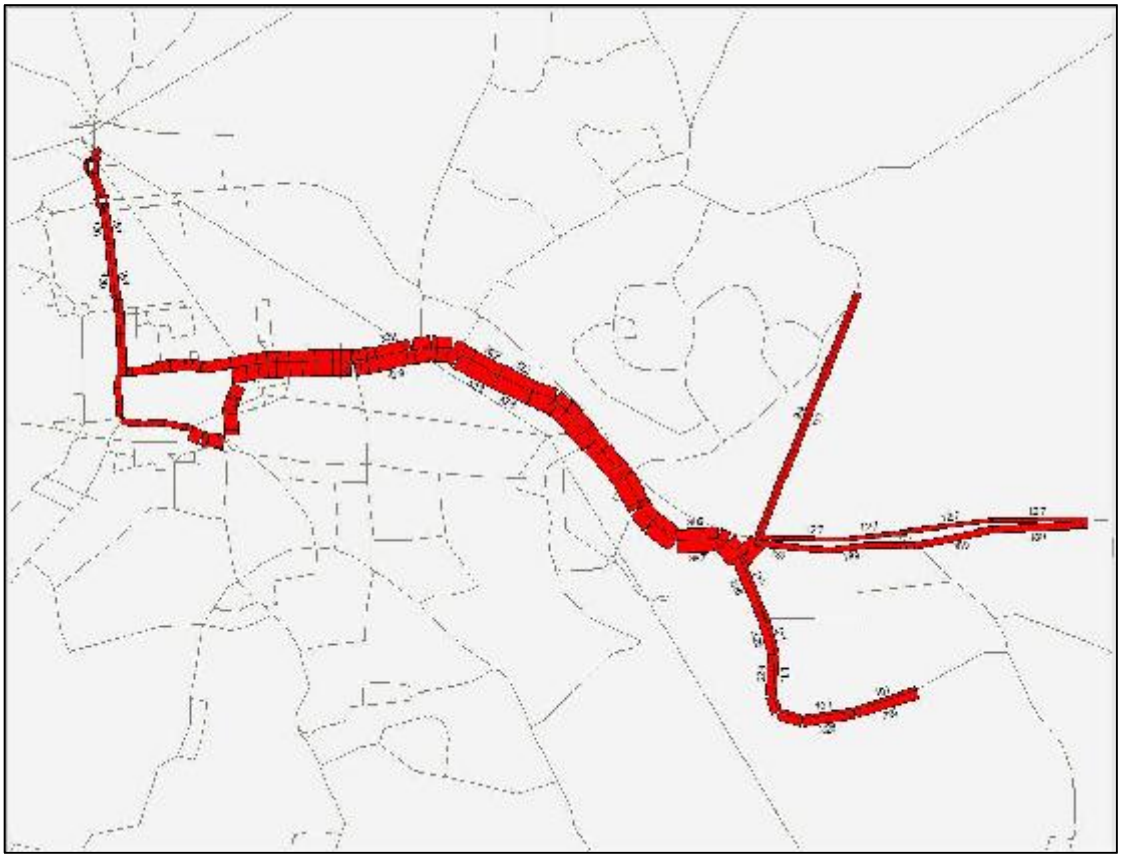


Figure 4.4 : Option 2B Assigned Demand (AM Peak Peak Hour)

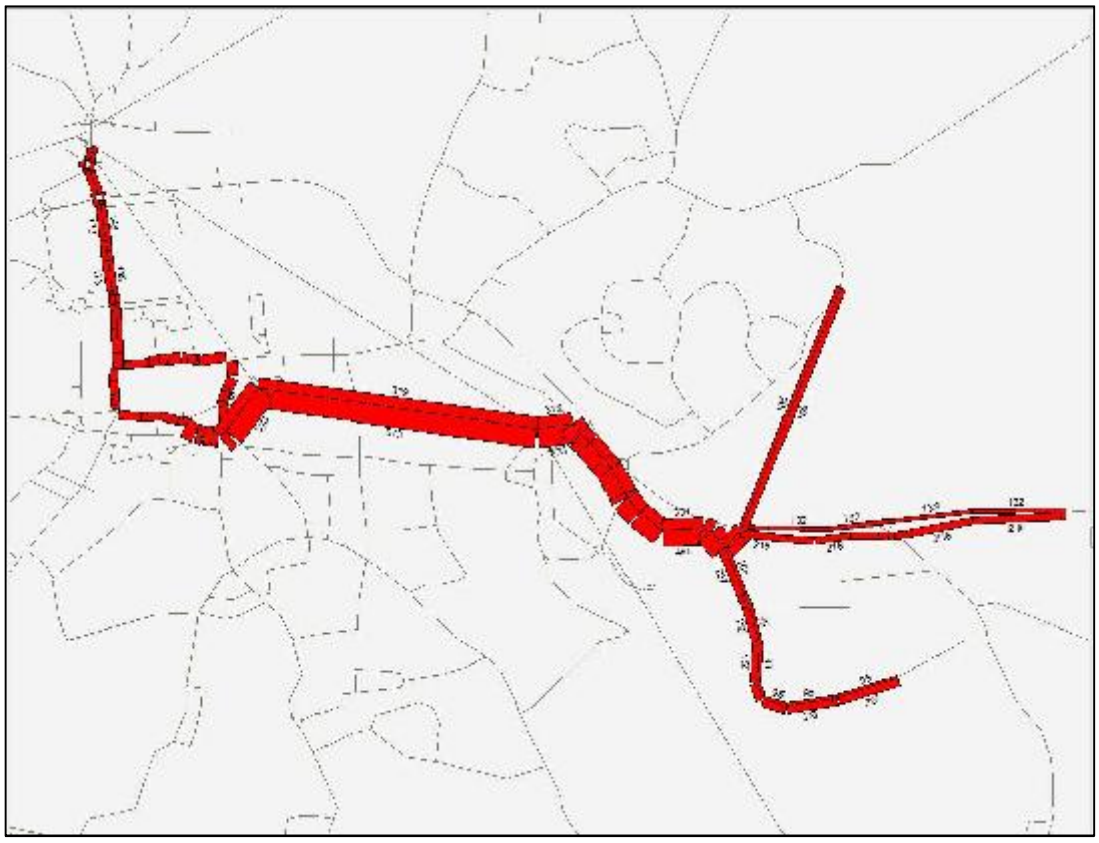


Figure 4.5 : Option 3 Assigned Demand (AM Peak Peak Hour)

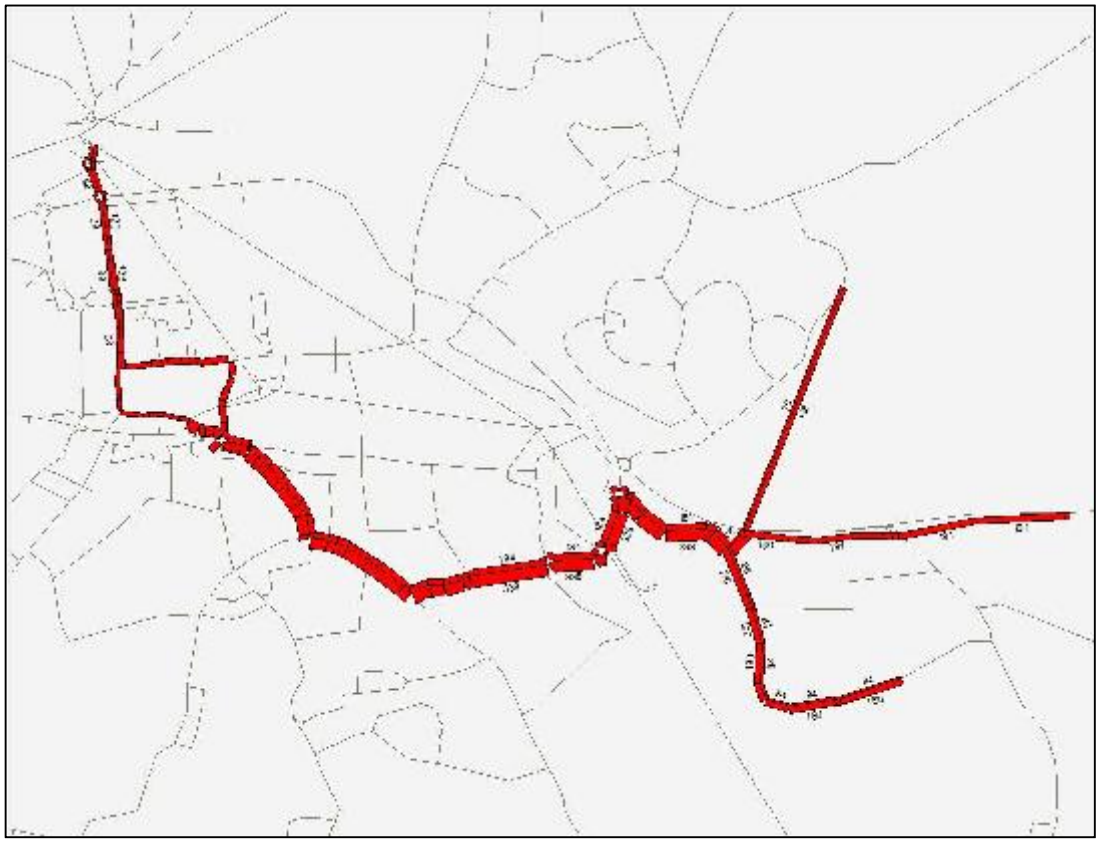


Figure 4.6 : Option 4 Assigned Demand (AM Peak Peak Hour)

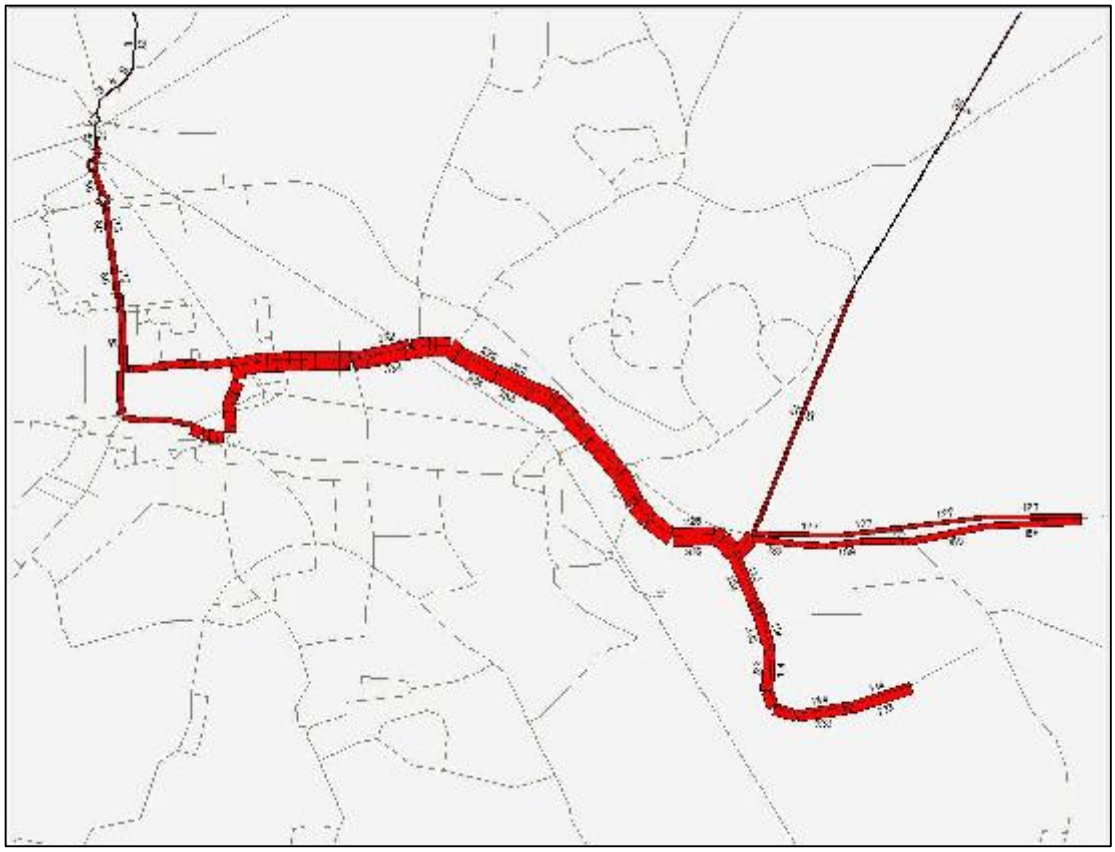
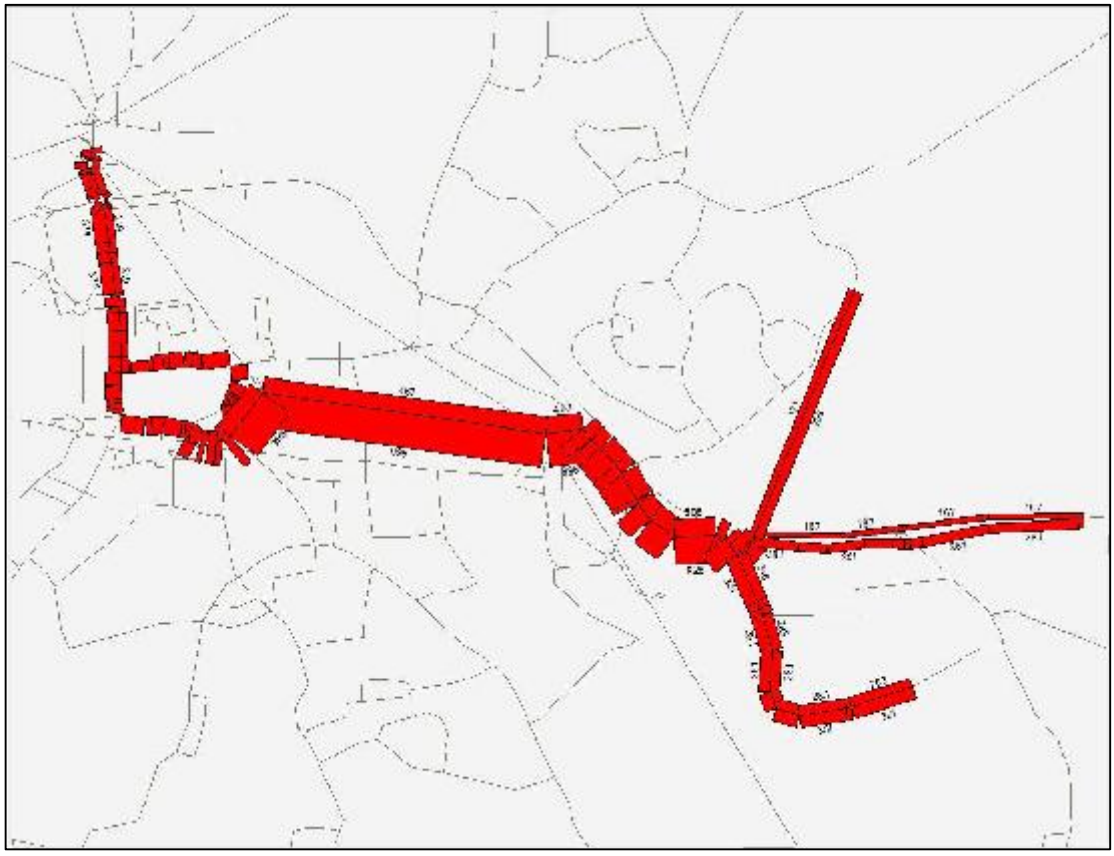


Figure 4.7 : Option 2T Assigned Demand (AM Peak Peak Hour)



4.5 Appraisal results

The appraisal Results for the five scheme options are summarised in Table 4.3 to Table 4.5. The scheme cost estimates feeding into this appraisal are documented under the Financial Case in the next chapter.

Table 4.3 : Appraisal Summary: Costs and Revenues (PV, 2010 prices)

	Option 1	Option 2B	Option 3	Option 4	Option 2T
Capital costs	-£52m	-£84m	-£55m	-£65m	-£287m
Operating and maintenance costs	-£79m	-£81m	-£90m	-£94m	-£238m
Total costs	**-£131m**	**-£164m**	**-£145m**	**-£159m**	**-£525m**
Net incremental revenue	**£48m**	**£50m**	**£34m**	**£41m**	**£92m**
Total Financial Effect	**-£83m**	**-£115m**	**-£110m**	**-£117m**	**-£433m**

Table 4.4 : Appraisal Summary: Social Benefits (PV, 2010 prices)

	Option 1	Option 2B	Option 3	Option 4	Option 2T
Time savings, business users	£6m	£6m	£5m	£5m	£10m
Time savings, commuting	£54m	£58m	£42m	£49m	£93m
Time savings, other users	£59m	£63m	£46m	£53m	£101m
Road operating cost savings	£4m	£4m	£3m	£3m	£9m
Road decongestion	£3m	£4m	£2m	£3m	£7m
Accidents	£8m	£9m	£5m	£7m	£19m
Noise, air quality and greenhouse gas[12]	£0m	£0m	£0m	£0m	£0m
Total Social Benefits	**£134m**	**£144m**	**£103m**	**£119m**	**£239m**

[12] Values lost in rounding

Table 4.5 : Appraisal Summary: NPV and Benefit/Cost Ratio

	Option 1	Option 2B	Option 3	Option 4	Option 2T
PV of project costs	£131m	£164m	£145m	£159m	£525m
PV of net revenue	£48m	£50m	£34m	£41m	£92m
Present Value of Costs (PVC)	**£83m**	**£115m**	**£110m**	**£117m**	**£433m**
PV of social benefits	£134m	£144m	£103m	£120m	£239m
PV of indirect taxation impact	£-2m	£-3m	£-2m	£-2m	£-6m
Present Value of Benefits (PVB)	**£132m**	**£141m**	**£101m**	**£118m**	**£234m**
Net Present Value (NPV=PVB-PVC)	**£48m**	**£26m**	**-£9m**	**£0m**	**-£199m**
Benefit/Cost Ratio (BCR=PVB/PVC)	**1.58**	**1.23**	**0.91**	**1.00**	**0.54**

The full set of WebTAG-compliant appraisal tables is provided in Appendix A. This includes the Transport Economic Efficiency Table (TEE), the Public Accounts Table (PA) and the Analysis of Monetised Costs and Benefits (AMCB).

4.6 Conclusions on the economic case

Based on the project costing, demand forecasting economic appraisal, Options 1 (East Hill/Greenstead Road) performs best in terms of affordability, Net Present Value and Benefit/Cost Ratio. With a BCR of 1.58, this project would be classified as “medium value for money” in the DfT value for money categorisation[13].

However, Option 2 (takeover of the rail corridor) generates the highest benefits and largest amount of revenue. Implemented as a bus scheme, this option still generates a positive NPV and BCR above 1. As a tram, the option generates significantly higher benefits and revenues but the increase is not sufficient to offset the substantial additional costs. This option results in a substantially negative NPV and a BCR of just 0.54.

Options 3 and 4 (alignment via Military Road and A120 respectively) do not perform well in economic terms.

4.7 Sensitivity tests

A series of simple sensitivity tests were undertaken for options 1, 2B and 2T to provide an understanding of the robustness of the current case. We have varied project costs, benefits and revenues by plus and minus 30% each and then combined these to create a worst and best case scenario. The resulting NPVs and BCRs are summarised in Table 4.6 and Table 4.7.

[13] Value for Money Assessment: Advice Note for Local Transport Decision Makers, DfT, December 2013:
- Poor VfM if BCR is below 1.0
- Low VfM if the BCR is between 1.0 and 1.5
- Medium VfM if the BCR is between 1.5 and 2.0
- High VfM if the BCR is between 2.0 and 4.0
- Very High VfM if the BCR is greater than 4.0

Table 4.6 : Sensitivity Test Summary: NPV

	Option 1	Option 2B	Option 2T
Main Appraisal	£48m	£26m	-£199m
30% increase in cost	£9m	-£23m	-£357m
30% reduction in cost	£88m	£76m	-£42m
30% increase in benefits	£88m	£69m	-£129m
30% reduction in benefits	£9m	-£16m	-£269m
30% increase in revenues	£62m	£41m	-£172m
30% reduction in revenues	£15m	-£9m	-£264m
Worst case combination	-£64m	-£100m	-£491m
Best case combination	£142m	£133m	£56m

Table 4.7 : Sensitivity Test Summary: BCR

	Option 1	Option 2B	Option 2T
Main Appraisal	1.58	1.23	0.54
30% increase in cost	1.07	0.86	0.40
30% reduction in cost	2.97	2.15	0.85
30% increase in benefits	2.05	1.60	0.70
30% reduction in benefits	1.10	0.86	0.38
30% increase in revenues	1.90	1.41	0.58
30% reduction in revenues	1.13	0.94	0.47
Worst case combination	0.59	0.50	0.25
Best case combination	5.70	3.62	1.23

This indicates that the initial conclusions of the appraisal are robust:

- Option 1 remains an economically worthwhile option under all but the most pessimistic set of assumptions;
- Option 2 as a tram remains economically unviable under all but the most optimistic set of assumptions; and
- Option 2 as a bus scheme is potentially viable but downside assumptions in sensitivity testing can easily push it into the territory of negative NPV and a BCR below 1.

5. The Financial Case

5.1 Overview of affordability assessment

An improvement to transport provision for East Colchester is needed to unlock the full potential of the development site. Strategic option development has identified a rapid transit network that is capable of addressing the transport needs of East Colchester.

The Financial Case outlines the project costing, considers the net subsidy requirements for construction and (if necessary) operation and explores likely third party funding sources such as s106 contributions towards the scheme from local developers and/or a section 278 agreement to pay for associated local highway improvements.

5.2 Project costs

5.2.1 Capital costs

High level outline capital costs for the different scheme options have been derived using a unit cost analysis applied to the scheme elements required by each of the options.

The unit cost assumptions used are summarised in Table 5.1.

Table 5.1 : Unit Cost Assumptions

	Unit Cost	Source
Tram capital cost per route km	£11.0m	DfT analysis
BRT capital cost per route km	£7.5m	Consultant's Analysis of Luton costs
BRT operating costs per vehicle km	£2.18	Consultant's analysis of UK bus industry
BRT maintenance costs per route km pa	£60,000	Consultant's Analysis of Luton costs
Tram operating and maintenance cost per vehicle km	£7.50	Consultant's analysis of UK systems
Tram vehicle cost	£1.5m	Consultant's analysis of UK systems
Cost of P&R facility	£5.0m	Based on Northern P&R
Cost of rail turnback facility at Hythe	£7.0m	Consultant's indicative assessment

Which of these elements are required, and in what quantity, is summarised in Table 5.2 for bus-based options and in Table 5.3 for the tram-based option.

While the bus options require a number of bespoke local infrastructure interventions, the tram option requires conversion of the entire route. It should be noted that costing for the tram option is very indicative only. If this scheme were to be pursued further, a more detailed exploration of infrastructure requirements and likely costs would be required.

Table 5.2 : Capital Cost Estimates – BRT Option Components

	Unit Cost (£m)	Option 1 East Hill	Option 2B Rail Corridor	Option 3 Military Rd	Option 4 A120
Greenstead Rd/ Elmstead Rd Crossover	2.3	Yes	Yes	No	Yes
P&R Facility	5.0	Yes	Yes	Yes	Yes
Rail Corridor Conversion	11.3	No	Yes	No	No
Recreation Rd Link	3.8	No	No	Yes	No
Garden Settlement guided bus infrastructure South	22.5	Yes	Yes	Yes	Yes
Garden Settlement guided bus infrastructure North	7.5	No	No	No	Yes
Additional Rail Turnback at Hythe	7.0	No	Yes	No	No
Total cost estimate (£m)		**29.8**	**48.0**	**31.3**	**37.3**

Table 5.3 : Capital Cost Estimates – Tram Option Components

	Unit Cost (£m)	Option 2T Rail Corridor (Tram)
P&R Facility	5.0	Yes
Additional Rail Turnback at Hythe	7.0	Yes
Tram Conversion of 11.1 kms of route	122.6	Yes
Rolling Stock	30.0	Yes
Total cost estimate (£m)		**164.6**

5.2.2 Upgrades and renewals

Appraising the project over 60 years means that a proportion of the infrastructure will become life-expired, and will require renewal, during the appraisal period. While, in practice, different lifespans will apply to different infrastructure elements, we have made the simplifying assumption that the entire capital cost will need to be spent again after 30 years, half way through the appraisal period.

5.2.3 Operations and maintenance costs

Annual operating costs have been calculated based on an operating pattern of 4 buses (trams) per hour on each route and using the following assumptions:

- BRT operating cost: £2.18 per km. This is based on an analysis of TfL bus tender values for gross cost contracts. The contracts include the provision of vehicles, so no capital cost or renewal cost is required for vehicles for bus-based options.
- BRT maintenance cost: £60,000 per route km per annum. This is has been derived from the Luton busway project. It is applied to the dedicated pieces of busway infrastructure only.
- Tram operating and maintenance cost: £7.50 per route km per annum. This is based on an analysis of existing UK tram systems in operation.
- Operating cost annualisation: 6,552 as outlined in Table 4.1, based on an operating day of 28 hours and 364 operating days per year.

The resulting overall operating cost estimate is summarised in Table 5.4.

Table 5.4 : Operating and Maintenance Costs

	Option 1 (BRT)	Option 2B (BRT)	Option 3 (BRT)	Option 4 (BRT)	Option 2T (Tram)
	Two-way route length (kms)				
GS - Town – Station	15	15	18	24	15
University - Town – Station	12	12	16	13	12
GS – University	10	10	10	10	10
P+R - Town	11	11	12	11	11
Annual vehicle kms	1.27	1.25	1.47	1.50	1.25
Annual operating cost (£m)	**2.76**	**2.73**	**3.19**	**3.27**	**9.40**
Annual busway maintenance cost (£m)	**0.18**	**0.27**	**0.21**	**0.24**	**-** [14]

[14] Operating cost per tram km includes permanent way maintenance

5.3 Budget provision

5.3.1 Capital cost

If a successful case for the scheme can be made by Essex County Council, then there may be a reasonable expectation of some funding from the Department for Transport. However, it is likely that this will be contingent on a number of additional funding contributions being secured, some of which are outlined below.

It may be possible to apply for project funding from European funds, particularly where the project demonstrates commitment to incorporating sustainability techniques in design and construction.

The most likely sources of local grants to finance capital costs of the project are:

- Section 106 contributions and Planning Obligations Community Benefit Strategy (POCBS) funding;
- A section 278 agreement to pay for associated local highway improvements; and

In addition, Network Rail has a number of funds available for England and Wales Enhancement Programmes which may be applicable for rail-related costs (such as the works required at Hythe Station). Potentially applicable funds in Control Period 5 (CP5, 2014-2019) include:

- F001 Level Crossings Risk Reduction Fund;
- F002a Stations – National Stations Improvement Programme (NSIP);
- F002b Stations – Access for All (AfA);
- F005 Network Rail Discretionary Fund (NRDF); and
- F007 Passenger Journey Improvement Fund (PJIF).

Although funds for CP5 are now likely to be largely allocated, the timescale of this project would require funding in CP6.

In addition, there is the possibility of contributions from the Community Initiatives Fund (CIF), though budget allocation for any individual project under this programme is currently small.

As funding is likely to be derived from a range of sources and given the uncertainties over most potential funding sources, it is important to continue to make the case for the project, develop funding applications for appropriate funds and work towards contribution agreements with developers under s106 and s278.

5.3.2 Operating cost subsidy

As shown in Table 4.3, with the given demand and revenue forecasts and the operating cost calculations outlined above, current estimates indicate that ongoing operating and maintenance costs will not be covered by the incremental revenues generated by the scheme for any of the options.

There may be a number of possible improvements to this position. It is anticipated that the introduction of rapid transit services would be associated with changes to existing bus services and consequential cost savings particularly if the rapid transit services were provided by the same operator. The outline service proposals deliver a significant increase in capacity between the town centre and Colchester station, which may not be required, especially if better rail interchange facilities for the University and the Garden Settlement are available at Hythe. In addition a reduced requirement to provide additional highway capacity for increased demand from other road vehicles may justify allocation of some or all of the busway maintenance to general highway maintenance budgets.

6. The Commercial Case

6.1 Introduction

The Commercial Case explores who could, and should, promote the project and which other stakeholders should be engaged in this process. It then considers construction and operational management and procurement arrangements. At this stage of the project, it is only possible to provide a very high level view.

6.2 Key Stakeholders

The project would be promoted by Essex County Council as the Highway and Transport Authority for Colchester, with the support of Colchester Borough Council as the local authority. A wide range of other stakeholders would need to support the project as outlined in section 2.4.

6.3 Procurement Strategy

It is too early in the project to define a firm procurement strategy. It is likely that a Design & Construct procurement route will deliver the project in the timeliest manner and provide the benefits of early stage contractor involvement. However, for the railway aspects of the project, procurement through Network Rail's own processes may be required. In the case of option 2, the take-over of the railway line to Colchester town would involve either the purchase or the long-term leasing of the land from Network Rail.

6.4 Contract Management

Essex County Council would be the likely contractual party for the construction phase of the project. However, for the railway elements of works, it is expected that the construction stage would be led by Network Rail, who are experienced in rail construction projects. The proposed scheme represents a relatively small project close to existing railway track, and would be managed within Network Rail's standard procedures.

6.5 Operation and Maintenance

For BRT options, it would be most efficient if an existing bus operator who is active in Essex was contracted to provide the services, with Essex County Council retaining the responsibility for maintaining the on-street infrastructure. For tram options, a dedicated operational company would need to be set up who may also assume responsibility for the maintenance of the on-street infrastructure.

Any rail assets would continue to be maintained by Network Rail, though station maintenance at Hythe may be contracted to the current franchise operator.

7. The Management Case

7.1 Introduction

The Management outlines likely models for project governance, sets out an outline programme, organisational structure and roles and project risks. As with the Commercial Case, it is only possible to provide a very high level view at this stage of the project.

7.2 Project governance

7.2.1 Background and structure

Essex County Council is the likely promoter of the scheme, working with key stakeholders such as Colchester Borough Council, Network Rail and local developers. The key stakeholders involved in the project will co-operate with each other, identify and report project risks and apply general principles of good governance when carrying out duties.

7.2.2 Approvals

The route taken to obtaining planning consent for the scheme will depend on the nature of the project. A tram scheme would require a Transport and Works Act Order (TWAO) application but it may be possible to pursue bus-based solutions through a simpler route. It may be possible to obtain consent for some of the bus infrastructure requirements (at least within, or adjacent to the Garden Settlement) as part of the consents process for the development.

Railway infrastructure works at Hythe Station could potentially be implemented under Permitted Development if no land-take is involved but would require a TWAO if they involve compulsory purchase of land. This TWAO would most likely be pursued by Network Rail. Before a TWAO submission, there would be a need for discussions and negotiations with DfT and the TOC to agree a contract change for any changes to service patterns involving Colchester Town, Hythe and Colchester stations.

The closure of the railway line to Colchester Town as required for option 2 would require statutory procedures as specified in the Railways Act 2005. In particular the Secretary of State for Transport would require evidence that

- the appraisal is consistent with the closures guidance and any subsequent changes made to it; and
- retention of the rail service, station or network proposed for closure does not represent good value for money compared with the option of closure.

In practice, the assessment of closure proposals required by the 2005 Act uses an approach to transport appraisal based on the New Approach to Appraisal (NATA) and so covers the five criteria specified in NATA used in assessing investment proposals. Thus the investment case for conversion would also have to demonstrate that the replacement services represented better value for money than the existing rail service.

7.2.3 Assurance and Reporting

Network Rail would oversee the implementation of the new rail infrastructure which would be approved through Network Rail's GRIP process. GRIP is an established and robust process which will provide assurance on the scheme as it progresses. Formal reporting accompanies the GRIP process at every stage, driven by formal stage gate reviews. The stage gate review process examines a project at critical stages in its lifecycle to provide assurance that it can successfully progress to the next stage.

Similarly robust processes will need to be adopted for the non-railway aspects of the project. These could be based, for example, on the extensive guidance previously published by the Office of Government Commerce (OGC). Although the OGC itself was integrated into the Efficiency and Reform Group of the Cabinet Office in

2011, its gateway review process still provides one of the best and most comprehensive sets of guidance for public projects. It offers a structure based around a series of independent peer reviews (or 'gateway reviews') carried out at key stages to verify that projects should be allowed to progress to the next stage.

7.3 Delivery Programme

An indicative delivery programme for the full scheme is outlined in Table 7.1.

Table 7.1 : Indicative Delivery Programme

Heading	Date
Confirmation of preferred option	2016
Refinement of business case	2017
Public consultation	2017/18
Outline funding agreements	2018
Development of full business case	2019
Outline design	2019
Further public and stakeholder consultation	2019
ECC decision to proceed with the project	2019
Start of Consents process (including TWAO if required)	2020
Consent obtained	2021
Design and Construct tender process	2021
Detailed design	2021/22
Construction phase	2022-2024
Testing and Commissioning	2024
Scheme Opening	2025

This timetable relates the complete delivery of the full scheme. Implementation of a tram scheme would require installation and testing of all elements before commencement of operation.

However, a bus-based solution could potentially be delivered in stages, including early substitution of new rolling stock on the existing route to the University. Relocation of bus stops on Greenstead Road could offer reduction of the interchange distance to Hythe station in advance of station enhancement works. Early completion of the Greenstead Road – Elmstead Road crossover would benefit existing bus services to the University in advance of commencement of BRT operation. Construction of infrastructure to link into the Garden Settlement and serve the Park and Ride would be phased to tie in with development

7.4 Stakeholder Communications Plan

Development of a communications strategy informing affected parties will be a vital element of the successful project. Consultation and communication will be required with the numerous stakeholders to ensure the project is developed as smoothly as possible.

Schedule 7 of the Railways Act 2005 sets out the requirements for how a consultation about a closure proposal must be initiated. It also states that the consultation should be carried out in line with the closures guidance. The guidance sets out the requirements for public notices, the parties who will require notification, and the content of the Consultation document.

Although public hearings or meetings are not a statutory requirement of the closure consultation, the guidance advises that organisation conducting the consultation will want to consider the most appropriate method for obtaining representative views from communities affected by the proposal.

7.5 Risk Management Strategy

A comprehensive risk management strategy will need to be developed as the project progresses. An initial assessment of high level risks is provided in Table 7.2.

Table 7.2 : High Level Risk Assessment

Risk Heading	Risk Description
Funding Availability	Inability to obtain sufficient funding for the project.
Unexpected Utilities	Construction affected by need for additional utility diversions not identified in initial project design
Railway Construction Constraints	Constraints imposed by the existing railway line and overhead equipment affecting construction methodology (e.g. plant used for work, time of access to land, etc) leading to increased programme time and additional cost.
Effect of new signals	There may be a need for re-spacing of signals in the area due to the knock-on effect of relocating signals in the immediate location of Hythe Station.
Planning Approvals	Risk of planning approval process taking longer than expected.
Design Approvals	Design approvals – risk that approvals process takes longer than anticipated.
Resource shortage	Signalling & OLE resources for railway-related works in particular are in short supply and may be unavailable when needed.

8. Conclusions and Recommendations

This strategic outline business case has examined the case for a Colchester Rapid Transit system focussed on serving the proposed new Garden Settlement and the Essex University Campus in East Colchester plus a park and ride side for demand from east of Colchester.

Through an option identification and development process we shortlisted four route and network options for further appraisal in consultation with members of the East Colchester Working Group. All these involve a route network to serve Colchester station, Colchester Town, the Knowledge Gateway, the University and the Garden Settlement as well as a park and ride site on the A133. They differ by the corridor chosen for achieving the connection between East Colchester and Colchester town centre:

- Option 1: alignment via East Hill/Greenstead Road;
- Option 2: Takeover of the rail corridor to Colchester Town;
- Option 3: alignment via Military Road; and
- Option 4: connection from Garden Settlement to Colchester town centre via the A120.

In general it was assumed that all options would be implemented as bus-based rapid transit systems. In addition, option 2 was appraised as a tram-based scheme.

Based on the project costing, demand forecasting and economic appraisal, Option 1 performs best in terms of affordability, Net Present Value (NPV) and Benefit/Cost Ratio (BCR). With a BCR of 1.58, this project would be classified as “medium value for money” in the DfT value for money categorisation.

However, Option 2 generates the highest benefits and largest amount of revenue. Implemented as a bus scheme, this option generates a positive NPV and a BCR above 1 (though not as positive as option 1). As a tram, the option generates significantly higher benefits and revenues but the increase is not sufficient to offset the substantial additional costs. Option 2 also has better potential for onward connections to the west.

Options 3 and 4 do not perform well.

These conclusions remain robust under most of the sensitivity tests undertaken.

Our recommendation is to continue to develop the case for the scheme based on a bus-based route network using the alignment put forward under Option 1, while exploring further how a later upgrade to Option 2 could be achieved. The need to tie in development in Marks Tey to the centre of Colchester could add justification to a strong, dedicated, east-west through corridor facilitated by Option 2. Additional development around Langham would strengthen the case for improving the bus priority corridor from the north Park and Ride site via Colchester Station to the town centre.

Appendix A. Full Appraisal Tables

A.1 Background

This appendix contains the full set of appraisal tables for the Transport Economic Efficiency (TEE) Appraisal, Public Accounts (PA) and the Analysis of Monetised Costs and Benefits (AMCB) in the standard DfT format for the five scheme options.

A.2 Option 1

Table A.1 : Transport Economic Efficiency Table

Non-business: Commuting	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£55.6		£1.4	£54.2	£0.0	£0.0
Vehicle operating costs	£1.6		£1.6			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: COMMUTING	£57.2	*(1a)*	£3.0	£54.2	£0.0	£0.0

Non-business: Other	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£60.8		£1.5	£59.3	£0.0	£0.0
Vehicle operating costs	£2.0		£2.0			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: OTHER	£62.8	*(1b)*	£3.5	£59.3	£0.0	£0.0

Business			**Goods**	**Business**	**BUS and COACH**	**RAIL**		**OTHER**
User benefits			**Vehicles**	**Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	£6.0		£0.0	£0.1	£5.9	£0.0	£0.0	£0.0
Vehicle operating costs	£0.1		£0.0	£0.1				£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
Subtotal	£6.1	*(2)*	£0.0	£0.3	£5.9	£0.0	£0.0	£0.0
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	£47.5				£47.5	£0.0	£0.0	£0.0
Operating costs	-£79.0				-£79.0	£0.0	£0.0	£0.0
Investment costs	-£51.9				-£51.9	£0.0	£0.0	£0.0
Grant/subsidy	£0.0				£0.0	£0.0	£0.0	£0.0
Subtotal	-£83.5	*(3)*			-£83.5	£0.0	£0.0	£0.0
Other business impacts								
Developer contributions	£0.0	*(4)*	£0.0		£0.0		£0.0	£0.0
NET BUSINESS IMPACT	-£77.3	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency	£42.7	*(6) = (1a) + (1b) + (5)*

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

Table A.2 : Public Accounts Table

Local Government	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Revenue	-£47		£0	-£47	£0	£0
Operating Costs	£79		£0	£79	£0	£0
Investment Costs	£52		£0	£52	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£83	*(7)*	£0	£83	£0	£0
Central Government Funding:						
Revenue	£0		£0	£0	£0	£0
Operating costs	£0		£0	£0	£0	£0
Investment Costs	£0		£0	£0	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£0	*(8)*	£0	£0	£0	£0
Central Government Funding: Non-						
Indirect Tax Revenues	£2	*(9)*	£0	£0	£2	£0
TOTALS						
Broad Transport	£83	*(10) = (7) + (8)*				
Wider Public Finances	£2	*(11) = (9)*				

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

Table A.3 : Analysis of Monetised Costs and Benefits Table

Noise	£0	*(12)*
Local Air Quality	£0	*(13)*
Greenhouse Gases	£0	*(14)*
Journey Quality	£0	*(15)*
Physical Activity	£0	*(16)*
Accidents	£8	*(17)*
Economic Efficiency: Consumer Users	£120	*(1)*
Economic Efficiency: Business Users and Providers	£6	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-£2	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	£132	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1) + (5) - (11)*
Broad Transport Budget	£83	*(10)*
Present Value of Costs (see notes) (PVC)	£83	*(PVC) = (10)*

OVERALL IMPACTS

Net Present Value (NPV)	**£48**	*NPV=PVB-PVC*
Benefit to Cost Ratio (BCR)	**1.58**	*BCR=PVB/PVC*

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

A.3 Option 2B

Table A.4 : Transport Economic Efficiency Table

Non-business: Commuting	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£59.2		£1.6	£57.6	£0.0	£0.0
Vehicle operating costs	£1.9		£1.9			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: COMMUTING	£61.0	*(1a)*	£3.5	£57.6	£0.0	£0.0

Non-business: Other	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£64.7		£1.7	£63.0	£0.0	£0.0
Vehicle operating costs	£2.3		£2.3			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: OTHER	£67.1	*(1b)*	£4.1	£63.0	£0.0	£0.0

Business			**Goods**	**Business**	**BUS and COACH**	**RAIL**		**OTHER**
User benefits			**Vehicles**	**Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	£6.4		£0.0	£0.2	£6.2	£0.0	£0.0	£0.0
Vehicle operating costs	£0.1		£0.0	£0.1				£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
Subtotal	£6.5	*(2)*	£0.0	£0.3	£6.2	£0.0	£0.0	£0.0
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	£49.5				£49.5	£0.0	£0.0	£0.0
Operating costs	-£80.7				-£80.7	£0.0	£0.0	£0.0
Investment costs	-£83.8				-£83.8	£0.0	£0.0	£0.0
Grant/subsidy	£0.0				£0.0	£0.0	£0.0	£0.0
Subtotal	-£115.0	*(3)*			-£115.0	£0.0	£0.0	£0.0
Other business impacts								
Developer contributions	£0.0	*(4)*	£0.0		£0.0		£0.0	£0.0
NET BUSINESS IMPACT	-£108.4	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency	£19.7	*(6) = (1a) + (1b) + (5)*

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

Table A.5 : Public Accounts Table

Local Government	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Revenue	-£49		£0	-£49	£0	£0
Operating Costs	£81		£0	£81	£0	£0
Investment Costs	£84		£0	£84	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£115	*(7)*	£0	£115	£0	£0
Central Government Funding:						
Revenue	£0		£0	£0	£0	£0
Operating costs	£0		£0	£0	£0	£0
Investment Costs	£0		£0	£0	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£0	*(8)*	£0	£0	£0	£0
Central Government Funding: Non-						
Indirect Tax Revenues	£3	*(9)*	£0	£0	£3	£0
TOTALS						
Broad Transport	£115	*(10) = (7) + (8)*				
Wider Public Finances	£3	*(11) = (9)*				

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

Table A.6 : Analysis of Monetised Costs and Benefits Table

Noise	£0	*(12)*
Local Air Quality	£0	*(13)*
Greenhouse Gases	£0	*(14)*
Journey Quality	£0	*(15)*
Physical Activity	£0	*(16)*
Accidents	£9	*(17)*
Economic Efficiency: Consumer Users	£128	*(1)*
Economic Efficiency: Business Users and Providers	£7	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-£3	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	£141	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1) + (5) - (11)*
Broad Transport Budget	£115	*(10)*
Present Value of Costs (see notes) (PVC)	£115	*(PVC) = (10)*

OVERALL IMPACTS

Net Present Value (NPV)	**£26**	*NPV=PVB-PVC*
Benefit to Cost Ratio (BCR)	**1.23**	*BCR=PVB/PVC*

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

A.4 Option 3

Table A.7 : Transport Economic Efficiency Table

Non-business: Commuting	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£43.0		£0.9	£42.2	£0.0	£0.0
Vehicle operating costs	£1.1		£1.1			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: COMMUTING	£44.1	*(1a)*	£2.0	£42.2	£0.0	£0.0

Non-business: Other	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£47.1		£1.0	£46.1	£0.0	£0.0
Vehicle operating costs	£1.3		£1.3			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: OTHER	£48.4	*(1b)*	£2.3	£46.1	£0.0	£0.0

Business			**Goods**	**Business**	**BUS and COACH**	**RAIL**		**OTHER**
User benefits			**Vehicles**	**Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	£4.7		£0.0	£0.1	£4.6	£0.0	£0.0	£0.0
Vehicle operating costs	£0.1		£0.0	£0.1				£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
Subtotal	£4.7	*(2)*	£0.0	£0.2	£4.6	£0.0	£0.0	£0.0
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	£34.4				£34.4	£0.0	£0.0	£0.0
Operating costs	-£90.2				-£90.2	£0.0	£0.0	£0.0
Investment costs	-£54.5				-£54.5	£0.0	£0.0	£0.0
Grant/subsidy	£0.0				£0.0	£0.0	£0.0	£0.0
Subtotal	-£110.3	*(3)*			-£110.3	£0.0	£0.0	£0.0
Other business impacts								
Developer contributions	£0.0	*(4)*	£0.0		£0.0		£0.0	£0.0
NET BUSINESS IMPACT	-£105.6	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency	-£13.1	*(6) = (1a) + (1b) + (5)*

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

Table A.8 : Public Accounts Table

Local Government	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Revenue	-£34		£0	-£34	£0	£0
Operating Costs	£90		£0	£90	£0	£0
Investment Costs	£54		£0	£55	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£110	*(7)*	£0	£110	£0	£0
Central Government Funding:						
Revenue	£0		£0	£0	£0	£0
Operating costs	£0		£0	£0	£0	£0
Investment Costs	£0		£0	£0	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£0	*(8)*	£0	£0	£0	£0
Central Government Funding: Non-						
Indirect Tax Revenues	£2	*(9)*	£0	£0	£2	£0
TOTALS						
Broad Transport	£110	*(10) = (7) + (8)*				
Wider Public Finances	£2	*(11) = (9)*				

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

Table A.9 : Analysis of Monetised Costs and Benefits Table

Noise	£0	*(12)*
Local Air Quality	£0	*(13)*
Greenhouse Gases	£0	*(14)*
Journey Quality	£0	*(15)*
Physical Activity	£0	*(16)*
Accidents	£5	*(17)*
Economic Efficiency: Consumer Users	£93	*(1)*
Economic Efficiency: Business Users and Providers	£5	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-£2	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	£101	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1) + (5) - (11)*
Broad Transport Budget	£110	*(10)*
Present Value of Costs (see notes) (PVC)	£110	*(PVC) = (10)*

OVERALL IMPACTS

Net Present Value (NPV)	**-£9**	*NPV=PVB-PVC*
Benefit to Cost Ratio (BCR)	**0.91**	*BCR=PVB/PVC*

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

A.5 Option 4

Table A.10 : Transport Economic Efficiency Table

Non-business: Commuting	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£49.7		£1.2	£48.5	£0.0	£0.0
Vehicle operating costs	£1.4		£1.4			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: COMMUTING	£51.1	*(1a)*	£2.6	£48.5	£0.0	£0.0

Non-business: Other	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£54.4		£1.3	£53.1	£0.0	£0.0
Vehicle operating costs	£1.8		£1.8			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: OTHER	£56.2	*(1b)*	£3.1	£53.1	£0.0	£0.0

Business			**Goods**	**Business**	**BUS and COACH**	**RAIL**		**OTHER**
User benefits			**Vehicles**	**Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	£5.4		£0.0	£0.1	£5.2	£0.0	£0.0	£0.0
Vehicle operating costs	£0.1		£0.0	£0.1				£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
Subtotal	£5.5	*(2)*	£0.0	£0.2	£5.2	£0.0	£0.0	£0.0
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	£41.3				£41.3	£0.0	£0.0	£0.0
Operating costs	-£93.7				-£93.7	£0.0	£0.0	£0.0
Investment costs	-£65.0				-£65.0	£0.0	£0.0	£0.0
Grant/subsidy	£0.0				£0.0	£0.0	£0.0	£0.0
Subtotal	-£117.4	*(3)*			-£117.4	£0.0	£0.0	£0.0
Other business impacts								
Developer contributions	£0.0	*(4)*	£0.0		£0.0		£0.0	£0.0
NET BUSINESS IMPACT	-£111.9	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency	-£4.6	*(6) = (1a) + (1b) + (5)*

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

Table A.11 : Public Accounts Table

Local Government	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Revenue	-£41		£0	-£41	£0	£0
Operating Costs	£94		£0	£94	£0	£0
Investment Costs	£65		£0	£65	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£117	*(7)*	£0	£117	£0	£0
Central Government Funding:						
Revenue	£0		£0	£0	£0	£0
Operating costs	£0		£0	£0	£0	£0
Investment Costs	£0		£0	£0	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£0	*(8)*	£0	£0	£0	£0
Central Government Funding: Non-						
Indirect Tax Revenues	£2	*(9)*	£0	£0	£2	£0
TOTALS						
Broad Transport	£117	*(10) = (7) + (8)*				
Wider Public Finances	£2	*(11) = (9)*				

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

Table A.12 : Analysis of Monetised Costs and Benefits Table

Noise	£0	*(12)*
Local Air Quality	£0	*(13)*
Greenhouse Gases	£0	*(14)*
Journey Quality	£0	*(15)*
Physical Activity	£0	*(16)*
Accidents	£7	*(17)*
Economic Efficiency: Consumer Users	£107	*(1)*
Economic Efficiency: Business Users and Providers	£5	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-£2	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	£118	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1) + (5) - (11)*
Broad Transport Budget	£117	*(10)*
Present Value of Costs (see notes) (PVC)	£117	*(PVC) = (10)*

OVERALL IMPACTS

Net Present Value (NPV)	**£0**	*NPV=PVB-PVC*
Benefit to Cost Ratio (BCR)	**1.00**	*BCR=PVB/PVC*

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

A.6 Option 2T

Table A.13 : Transport Economic Efficiency Table

Non-business: Commuting	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£95.9		£3.3	£92.6	£0.0	£0.0
Vehicle operating costs	£3.9		£3.9			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: COMMUTING	£99.8	*(1a)*	£7.2	£92.6	£0.0	£0.0

Non-business: Other	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	£104.9		£3.6	£101.3	£0.0	£0.0
Vehicle operating costs	£4.8		£4.8			£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0
NET NON-BUSINESS BENEFITS: OTHER	£109.7	*(1b)*	£8.4	£101.3	£0.0	£0.0

Business			**Goods**	**Business**	**BUS and COACH**	**RAIL**		**OTHER**
User benefits			**Vehicles**	**Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	£10.4		£0.0	£0.4	£10.0	£0.0	£0.0	£0.0
Vehicle operating costs	£0.3		£0.0	£0.3				£0.0
User charges	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
During Construction & Maintenance	£0.0		£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
Subtotal	£10.6	*(2)*	£0.0	£0.6	£10.0	£0.0	£0.0	£0.0
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	£92.4				£92.4	£0.0	£0.0	£0.0
Operating costs	-£238.3				-£238.3	£0.0	£0.0	£0.0
Investment costs	-£287.3				-£287.3	£0.0	£0.0	£0.0
Grant/subsidy	£0.0				£0.0	£0.0	£0.0	£0.0
Subtotal	-£433.2	*(3)*			-£433.2	£0.0	£0.0	£0.0
Other business impacts								
Developer contributions	£0.0	*(4)*	£0.0		£0.0		£0.0	£0.0
NET BUSINESS IMPACT	-£422.6	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency	-£213.1	*(6) = (1a) + (1b) + (5)*

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

Table A.14 : Public Accounts Table

Local Government	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Revenue	-£92		£0	-£92	£0	£0
Operating Costs	£238		£0	£238	£0	£0
Investment Costs	£287		£0	£287	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£433	*(7)*	£0	£433	£0	£0
Central Government Funding:						
Revenue	£0		£0	£0	£0	£0
Operating costs	£0		£0	£0	£0	£0
Investment Costs	£0		£0	£0	£0	£0
Developer and Other	£0		£0	£0	£0	£0
Grant/Subsidy	£0		£0	£0	£0	£0
NET IMPACT	£0	*(8)*	£0	£0	£0	£0
Central Government Funding: Non-						
Indirect Tax Revenues	£6	*(9)*	£0	£0	£6	£0
TOTALS						
Broad Transport	£433	*(10) = (7) + (8)*				
Wider Public Finances	£6	*(11) = (9)*				

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

Table A.15 : Analysis of Monetised Costs and Benefits Table

Noise	£0	*(12)*
Local Air Quality	£0	*(13)*
Greenhouse Gases	£0	*(14)*
Journey Quality	£0	*(15)*
Physical Activity	£0	*(16)*
Accidents	£19	*(17)*
Economic Efficiency: Consumer Users	£210	*(1)*
Economic Efficiency: Business Users and Providers	£11	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-£6	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	£234	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1) + (5) - (11)*
Broad Transport Budget	£433	*(10)*
Present Value of Costs (see notes) (PVC)	£433	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	**-£199**	*NPV=PVB-PVC*
Benefit to Cost Ratio (BCR)	**0.54**	*BCR=PVB/PVC*

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

Appendix B. Bibliography

Rail Station at Essex University, Final Report, SDG, February 2001

East Colchester Rapid Transit Link Feasibility, Role of Colchester Town rail link in East, Colchester Transit Corridor, Mouchel, May 2009

East Colchester Rapid Transit Link Feasibility, Background Information, Mouchel, May 2009

East Colchester Rapid Transport Link Feasibility, Existing Routes, Audit and Opportunities to improve bus Operations, Mouchel, November 2009

East Colchester Rapid Transit Link, Investigation of the requirements of placing a bus facility adjacent to the existing Colchester Town rail spur, Mouchel, January 2010

East Colchester, Rapid Transport Link Feasibility, Preliminary Engineering Investigation, Mouchel, January 2010

Draft - East Colchester Rapid Transit Paper, Colchester Borough Council, January 2015

Local Development Framework Core Strategy Adopted December 2008 Selected policies revised July 2014 Colchester Borough Council, July 2014

Essex Transport Strategy: The Local Transport Plan for Essex, Essex County Council, June 2011

Value for Money Assessment: Advice Note for Local Transport Decision Makers, DfT, December 2013