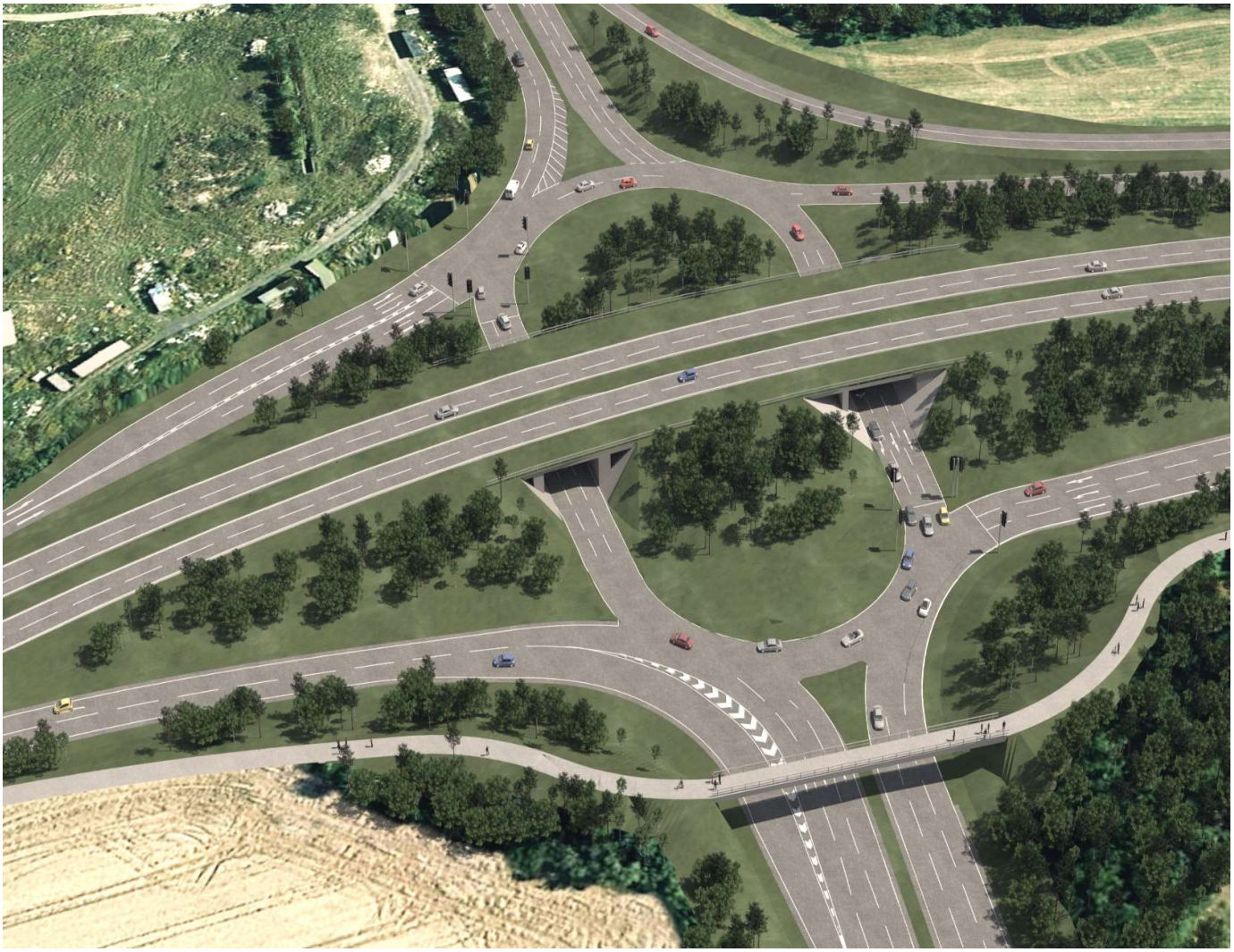
Essex Highways

A127/A130 Fairglen Interchange

DRAFT Full Business Case

September 2020



RINGWAY JACOBS

Essex County Council

Document Control Sheet

Document prepared by:

Essex Highways
Victoria House
Chelmsford
CM1 1JR

T
E
W www.essex.gov.uk/highways

Report Title	**DRAFT Full Business Case**
Project Number	**B3553T26**
Status	**Draft**
Revision	**1.4**
Control Date	**September 2020**

Record of Issue

Issue	Status	Author	Date	Check	Date	Review	Date
01	Draft	SU	16/06/2020	MS	18/06/2020	SD	22/06/2020
1.4	Draft	SU	01/09/2020	MS	02/06/2020	SD	02/09/2020

Approved for Issue By	Date
GI	04/09/2020

Distribution

Organisation	Contact	Number of Copies

(Left blank intentionally)

Contents

1 Introduction 6
1.1 Background 6
1.2 Purpose of This Document 7
1.3 Document Structure 8
2 Strategic Case 9
2.1 Introduction 9
2.2 Fairglen Interchange 9
2.3 Economic Context 11
2.4 Current Road Operations 16
2.5 Future Demand on Fairglen Junction 21
2.6 Problem Identification 25
2.7 Scheme Objectives 29
2.8 Scheme Options 29
3 Economic Case 36
3.1 Summary of Findings 36
3.2 Overview of Option Appraisal Approach 37
3.3 Demand Scenarios 41
3.4 Overview of Benefits Estimation 43
3.5 Transport Economic Efficiency Benefits 44
3.6 Construction Delays 53
3.7 Accident Benefits 53
3.8 Greenhouse Gas Emissions, Noise and Air Quality Benefits 57
3.9 Journey Time Reliability Benefits 59
3.10 Wider Economic Impacts 62
3.11 Maintenance delays 62
3.12 Changes in Indirect Taxes 63
3.13 Non-Monetised Impacts 63
3.14 Costs 65
3.15 Investment Costs 66

3.16 Maintenance costs 68
3.17 Present value of costs 69
3.18 Public Accounts (PA) table 69
3.19 Value for Money Assessment 70
3.20 Sensitivity Tests 72
3.21 Summary 75
4 Financial Case 77
4.1 Introduction 77
4.2 Key Financial Assumptions 77
4.3 Capital costs 78
4.4 Maintenance costs 78
4.5 Quantified Risk Assessment 79
4.6 Expenditure Profile 80
4.7 Funding Arrangements 80
5 Commercial case 82
5.1 Purpose 82
5.2 Services to be procured 82
5.3 Procurement Strategy 83
5.4 Tender Evaluation Process 84
5.5 Phasing of Implementation Works 86
5.6 Contractual Arrangements 86
5.7 Payment Approach and Mechanisms 87
5.8 Contract Management 88
5.9 Contract Length 88
5.10 Risk Management 88
6 Management Case 90
6.1 Purpose 90
6.2 Project Dependencies 90
6.3 Project Governance Structure and Reporting 90
6.4 Project Reporting 94
6.5 Project Plan 95

6.6 Risk Management Strategy 96
6.7 Monitoring and Evaluation 96
6.8 Benefits Realisation Plan 100
6.9 Evidence of successful project delivery 101
7 Appendix A – Risk Register 104
8 Appendix B – Appraisal Summary Table 105

1 Introduction

1.1 Background

In 2012, Ringway Jacobs was appointed as strategic partner to Essex County Council (ECC) to maintain the county's 5,000-mile road network. Through this integrated service contract, Jacobs have been commissioned by Essex Highways to develop a full business case for the A127 / A130 Fairglen Interchange in support of the South East Local Enterprise Partnerships (SELEP) Strategic Economic Plan (SEP). For the purposes of this report, the proposals at the A127 / A130 Fairglen Interchange are referred to collectively as the 'scheme'.

The scheme has been prioritised as a location which can be upgraded to improve movement through the A127 and A130 corridors. The scheme is located close to the boundary of five local authorities (Basildon Borough Council, Castle Point Borough Council, Rochford District Council, Thurrock Council, and Southend-on-Sea) and therefore plays an important role to support housing and job growth in these areas, and the wider growth across the county in the A127 and A130 corridors.

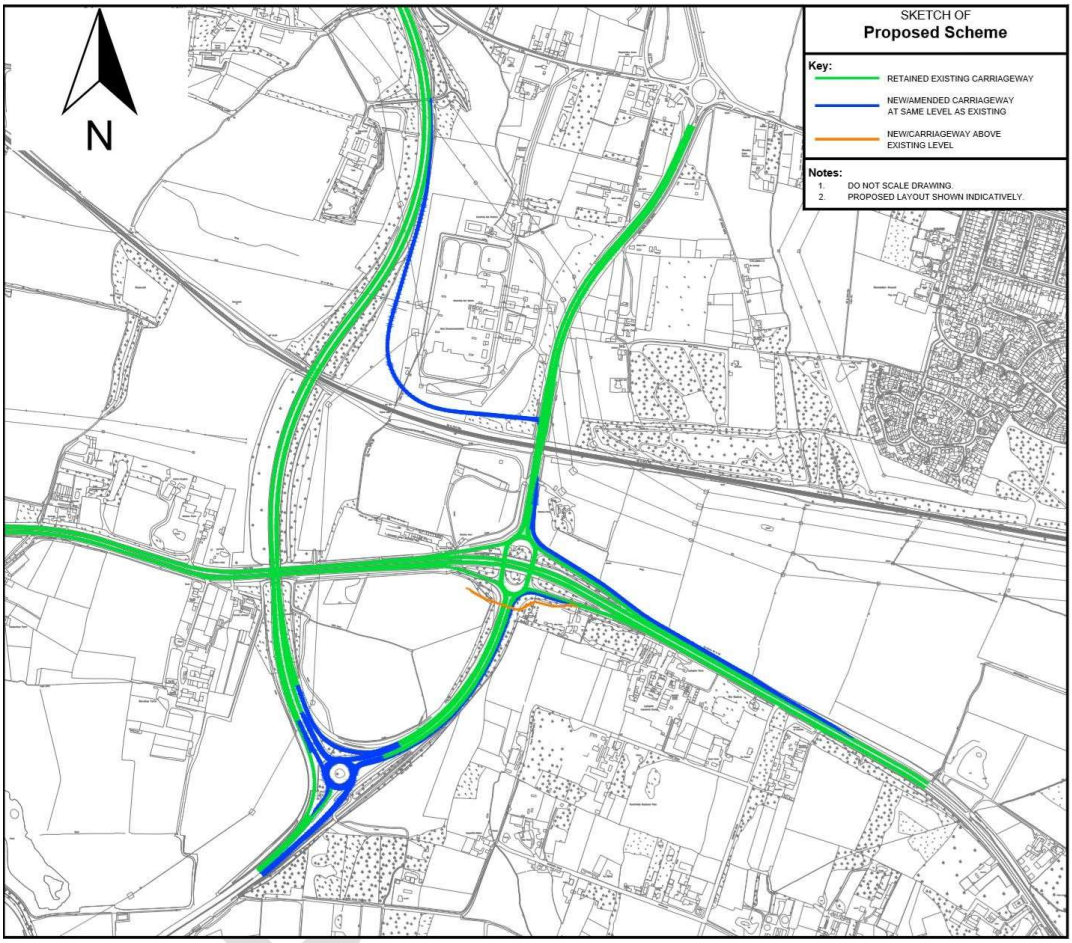
Essex Highways investigated the underlying reasons for congestion in the area of the Fairglen Interchange and developed, assessed and costed the potential options to improve conditions in the study area. Following the option assessment exercise, Option S3 along with value engineering measures has been selected as the preferred option and further developed and assessed as part of the full business case submission to the Department for Transport (DfT).

The proposed scheme (as shown in Figure 1) is designed to increase the capacity of the Fairglen Interchange, reduce travel times, address existing safety concerns and improve pedestrian and cycling connectivity. It involves:

- Constructing a new one-way 'Southend Link Road' north of the railway line, connecting the A130 southbound with a signalised junction on the A1245, which is restricted to right-turn movements.
- Widening the A127 Westbound diverge slip road onto Fairglen Roundabout.
- Constructing additional and longer slip lanes on the A127 Eastbound on slip.
- Providing a third lane southbound between Fairglen Roundabout and Raleigh Spur Roundabout
- Improving the Rayleigh Spur Roundabout, including signal control.
- Removal of the existing bypass lane at Rayleigh Spur Roundabout.

- Constructing a new bridge for pedestrians and cyclists to the south of Fairglen Roundabout.
- Improving the geometric design of the Interchange generally, providing improved lines of sight and visibility for motorists.
- Updating signage and speed limits.

Figure 1: Proposed Scheme



1.2 Purpose of This Document

This document represents the Full Business Case (FBC) for the Fairglen Interchange preferred option. This FBC has been developed in line with Department for Transport's (DfT) Transport Business Case guidance to establish whether the preferred option is:

- Supported by a robust case for change that fits with wider policy objectives (**the Strategic Case**);
- Demonstrates value for money (the **Economic Case**);
- Financially affordable (the **Financial Case** – accounting analysis);
- Commercially viable (the **Commercial Case** – procurement issues); and
- Achievable (the **Management Case** – deliverability assessment).

1.3 Document Structure

The rest of this document is structured as follows:

- Chapter 2: Strategic Case
- Chapter 3: Economic Case
- Chapter 4: Financial Case
- Chapter 5: Commercial Case
- Chapter 6: Management Case

2 Strategic Case

2.1 Introduction

This Strategic Case demonstrates the case for change by presenting a clear rationale for making an investment against the backdrop of local, regional and national policy objectives. In doing so, the strategic case determines the need for investment, making explicit the challenges and issues for the project, and provides evidence of how various options have been sifted and distilled to a preferred scheme.

2.2 Fairglen Interchange

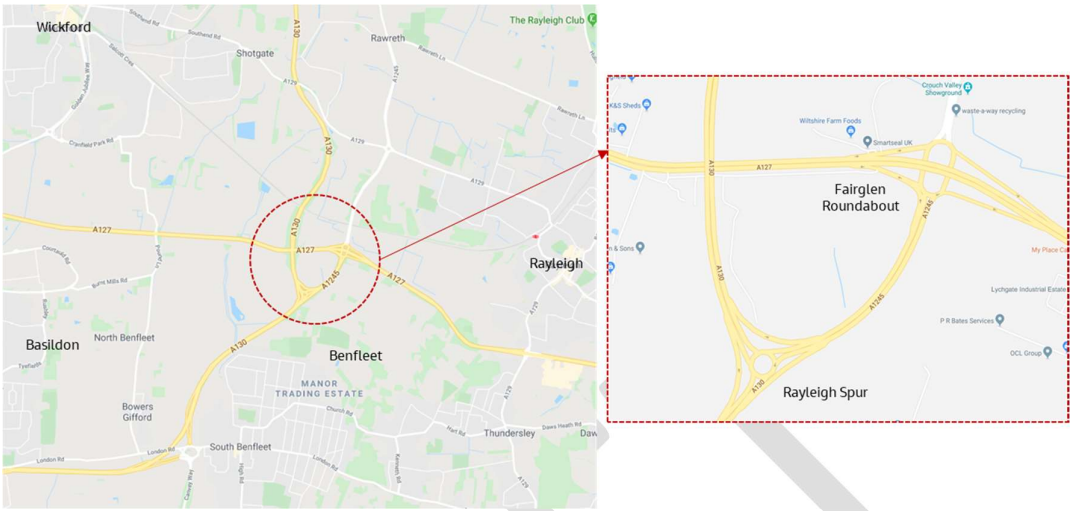
The A127/A130 Fairglen Interchange lies towards the southern part of Essex, within the administrative areas of Basildon Borough Council, Castle Point Borough Council, Rochford District Council, Thurrock and Southend-on-Sea. The interchange is a key link in the strategic highway network for South Essex. The interchange is made up of two main elements - Fairglen Roundabout and Rayleigh Spur Roundabout. The A1245 intersects the A127 at Fairglen Roundabout while the A130 intersects the A1245 at Rayleigh Spur Roundabout. Both of the roundabouts are connected via the A1245/A130 link (Figure 2).

The A127 is an east-west dual carriageway linking Southend, Basildon, the M25 and Romford, and merges with the A12 into East London (Figure 2). Approximately 15 miles of the A127 is within the ECC boundary, from Southend-on-Sea to the M25 Cranham Interchange.

The A1245 intersects the A127 at a grade-separated junction, known as the Fairglen Roundabout. South of this junction is Rayleigh Spur Roundabout, a three arm at-grade roundabout. Rayleigh Spur Roundabout is connected to Fairglen Roundabout via the A1245/A130 Link. The other arms of the Rayleigh Spur Roundabout are the A130 dual carriageway to and from the A12 and Chelmsford, and the A130 heading to and from the A13, via Sadlers Farm (Figure 2).

Fairglen Interchange is the collective name for both these junctions, and forms a strategic connection between the A13, A127, A130 and A1245 Priority Route 1 roads in southern Essex. It is a South East Local Enterprise Partnership (SELEP) funded scheme, retained by the DfT.

Figure 2: Fairglen Interchange



The function of the Fairglen interchange can be considered in a national, regional, and local context. The A127 and A130 provide connections to national infrastructure, including Stansted and Southend Airports, the M25 and A12. Regionally the A127 and A130 connect urban settlements including: Southend, Basildon, Rayleigh, Chelmsford, and Grays (via the A13). Locally, traffic travelling between Wickford, Basildon, Rayleigh, and South Benfleet can use the Fairglen interchange. A summary of the functions, which result in significant traffic volumes using the interchange, are shown below in Table 1.

Table 1: Fairglen Interchange Functions

The Fairglen interchange…	
National	• Provides part of the strategic connection to Stansted and Southend Airports. • Connects to Highways England's Trunk Road Network between London, the South East and the East of England (M25 and A12).
Regional	• Links the major regional centres along the route. • Provides for the distribution of goods and services. • Provides access to holiday destinations within the region.
Local	• A route for connecting local settlements. • Is used by commuters on a daily basis.

A capacity improvement scheme was implemented at Fairglen Roundabout in 2009, providing a segregated left turn only lane for northbound vehicles from the A1245 / A130 Rayleigh Spur Roundabout onto the London-bound A127 slip road. Rayleigh Spur Roundabout remains as built in 2002. Nevertheless, the Interchange routinely experiences traffic congestion at peak times and has unacceptably high rates of collision and incidents.

In 2014, the ECC and Southend Borough Council (SBC) co-authored a paper which emphasized the importance of the A127 corridor to growth and financial wellbeing in South Essex. The paper acknowledged that the scheme is a priority in the period to 2020, and that there were wider issues beyond traffic congestion in this location e.g. flooding (the interchange has reported instances of being completely flooded in recent years) and embankment failures.

The importance of the A127 corridor and the Priority Route 1 network in the economic growth of south Essex is also discussed in the ECC Key Corporate Outcomes Framework 2014-2018, and the ECC Vision for Essex 2013-2017. This has highlighted that the scheme is critical to both the short and long-term economic prospects of the area.

The current local transport plan (LTP3) acknowledges that there is forecast to be substantial housing and job growth in the corridor[1]. Of particular note are the expansion of Southend Airport and neighbouring Southend and Rochford Joint Area Action Plan (JAAP) for Saxon Business Park, which will increase travel demand in the A127 corridor.

This report sets out a clear rationale for the scheme, the need for investment in this area, and the intervention options under consideration.

2.3 Economic Context

The A127 corridor has a prosperous economy. Basildon is home to one of the largest single concentrations of advanced manufacturing in the south of England, making a significant contribution to the prosperity of the area. Southend Airport has scheduled air services to destinations throughout Europe, and the neighbouring business park is attractive to global companies.

[1] https://www.essexhighways.org/uploads/docs/essex_ltp.pdf

2.3.1 Enterprise and employment

Overall rates of economic activity in the SELEP area are above the national rates, but below those for the wider South East. Employment rates show a similar pattern. Moreover, London's employers rely on 273,000 residents from the SELEP area each day.

There are 344,300 businesses in the SELEP area which equates to approximately 86 firms per 1,000 residents, compared with 82 for England. Self-employment is also above the national average in the SELEP area (11.0% compared to 9.8% for England). The SELEP area has an above average proportion of registered micro-enterprises.

As of 2019 there are 28,060 businesses in the TGSE (Basildon, Castle Point, Rochford, Southend and Thurrock) area which has an above average proportion of micro-enterprises at 81% in 2019. The A127 corridor is of economic importance to the businesses in the area, particularly to smaller enterprises which rely strongly on roads for the operation of their business, with 72%[2] saying their car is crucial to their business. Poor infrastructure that cause delays due to congestion reduces the productivity of small enterprises and significantly hampers their growth.

The town of Basildon is an economic centre in the area, it is the largest employment centre in the TGSE area and is home to Basildon Enterprise Corridor, the largest concentration of employment in Essex. The A127 and Fairglen Interchange are crucial networks for Basildon and as well as the Enterprise corridor which plays host to major international businesses such as Ford, SELEX Galileo, New Holland Agriculture and a growing concentration of advanced engineering SMEs.

Notable investments are foreseen for the region's future development. This includes growth in the Basildon and Southend towns centres, the new Saxon business parks adjacent to London Southend airport, which will also be the home to the new Anglia Ruskin's MedTech campus. Infrastructure connections play a vital role in the Life Sciences (LS) sector. The LS sector is one defined by a high-level of productivity and disruption caused by congestion and poor infrastructure can have a significant impact. Infrastructure quality is therefore of high importance for the development of a LS cluster. These developments will result in higher traffic flows thus adding more pressure to the A127. A report published

[2] https://www.politics.co.uk/opinion-formers/federation-of-small-businesses/article/fsb-accelerating-infrastructure-investment-welcomed-as-poor

by SELEP, finds businesses and communities in the region are already concerned with the lack of investment in national road networks as it translates into additional costs arising from congestion.

However, economic activity is not evenly spread across the SELEP area. Unemployment tends to be higher in more peripheral parts of the LEP, particularly in the coastal communities, and some other areas. Improvements to the corridor are therefore important to maintain economic investment, and support growth in new and existing economic centres, including Basildon and Southend Airport.

Businesses and communities within SELEP are impacted by delay to vehicles using the national road network, resulting in additional costs arising from congestion. Heavy congestion and delays impede the movement of local traffic across the Thames Gateway, and increase pressure on the surrounding road network, particularly the M25, A13, A127 and A2. The scheme should aim to address several issues at the local and regional level, including increased business efficiency through more reliable journey times, and facilitate economic growth through new housing and job creation in the A127 and A130 corridors.

2.3.2 Population, housing and tourism

Population

The A127 provides the main road commuter link from the Southend and Basildon areas to London, with roughly 17%[3] in 2014 of people living in Essex commuting to London. This number will only rise as population growth is forecasted to grow in the coming years. The five of the largest councils in the South Essex area (Basildon, Castle Point, Rochford, Southend and Thurrock) are home to 650,000 people[4].

The population growth rate in the TSGE area has been trending upwards and in the most recent two years of data the rates have been higher than the average population growth in the UK. The growth rate in the study area has stayed above 1% over the last few years and is projected to grow above the UK average in the foreseeable future. Population growth in the study area is robust and shows signs of recent strengthening and consolidation against the national trend. This is likely to lead to increased background demand, due to a strong working age population (19-64) years, for road travel which will put increased pressure on the existing

[3] https://londondatastore-upload.s3.amazonaws.com/Zho%3Dttw-flows.pdf
[4] file:///C:/Users/ji073844/Downloads/SHMA_update_2010.pdf

services and increase the number of people who would benefit from the improved interchange.

The A127 corridor makes a substantial contribution to the SELEP area and offers considerable growth prospects. The success of the region attracts a large demand for new homes and jobs, which would generate traffic that would use the Fairglen Interchange. The level of growth forecast by 2031 in the emerging local plans of Castle Point, Basildon, Rochford, and Southend is approximately 26,000 homes and 25,400 jobs. Increasing road capacity in this corridor has been identified in the SEP as critical to the facilitation of the creation of jobs and homes in this area.

Housing

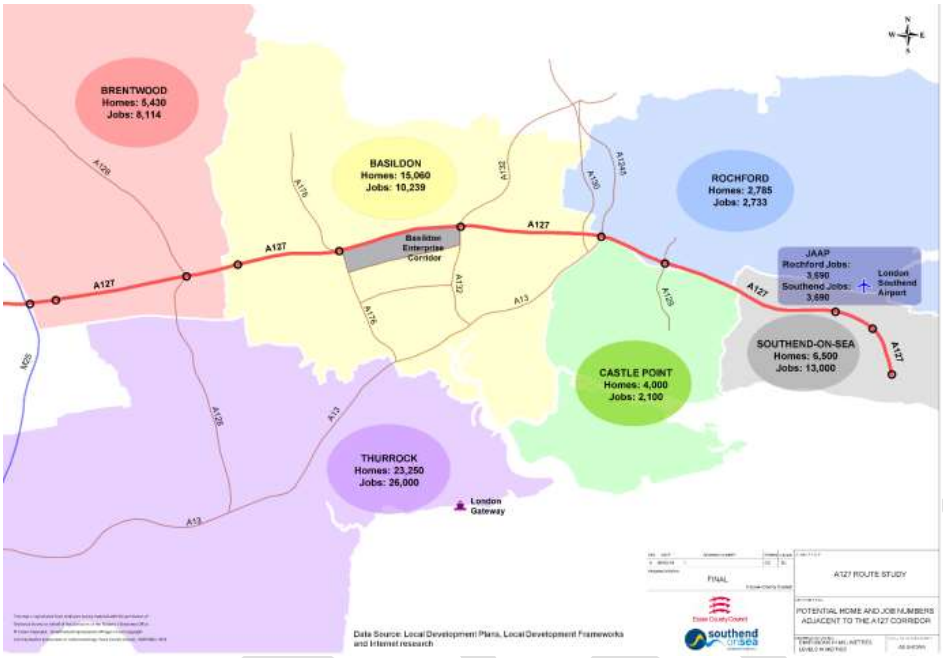
Good road networks are an important aspect of an area's desirability and the disparity along the corridor indicates that people consider the areas covered by different local authorities as very different places. Decreasing congestion and improving connectivity should reduce the disparity as people are able to travel between areas more easily. This spreads the positive effect of a desirable location along the transport corridors that extend from it. This is most obviously seen on the major commuting corridors into London where house prices have risen quickly due to the proximity to London.

Furthermore, South Essex is set to create an additional 62,000 jobs by 2037, that will require the construction of 3,400 new homes per year to accommodate the growth in workforce[5] (Figure 3). This will add to the number of people using the interchange, increasing the overall congestion level.

As the economies in the TGSE region grow there is a real opportunity to spread benefits along the full length of the A127 corridor, making the whole area a more desirable place to live. If this economic growth can be supported by the improvement of the A127 interchange it will accelerate the spread of benefits as well as supporting the economic growth as the larger economic centres gain better access to labour markets and businesses benefit from agglomerative effects.

[5] https://www.essexhighways.org/highway-schemes-and-developments/highway-schemes/a127-a130-fairglen-interchange.aspx

Figure 3: Prospective homes and jobs in the TSGE area



Source: Essex County Council – A127 / A130 Fairglen Interchange

Tourism

The A127 is a major corridor used to access Southend and the sea front, which makes it a key asset to enabling the mobility of tourism. The TGSE region has seen a decline in the number of tourism related trips in 2018, apart from Southend and Rochford (Table 2). Southend attracted seven million[6] tourists in 2019, which directly and indirectly employs nearly 8,000 people. Although congestion may not be the sole reason for the decline in tourist trips, it does reduce the willingness to travel especially for short weekend trips.

Southend Airport has scheduled air services to destinations throughout Europe, and the neighbouring business park is attractive to global companies. Additional traffic growth will eventuate as a result of the expansion of airport capacity in the region. Phase 2 of the terminal development at Southend Airport is forecast to accommodate 2 million passengers per year by 2020, which is an increase of

[6] https://localplan.southend.gov.uk/sites/localplan.southend/files/2019-02/South%20East%20Essex%20Strategic%20Growth%20Locations%20Assessment%202019.pdf

900,000 passengers compared to the 1.1 million passengers per year using the airport in 2013.

Table 2: Total tourism to TSGE region[7]

Total Tourism Trips to TGSE Region	2006 - 2008	2014 - 2016	% Change
Southend	213,000	249,000	+17%
Basildon	153,000	112,000	-27%
Thurrock	111,000	54,000	-52%
Rochford	28,000	39,000	+38%
Castle Point	21,000	17,000	-17%

The measures proposed at the Fairglen Interchange present an opportunity to promote better connectivity across the area that will enable people to reap the benefits of future growth and improve access to employment, education, leisure and tourism opportunities. This scheme aims to address several issues at the local and regional level, including increased business efficiency through more reliable journey time, and facilitate economic growth through new housing and job creation in the A127 and A130 corridors.

2.4 Current Road Operations

The Interchange is mainly used by traffic heading to/from the east, Southend and London Southend Airport, in addition to other traffic from Canvey Island, Basildon, Rochford, Thurrock and Brentwood. As stated in previous sections the interchange is used for many reasons such as commuting, leisure, business and retail trips, and there are also seasonal trips made to and from Southend for tourism.

Current traffic flow data shows that the A130 arm from the north has reached its maximum capacity while all other arms on the Rayleigh Spur and Fairglen Roundabouts are nearing their maximum capacity. The highest traffic flows are experienced on the A127 westbound towards London during the morning peak period (7.15am to 8.15am) with 8,014 vehicles daily (AADT). There are also high flows on the A130 travelling towards Southend. This results in higher congestion along the A1245 / A130 link, which connects the two roundabouts at the A127 / A130 Fairglen Interchange.

[7] GB Tourism Survey

The Fairglen Interchange is vital to ensuring the free flow of traffic on the A127, and any incidents at the junction have knock-off effects on neighbouring road networks and result in further disruption along the A127. Currently, South Essex businesses and communities are impacted by delay to vehicles using the national road network, including the A127, resulting in additional costs arising from congestion. Further, heavy congestion and delays impede the movement of local traffic across the Thames Gateway, and increase pressure on the surrounding road network, particularly the M25, A13, A127 and A12.

Moreover, the A127 has been designated as a PR1 Strategic Route, hence any asset failure along its course has a significant impact on the local economy. Both the ECC and Southend authorities have stated that one of their major aims is to improve journey time reliability along this route. The report further argues that the proposed growth in the area is contingent upon addressing the reliability and capacity issues within the A127 corridor, hence the investments proposed in this scheme are vital.

The A127 is an ageing corridor but nevertheless a vital one. From the Fairglen Interchange to the east of Basildon, the A127 is the main corridor for traffic travelling west/east to and from Southend. The scheme needs to address several issues at the local and regional level, including increased business efficiency through more reliable journey time, and facilitate economic growth through new housing and job creation in the A127 and A130 corridors.

The analysis undertaken as part of the OAR confirmed that without intervention the current road network at the Fairglen Interchange will be put under increasing pressure, leading to increased congestion and poor connectivity that ultimately will have a negative impact on the local economy, society, and environment. This would culminate in a poorer standard of living for residents and a reduction in economic competitiveness of businesses located in the A127 and A130 corridors.

Age profile of residents

Annual mid-year population estimates for mid-2019 were published by the Office for National Statistics (ONS) in May 2020. Table 3 shows population breakdown by age for the local authorities surrounding the Fairglen Interchange. It shows that the percentage of people at working age (16 to 64 years old) is equal to or less than the UK average.

Table 3: Age distribution in local authorities in vicinity of Fairglen Interchange

	Age 0-15 years (%)	Working age 16 to 64 (%)	Age 65+ (%)
Basildon	19.6%	60.9%	19.5%
Castle Point	23.3%	62.9%	13.8%
Rochford	19.0%	60.4%	20.7%
Southend-on-Sea	21.1%	61.7%	17.2%
Thurrock	17.1%	57.5%	25.4%
Essex	17.3%	59.5%	23.2%
UK	19.0%	62.5%	18.5%

Car ownership of residents

Car ownership data (2011 Census) has also been analysed. This shows that between 14% and 28% of households in Basildon, Castle Point, Rochford, Southend-on-Sea, and Thurrock have no car or van. Therefore, the majority of households do have access to at least one car or van, which suggests that car usage is likely to be high in this area.

Travel to work commuting

The commuting patterns for all modes of transport show that the towns on the A13, A130 and A127 corridors are both the origin and destination of commuting journeys, indicating that there is a significant amount of internal travel within south Essex on these roads. Unsurprisingly, given its proximity to London, London is also a key destination for commuters, although the majority of people travelling to London choose to travel by train.

Current traffic volumes

The Fairglen Interchange is located on the boundary of three local authorities and connects locally and regionally important roads: the A130, A127, and A1245.

The AM and PM peak period traffic movements through the interchange were surveyed using automatic number plate recognition (ANPR) on a weekday in March 2016. This data was used to model a 2016 base year to estimate the number of vehicles using the interchange. The AM and PM peak period modelled flows are shown in Figure 4 and Figure 5 respectively.

This shows that the movements with the highest traffic flows are those on the A127. The other movements which are significant (in the context of this

interchange) are the one-way movements on the A130, and the one-way movements between the A130 and the A127 (east).

Figure 4: Traffic movements through Fairglen Interchange (AM peak period, 7am to 10am)

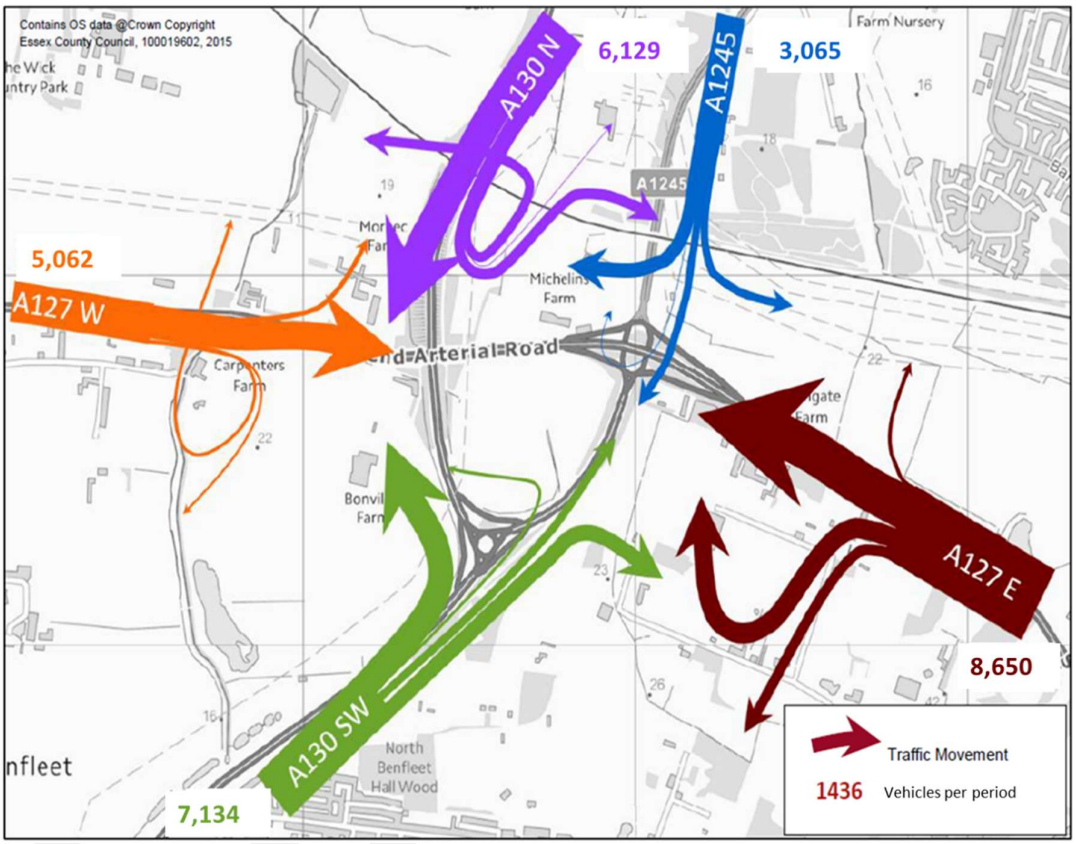
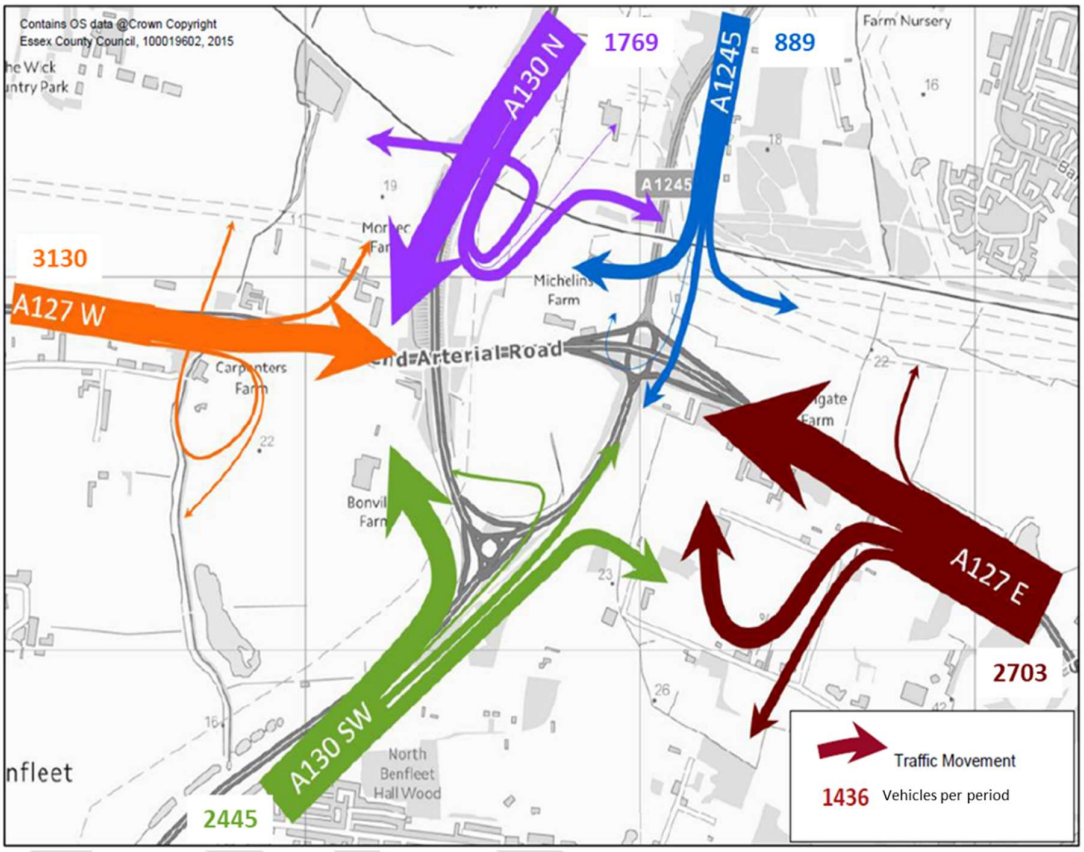


Figure 5: Traffic movements through Fairglen Interchange (PM peak period, 4pm to 7pm)



Road accidents

A collision investigation and prevention study (CIP) was undertaken in July 2015 for the road network including and surrounding the Fairglen Interchange. This identified 32 collisions that resulted in injury at the Fairglen Roundabout and 18 at the Rayleigh Spur Roundabout. The average number of collisions at the Fairglen Roundabout is higher than the national average for a typical four arm grade separated roundabout[8].

The data also shows a high proportion of rear end collisions at the Fairglen Roundabout, on approaches and slip roads. The vehicle collisions at Rayleigh Spur Roundabout seem to be due to loss of control, possibly caused by poor

[8] https://www.southeastlep.com/app/uploads/2019/01/Fairglen-Link-Road-and-Slip-Road-Business-Case-.pdf

visual alignment on approaches. It is reasonable to infer that unmitigated growth in traffic at this location would exacerbate existing safety concerns.

2.5 Future Demand on Fairglen Junction

The Fairglen Interchange project is identified by the SELEP SEP as a scheme within the wider Thames Gateway and A127 corridor, including amongst others an A127 route management strategy, and Joint Area Action Plan scheme for the Kent Elms junction.

The existing function of the corridor will remain and may become more strategically important for north-south movement as a result of investment schemes in the immediate vicinity of the junction and those further afield.

2.5.1 Schemes in close proximity

Crossrail at Shenfield

Shenfield Train Station is situated approximately 10 miles north-west of the Fairglen Interchange and is accessible from both Rayleigh and Wickford Train Stations. This is undergoing changes to facilitate Crossrail, with the full service due to be operational in 2019. The potential impact on Fairglen interchange from Crossrail at Shenfield is not anticipated to be substantial, given that the new trains will not provide a much quicker journey than TfL Rail does at present, and the Great Eastern Main Line services to and from Shenfield, Billericay and Wickford will continue as they do today.

A12 route investment

There are proposals being progressed by Highways England to upgrade the A12 corridor, including road widening, junction upgrades, and technology improvements. It is envisaged that this would provide additional capacity and improve journey time reliability in the A12 corridor.

A127 speed limit reduction

A permanent reduction in speed limit from 70mph to 50mph along the A127 between near Noak Bridge Junction to A127/Pound Lane Junction has been introduced and is being enforced by average speed camera technology. Currently there is a 40mph speed limit on the east and west approaches to Fortune of War Roundabout.

A127 Pound Lane / Cranfield Park Road junction

The Emerging Draft New Local Plan for Basildon Borough Council describes proposals for a new grade separated junction situated approximately halfway between the Nevendon and Fairglen Interchanges, at the current junction of the A127 Westbound at Pound Lane and Cranfield Park Road on the eastbound carriageway. This junction would serve the development proposed at East Basildon and South Wickford and could reduce pressure at the A132 Nevendon Interchange. A new link road from the new grade separated junction to the A130 could reduce some movements at the Fairglen Interchange.

South East Local Enterprise Partnership (SELEP)

The South East Local Enterprise Partnership is the largest in England outside London: local authorities involved are Essex, Southend, Thurrock, Kent, Medway and East Sussex. The South East LEP (SELEP) will inject almost half a billion pounds worth of Government investment into the area through its Growth Deal. The Deal has seen at least £84.1 million invested in the SELEP area in 2015-16, supporting the delivery of up to 35,000 jobs and 18,000 new homes and over £100m in private investment over the period to 2021[9]. The SELEP growth plan will also benefit the councils of the TGSE area.

Basildon's Town Centre Regeneration

Basildon's Town Centre regeneration is one of the many initiatives that would drive the forecasted growth and, due to its proximity, directly impact on benefits from improvements at the Fairglen Interchange. Basildon Borough Council has secured £9.7 million from the Housing Infrastructure Fund (HIF) to enable and support housing development within the town centre. Key projects identified include the redevelopment of the former Post Office Block for mixed use development, increases in car park capacity and public realm improvements.

2.5.2 Schemes within the wider catchment area

Lower Thames Crossing

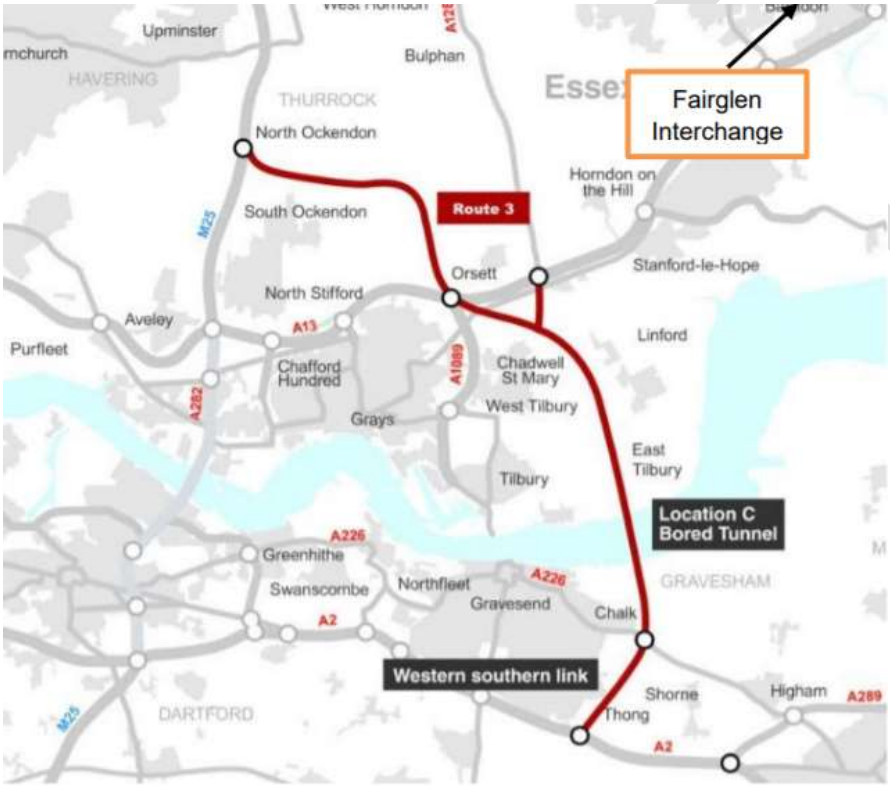
Highways England are currently proposing a tunnel crossing beneath the River Thames and consulting on several potential routes. Subject to the necessary funding and planning approvals, Highways England anticipate that the new crossing, if publicly funded, could be open to traffic in 2026. If private funding is

[9] https://www.essexgrowth.co.uk/media/1020/enterprising-essex.pdf

also used to meet the costs of the project, the opening year is anticipated to be 2027.

The potential impact of the Lower Thames Crossing on the Fairglen interchange has been modelled by Highways England, Figure 6 shows the schemes preferred route. Lower Thames Crossing has the potential to increase the number of vehicles passing through the Fairglen Interchange given its proximity, adding higher demand on the interchange and its capacity.

Figure 6: Lower Thames Crossing – Preferred Route



Thames Estuary 2050 Growth Commission

The Thames Estuary 2050 Growth Commission was announced in March 2016 by the Chancellor of the Exchequer in order to 'develop an ambitious vision and delivery plan for North Kent, South Essex and East London up to 2050.' Major current investments include the London Gateway Port and expansion of Southend Airport as well as the planned Lower Thames Crossing. The Growth Commission, chaired by Lord Heseltine, is tasked with taking investment to another level. Its initial work will focus on six work streams: creating high productivity clusters; increasing connectivity; creating new homes and

communities; securing investment; harnessing innovation in the built environment; and developing centres of excellence.

The council of Thurrock will directly benefit from large scale investments into the 'Inner Estuary' area. These include £1 billion investment into the Port of Tilbury and further investment in the London Gateway Port and the planned growth of new town centres[10].

Furthermore, the 'Growth Commission' is planning on transforming the town centres, restore post-industrial landscapes, and fill up empty business spaces in the South Essex area which includes Basildon, Castle-Point, Southend, and Rochford councils.

London Southend Airport and environs Joint Area Action Plan (JAAP)

The JAAP has been developed by Southend Borough Councils together with the Rochford District with the objective to respond to challenges and opportunities offered by London Southend Airport and the adjacent area.

Southend Airport has scheduled air services to destinations throughout Europe. Furthermore, traffic growth will eventuate as a result of the expansion of airport capacity in the region. Phase 2 of the terminal development at Southend Airport is forecast to accommodate 2 million passengers per year by 2020, which is an increase of 900,000 passengers compared to the 1.1 million passengers per year using the airport in 2013.

Additionally, the expansion involves the development of a business park which is currently undergoing construction works which are expected to be completed by 2021. These developments are key to attracting businesses and global companies. The clusters of business parks will comprise almost 100,000m² of employment floorspace and approximately 6,000 new jobs in Saxon Business Park and around Nestuda Way and Aviation Way Industrial Sites. The JAAP is expected to deliver approximately 7,400 jobs. Saxon Business Park will be home to the Anglia Ruskin MedTech Campus and high-end business space will be provided for a range of aviation businesses and commercial headquarters.

Developments within the JAAP will increase traffic levels. Consequently, the capacity of surrounding highway networks will be put under further pressure. This is recognised by the authorities responsible for the implementation of the JAAP,

10 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718805/2050_Vision.pdf

which have reiterated the need for efforts to be focussed on managing traffic growth and making transport improvements within the area.

2.6 Problem Identification

As assessed in Section 2.4, the current Fairglen Interchange road network is not maximising its potential value and is thereby constraining the growth and productivity of the area's economy and its desirability as a place to live. It is also impairing connectivity between communities. More can be done with the existing infrastructure, but without improvement the existing infrastructure will not allow for its full potential to be realised.

2.6.1 Summary of the transport problems and challenges

The summary of the transport problems and challenges presented in Table 4 is from the OAR. Some of these are discussed in greater detail in the OAR as well as other technical reports of the wider project.

Table 4: Summary of existing and future transport problems and challenges

Problem/ challenge	Current	Future
Journey time reliability	Poor journey time reliability through the interchange adversely affects businesses.	If not addressed, poor journey time reliability will adversely affect ECC's ability to deliver increased connectivity and journey time reliability on their priority route network.
Network capacity	Interchange suffers from a lack of capacity during peak periods. Conflicting movements at the Fairglen Roundabout cause congestion in peak periods. Peak spreading occurs at the interchange, whereby flows build up early in the AM peak hour and continue beyond traditional peak times.	A number of schemes elsewhere in South Essex, under construction or in development, are likely to increase traffic through the Fairglen interchange. Growth from emerging developments will increase demand for movement through the junction.
Alternatives to the car	Private car is the key mode of travel for most trips due to the lack of current alternative modes available. Cycling is becoming more popular in Essex, but there are missing links currently in the cycle infrastructure at Fairglen, which will affect its potential future growth in the area.	Essex LTP3 states that ECC must "actively manage car, freight and passenger transport traffic through integrated transport management and information systems to improve network resilience and provide alternatives to the car."

Problem/ challenge	Current	Future
	A lack of pedestrian provision at the Fairglen interchange.	Direct NMU routes will need to be provided between new developments in the vicinity of the Fairglen interchange. Potential strategic cycle routes between key settlements in South Essex should not be frustrated.
Road accidents	A high proportion of rear end collisions have occurred at the Fairglen Roundabout, on approaches and slip roads, potentially due to poor lane discipline, side swipe collisions and collisions in darkness. Evidence of vehicular collisions at Rayleigh Spur Roundabout caused by loss of control, possibly caused by poor visual alignment on approaches.	Greater number of vehicles will increase the likelihood of a collision.
Ageing infrastructure	Bridge structures - pier & abutment concrete defects are generally limited to concrete surface degradation, but there may be more significant issues which have not been revealed by current inspections. Drainage – the Fairglen Roundabout, being located in a hollow, does not help with aiding drainage, and land drainage from the south-east entering the highway drainage is still an issue.	Bridge structures – the load carrying capacity and safety of operation of the Fairglen bridges will be diminished unless remedial works and further preventative measures are addressed. Drainage will continue to be a problem.
New infrastructure and accesses for planned developments		New development sites in the vicinity of the interchange will require adequate access. Additional traffic resulting from the emerging Local Plan sites will need to be managed effectively.

2.6.2 Scheme and environmental constraints / considerations

The future highways issues and constraints are interdependent with the scheme option selected. The design of the option will be refined during the project, and therefore the magnitude of the issues and constraints that require mitigation will increase or diminish. These were considered during the development of the OAR.

There are multiple constraints which could impact on the cost, schedule, and delivery of the scheme, as set out in Table 5.

Table 5: Summary of the scheme constraints / considerations

Scheme consideration	Current constraint / consideration
Existing road corridor	Any development outside of the existing highway boundary will require land expropriation.
Crouch Valley Showground	This is located north of the intersection between the A127 and A1245.
Railway lines	Realignment of the A130 or A1245 as part of the upgrade of the Fairglen Interchange would potentially impact on the existing structures above the railway or require new structures. This would necessitate extensive and potentially prolonged discussions with Network Rail and the train operating company (TOC).
Action Park at Bonvilles Farm	This is located west of the A130 and Fairglen Interchange.
Electrical sub-station power and lines	There are power lines and pylons located to the north of the A127 and east of the A130, and a sub-station north of the Fairglen Interchange.
Pumping station/ existing services	There are pumping stations located within the grade separated junction between the A127 and A1245. Relocation of pumping stations will incur costs and impact on the project programme.
Watercourses	There are watercourses located north and east of the Rayleigh Spur Roundabout, west of the A1245, south and east of the grade separated junction between the A127 and A1245, and north and east of the grade separated junction between the A127 and A1245.
Earthworks	Any realignment of the A139 as part of the proposed Fairglen Interchange works would potentially require re-profiling of the existing earthworks. The impact of this would potentially require additional time and cost associated with design development, stakeholder liaison and land expropriation.
Properties	There are farms surrounding the Fairglen Interchange: Bonvilles Farm, Michelins Farm, Lychgate Farm, and Morbec Farm. Access will need to be maintained to the farms, and there may be potential land severance impacts associated with the proposed works.

Scheme consideration	Current constraint / consideration
Annwood Lodge Business Park	This is located north and west of the grade separated junction between the A127 and A1245. Development outside of the existing highway boundary will require land expropriation.
Traffic management	Traffic management during construction will also be a key issue, particularly where construction works are online. Works may need to be programmed to be undertaken off peak and overnight.

A desk-based environmental constraints report was prepared in June 2015 to review local conditions, which could influence the design of the scheme. The key potential environmental constraints are summarised in Table 6. This shows that there are issues to be considered, but none are flagged as being insurmountable.

Table 6: Summary of environmental constraints and considerations

Environmental consideration	Current constraint / consideration
Air quality	Rayleigh AQMA extending to the junction with the A127.
Cultural heritage	Great Burches Farmhouse and Beke Hall. Both are Grade II listed buildings.
Nature and conservation	CPT8 Fane Road Meadows local wildlife site including badgers, great crested newts and deciduous woodland.
Landscape and visual	Residential properties to the south in Benfleet, to the east in Rayleigh and Thundersley.
Noise and vibration	Potential receptors are residential properties and farm houses.
Pedestrians, cyclists, equestrians, and community effects	Footpaths and bridleways, public rights of way and cycle routes within the study area are considered to be constraints. Annwood Lodge Business Park, Crouch Valley Shoground, Action Park Motocross Track and the Carpenters Arm Restaurant.
Road drainage and water environment	Known risk of flooding. Crouch Estuary (moderate status) is the closest Water Framework Directive water body.
Geology and soils	Potential sources of contamination on site: Rayleigh main substation, former petrol station at A1245 / A129 roundabout and industrial areas.

2.7 Scheme Objectives

The scheme objectives relate to the problems, opportunities and issues raised at stakeholder workshops held as part of the options development, including:

Connectivity:

- Accommodate / manage future travel demands to facilitate proposed growth in south Essex;
- Ensure good connectivity to South Essex via key transport corridors.

Environment:

- Improve opportunities for residents and employees in south Essex to access alternative modes and encourage their use;
- Protect and enhance the natural, built and historic environment.

Sustainability:

- Improve connectivity for non-motorised users through Fairglen / A130 Interchange.

Safety:

- Improve safety at Fairglen / A130 Interchange through appropriate geometric design, signage, speed limits and visibility.

Resilience:

- Manage congestion at peak times to ensure reliable journey times through Fairglen / A130 Interchange;
- Ensure ECC assets are appropriate for future highway network;
- Keep Fairglen / A130 Interchange operational through improved maintenance provision and incident management.

2.8 Scheme Options

An Options Workshop was held at the Cathedral Learning Centre in Chelmsford on 9th July 2015, with approximately 20 stakeholders identified by ECC, with the aim of tabling the evidence of current and future transport related problems at the Fairglen Interchange and working with the stakeholders to identify as many potential improvement options for the Fairglen Interchange as possible across all modes. This generated 32 potential options to improve the Fairglen Interchange.

An additional three options were generated following the workshop. Two of the three options were developed by Essex Highways as combination schemes comprised of many constituent parts drawn from the workshop options. The other option was put forward by a member of the public. This gave a total of 35 options for consideration.

2.8.1 Initial sifting and early assessment

The 35 options were reviewed as part of the OAR to sift out the options that do not contribute significantly to the identified challenges (overarching problems) and objectives of the appraisal study. In addition, the OAR identified those options that potentially face significant challenges in terms of deliverability, feasibility and affordability. This identified options that face one or more insurmountable hurdles, which justified not taking them any further.

At the end of this process, 13 options remained. These options were analysed to determine, at a very initial stage, the impact the proposed schemes could have on traffic flows at the junction. No analysis was carried out to determine what impact any of the schemes would have on trip generation or route choice, but additional demand has been included based upon broad assumptions related to predicted traffic growth from proposed developments.

Eight options emerged from this process and are assessed as likely to be deliverable, feasible and affordable, whilst also contributing positively to many of the challenges and objectives of this study.

2.8.2 Options for future development

These options have been subjected to further analysis including traffic modelling and initial engineering design. This work has led to further scheme refinement. In some cases, it revealed challenges that provided justification for discarding the other scheme options. The process also revealed options that were not previously considered, and these were included in the analysis.

The options were then classified as short and long term. The short-term options are those that can accommodate lower levels of traffic growth (compared with the longer-term options) and have a higher prospect of delivery due to the greater likelihood of funding from SELEP and could be constructed within the next 5-10 years. The long-term options are those that are able to accommodate future year flows under a higher growth scenario, but that would require significant additional funding in order to achieve delivery. The short-term options were developed with

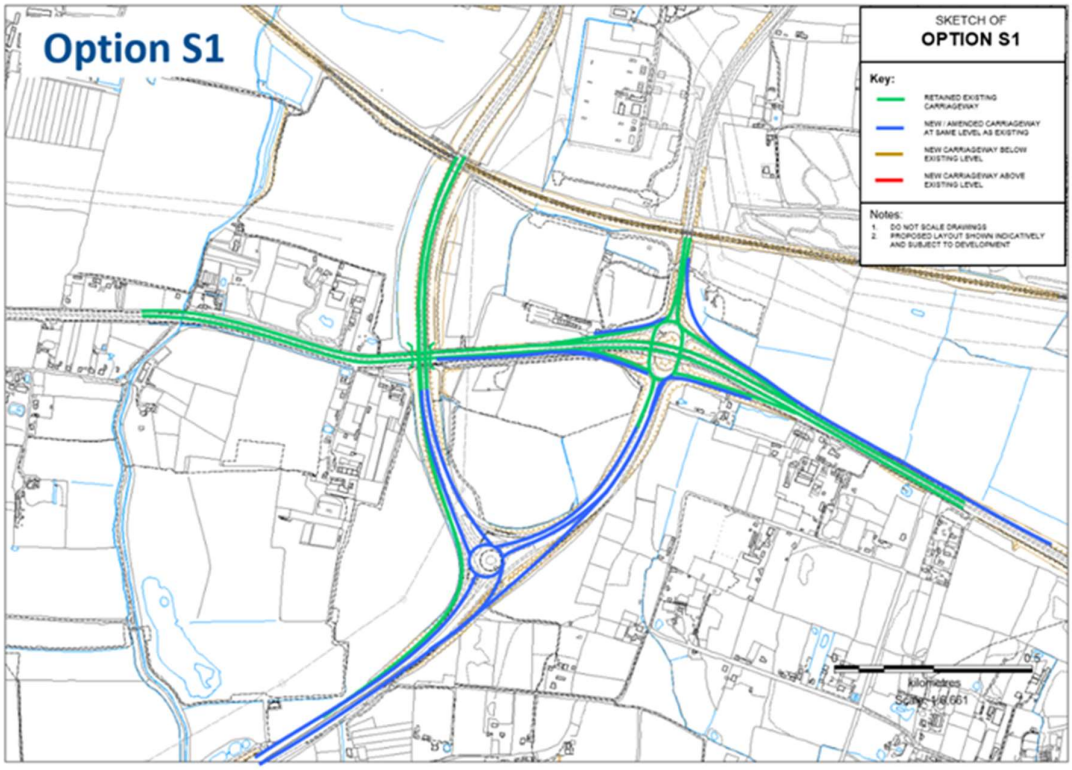
a view to be fully compatible with long-term options should they need to be implemented in the future[11].

2.8.3 Preferred Options

This OBC considered the case for the short-term options only. The assessment work undertaken in earlier stages of the business case and as set out in the OAR identified two short term options for further consideration.

The first option, known as 'Option S1' is illustrated in Figure 7.

Figure 7: Options S1



Option S1 includes the following improvements:

Fairglen Roundabout

- The A127 eastbound has a two-lane off-slip which widens to four lanes for a length of 100 metres on the approach to the stop line.

[11] Essex Highways https://www.essexhighways.org/highway-schemes-and-developments/highway-schemes/a127-a130-fairglen-interchange.aspx

- The A1245 southbound has two full lanes, which widen to four lanes for a length of 100 metres. Three of the lanes enter the roundabout at a give-way line and the fourth forms a left-slip which merges with the eastbound A127 on-slip.
- The eastbound on-slip widened to two lanes with a staggered merge.
- The westbound off-slip widened to three lanes.
- The westbound on-slip widened to two lanes with a staggered merge, with the left-slip rebuilt to make room for the widened on-slip.
- Extended auxiliary lanes on both on-slips.

Rayleigh Spur Roundabout

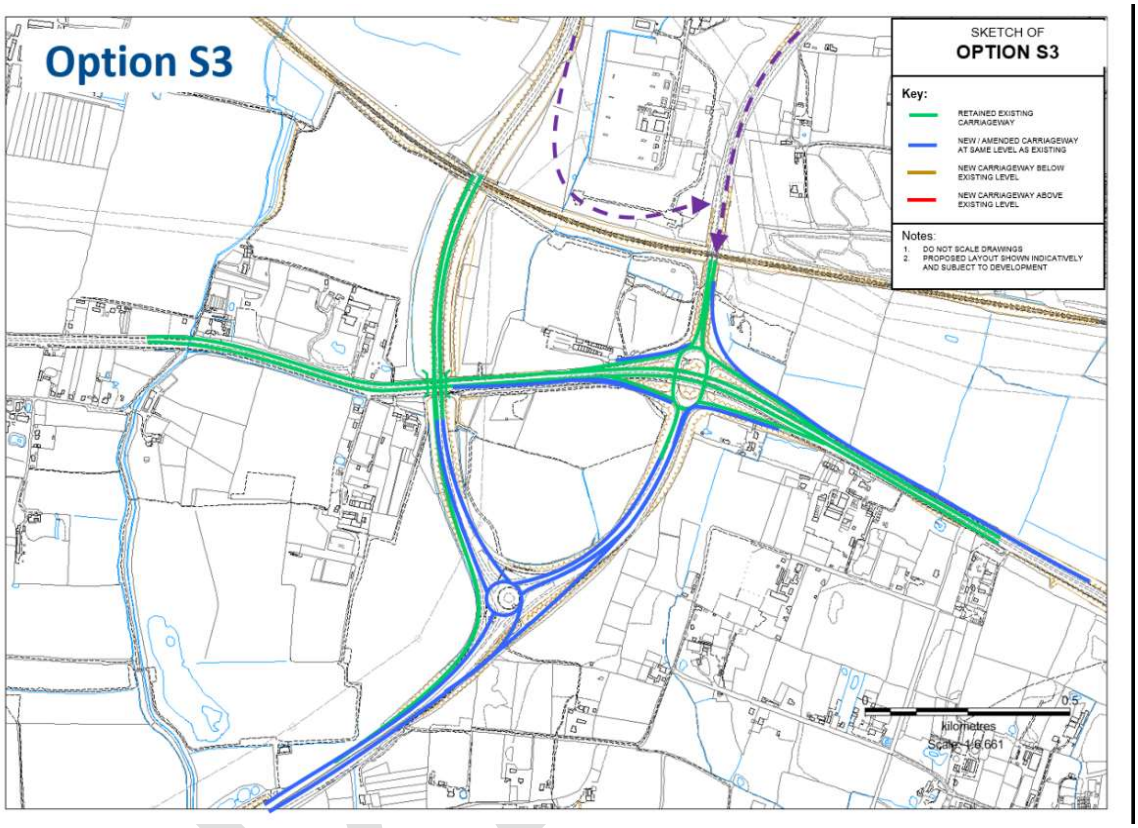
- Circulatory carriageway enlarged.
- Traffic signals on the A130 arms.
- The A130 southbound widened to five lanes on approach to signalised stop line.
- Bypass from A130 to A1245 removed.
- Bypass from A130 to A130 retained.
- Bypass from A1245 to A130 rebuilt.

A1245

- The A1245 northbound widened to four lanes from Rayleigh Spur Roundabout to connect in with left-slip at Fairglen Roundabout.
- The A1245 southbound between Fairglen Roundabout and Rayleigh Spur Roundabout widened to 3 lanes.

The second option, 'Option S3', includes all of the Option S1 improvements, with the addition of a new one-way link road allowing A130 southbound traffic heading to A127 east to be redirected via A1245 (Figure 8).

Figure 8: Option S3



These two options were considered against the project objectives to understand their performance in terms of strategic fit. This assessment is shown in Table 7 and demonstrates that Option S3 performs better than Option S1 and is the preferred option that has been taken forward.

Table 7: Assessment of options against project objectives

Objective	Option S1	Option S3
Accommodate / manage future travel demands to facilitate proposed growth in south Essex	0	1
Ensure good connectivity to South Essex via key transport corridors	1	2
Improve opportunities for residents and employees in south Essex to access alternative modes and encourage their use	0	0
Protect and enhance the natural, built and historic environment	-1	-1
Improve connectivity for non-motorised users through Fairglen / A130 Interchange	-1	0

Objective	Option S1	Option S3
Improve safety at Fairglen / A130 Interchange through appropriate geometric design, signage, speed limits and visibility	0	0
Manage congestion at peak times to ensure reliable journey times through Fairglen / A130 Interchange	1	1
Ensure ECC assets are appropriate for future highway network	0	1
Keep Fairglen / A130 Interchange operational through improved maintenance provision and incident management	1	1
Score	1	5

2.8.4 Value engineering option

Some of the below paragraph has been redacted

Due to an anticipated increase in scheme costs, there was a need to value engineer Option S3. Option S3 contained two additional lanes over a short length on the A127 East bound diverge designated for traffic wanting to head north on the A1245. This short length of new carriageway required a retaining wall and numerous utility diversions in order for it to be constructed, which raised the cost of this particular improvement significantly. Additionally, because of the improvements at Raleigh Spur Roundabout, this required realignment of the existing bypass lane at Raleigh Spur Roundabout which in turn required additional land to be purchased for the scheme. An alternative was to remove the bypass lane and install a third lane heading southbound to the Raleigh Spur circulatory.

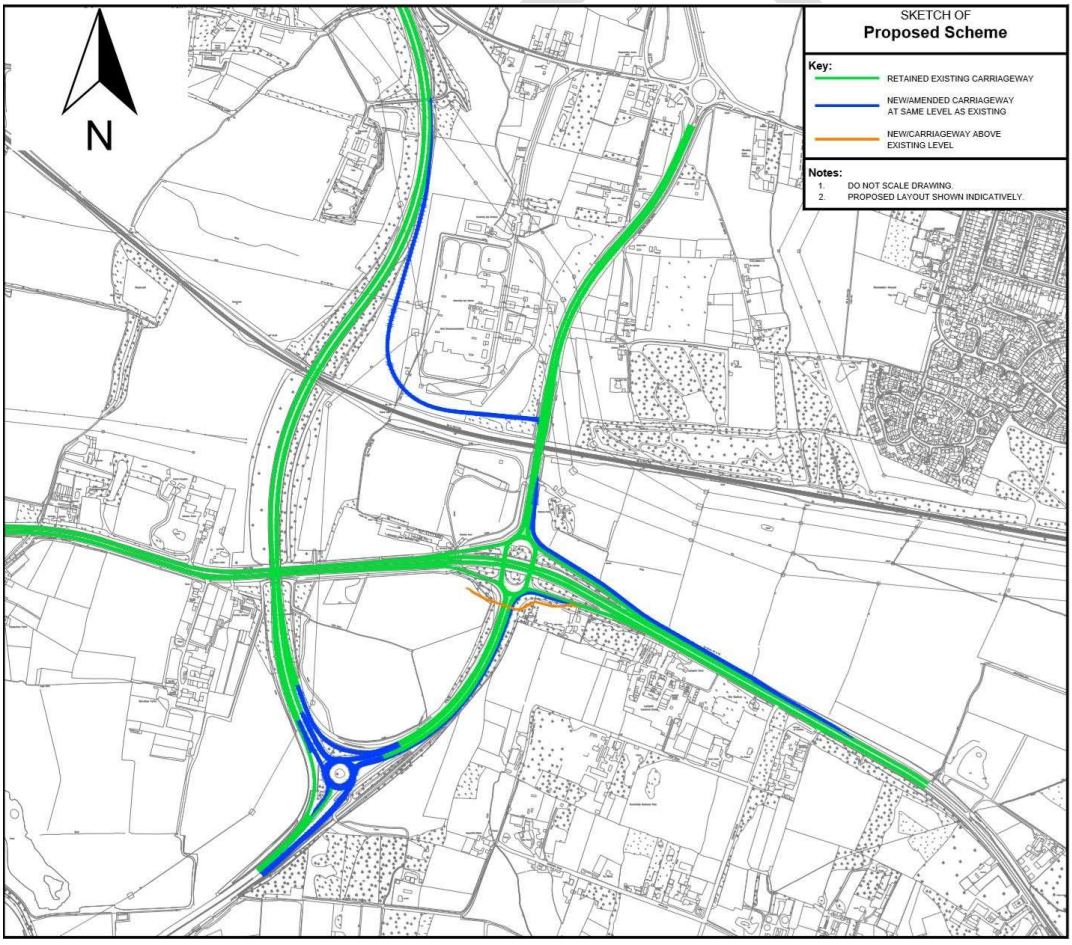
Some sensitivity tests were run to check that the removal of these two elements from the scheme would not erode the BCR. It was found that their removal had very little impact on the BCR and they were therefore removed from the scheme.

The proposed scheme (as shown in Figure 9) is designed to increase the capacity of the Fairglen Interchange, reduce travel times, address existing safety concerns and improve pedestrian and cycling connectivity. It involves:

- Constructing a new one-way 'Southend Link Road' north of the railway line, connecting the A130 southbound with a signalised junction on the A1245, which is restricted to right-turn movements.
- Widening the A127 Westbound diverge slip road onto Fairglen Roundabout.
- Constructing additional and longer slip lanes on the A127 Eastbound on slip.

- Providing a third lane southbound between Fairglen Roundabout and Raleigh Spur Roundabout
- Improving the Rayleigh Spur Roundabout, including signal control.
- Removal of the existing bypass lane at Rayleigh Spur Roundabout.
- Constructing a new bridge for pedestrians and cyclists to the south of Fairglen Roundabout (highlighted in Figure 9).
- Improving the geometric design of the Interchange generally, providing improved lines of sight and visibility for motorists.
- Updating signage and speed limits.

Figure 9: Proposed A127 interchange scheme



3 Economic Case

This section presents the economic case for the preferred option value engineered Option S3. The economic case assesses the likely costs and benefits in terms of economic, environmental and social impacts, and the impacts on public accounts using both qualitative and quantitative information.

This section presents the monetised costs and benefits in the standard economic appraisal tables to produce economic performance indicators. The monetised impacts presented in this report are used to inform the overall Value for Money assessment of the scheme.

The economic assessment has been conducted in line with DfT's Transport Appraisal Guidance (TAG), and therefore a proportionate approach has been adopted taking into consideration the current stage of scheme development and size of the proposed scheme.

3.1 Summary of Findings

As per TAG guidance, the economic appraisal has been assessed to include 60 years after the scheme opening year, therefore 2022 to 2081 (inclusive). The results are presented in 2010 prices and have been discounted (as per Green Book guidance) to present a 2010 net present value (NPV) and ultimately a benefit-cost ratio (BCR).

The initial and adjusted BCR of the Core Scenario of the preferred scheme option are estimated to be 6.8 and 7 respectively (Table 8). The remainder of this chapter provides in-depth detail of our approach and the resulting estimates.

Table 8: Summary Benefit-Cost ratio - Core Scenario (£000s' discounted to 2010, in 2010 prices)

Impact	Core Scenario
Travel Time, VOC User Charge and Indirect Tax benefits	£102,794
Total PVB	£111,086
Total PVC	£16,447
Total NPV	£94,639
Initial Benefit to Cost Ratio (BCR)	**6.8**
Total PVB including Wider Economic Impact	£115,803
Adjusted Benefit to Cost Ratio (BCR)	**7.0**

3.2 Overview of Option Appraisal Approach

The cost-benefit analysis is based on the following elements:

- Travel time & vehicle operating cost and indirect tax impacts
- Construction impacts
- Accident impacts
- Environmental impacts including greenhouse gases, noise and air quality impacts
- Journey time reliability assessment
- Wider economic impacts, specifically output change in imperfectly competitive markets

Some methods for identifying these impacts, and estimating their monetary values are more widely-accepted than others because they are well-researched, tried-and-tested, and therefore considered more robust. These impacts, referred to as "Established Monetised Impacts" in the DfT Value for Money Framework (July 2017), along with the analysis of scheme costs are used in calculation of the Initial Benefit Cost Ratio of the Scheme. Other impacts, known as "Evolving Monetised Impacts", will be subsequently added to the original assessment to generate an Adjusted Benefit Cost Ratio. The evidence relating to the appraisal of evolving monetised impacts, such as reliability, is less developed so there is less certainty about their results.

The economic assessment for the Fairglen Interchange full business case includes consideration of the following impacts as defined within the DfT's Transport Analysis Guidance (TAG):

Established Monetised Impacts:

- Transport Economic Efficiency (TEE) benefits, consisting of two elements:
  - Travel time and Vehicle Operating Cost (VOC) benefits and disbenefits
  - Travel time and VOC benefits and disbenefits as a result of construction and maintenance activities
- Changes in taxes;
- The impact of the scheme on Accidents calculated; and
- The Greenhouse Gases, Noise and Air Quality Impacts.

Evolving Monetised Impacts:

- Wider Economic Impact; and
- The impact of the scheme on Journey Time Reliability.

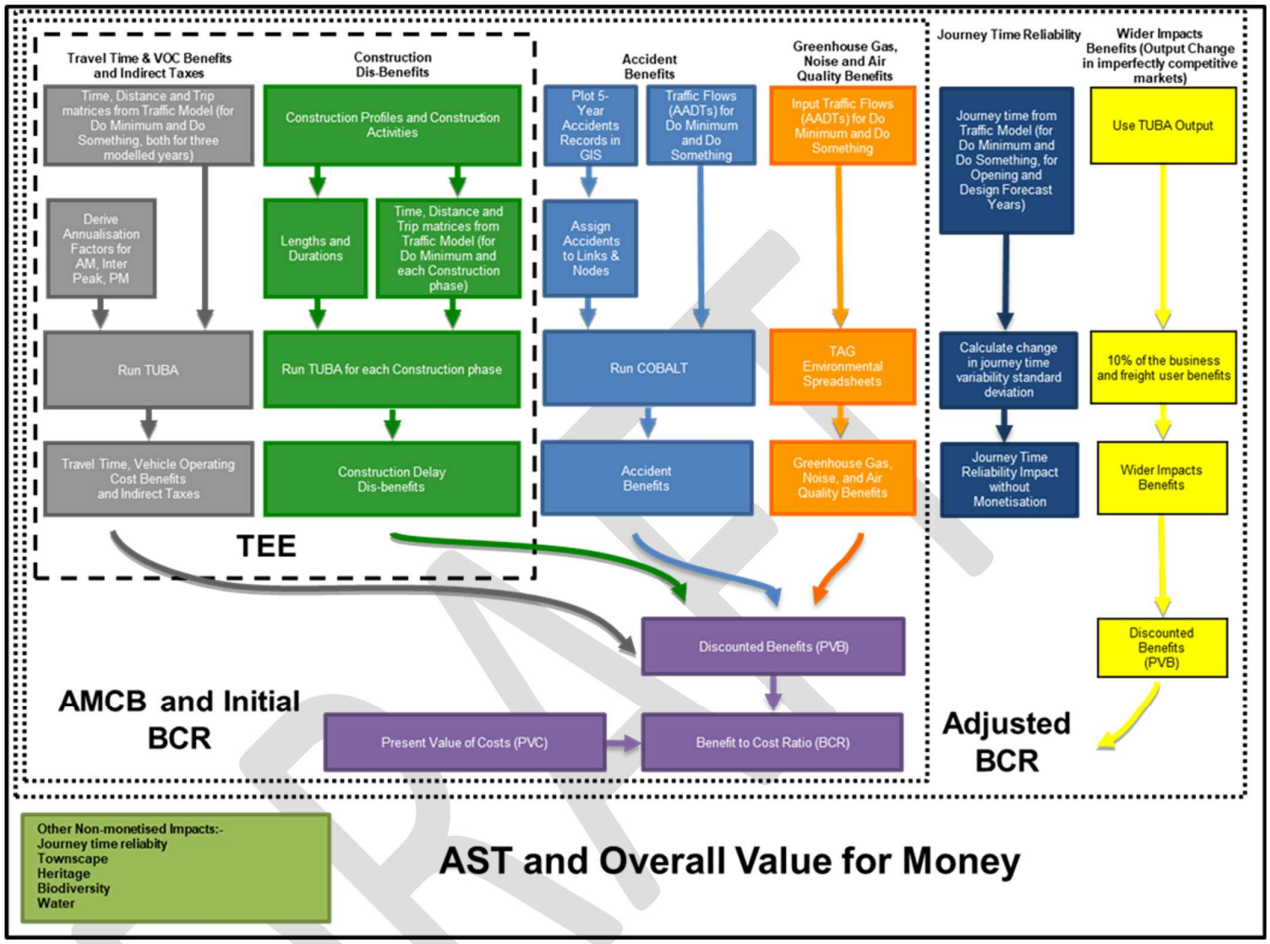
Scheme Cost:

- Cost of construction and maintenance, land and compensation, and preparation and supervision.

Each of these elements informs the overall Value for Money (VfM) of the scheme and is considered within the Appraisal Summary Table (AST). The established monetised benefits will be included within the Transport Economic Efficiency (TEE) table, Analysis of Monetised Costs and Benefits (AMCB) table and the calculation of the initial Benefit to Cost Ratio (BCR). The evolving monetised impacts will be only included in the calculation of the adjusted BCR.

In addition to these impacts, some further elements cannot be monetised but still contribute to the overall VfM. The relationship between each of the economic impacts, the AMCB, BCR and VfM is illustrated in Figure 10.

Figure 10: Economic assessment approach and relationship between each of the economic impacts, the AMCB, BCR and VfM



3.2.1 Assessment tools

The approach to assessing the economic impacts identified above in Figure 10 was developed in line with TAG guidance, and impacts were quantified through the following main analytical approaches:

- **Transport User Benefit Appraisal (TUBA):** Version 1.9.13 has been used to derive travel time, VOC and indirect tax impacts of the scheme, as well as the impacts of the scheme's construction activities on the surrounding transport network. This version of TUBA uses the economic parameters reflected in TAG Data Book published in May 2019. A sensitivity test was also undertaken to assess the impact of the revised long-term economic and population projections, published by the Office for Budget Responsibility

(OBR) in March 2020 on the scheme appraisal. Refer to Section 3.3.6 for further details.

- **Cost and Benefit to Accidents (COBA-LT):** Version 2013.2 with parameter file 2018.1 has been used to derive the expected change in number of accidents and their associated cost to the society. The standard worksheets from TAG Unit A3 have been used to assess the impact of the scheme on Air Quality, Noise and Greenhouse Gases.

3.2.2 Appraisal Period

To assess the economic benefits over the life cycle of the scheme, there is a need for a minimum of two forecast years to demonstrate the long-term benefits of the scheme. In line with TAG the two forecast years should represent the opening year and the design year of the scheme. Therefore, the following forecast years have been developed to consider future economic environmental and operational benefits of the scheme:

- 2022 first forecast year
- 2037 design year

In accordance with TAG unit A1.1, the economic assessment period should extend to 60 years after the scheme's Opening Year. Since the forecast years have been developed a revised construction profile assumes that construction activities will continue to take place through 2021. It was therefore assumed that the Opening Year of the scheme for the purposes of economic appraisal will be 2022. Therefore, the economic assessment was carried out up to 2081 (inclusive).

3.2.3 Discounting

As per TAG and Green Book guidance, values have been discounted to 2010. Discounting is undertaken internally within the computer programs mentioned above, using the standard DfT discount rates of 3.5% per year for the first 30 years of appraisal (from current year) and 3.0% per year thereafter. In this study, the current year is 2020.

Costs can also be in different price bases. To enable comparisons between such costs they need to be adjusted to a common 2010 price base and discounted to 2010. All costs and benefits within this economic case are therefore presented in 2010 prices, discounted to 2010 (unless explicitly stated).

The unit of account must also be consistent between costs and benefits in order to allow comparison between the two. There are two different units of accounts:

- Market price unit of account – this refers to the prices paid by consumers for goods and services and therefore includes indirect taxation (e.g. VAT); and
- Factor cost unit of account – this excludes indirect taxation. Prices paid by Government bodies are usually quoted in the factor cost unit of account as any tax paid is recovered by the Government and is therefore ignored.

While scheme benefits are calculated in market prices, scheme costs are usually quoted as factor costs. The scheme costs must therefore be adjusted to market prices for economic assessment purposes.

3.3 Demand Scenarios

Given the nature of the scheme, a micro-simulation model of the highway network, with the latest VISSIM software (Version 8), was used. The coverage of the VISSIM base model is consistent with the network area required to capture the impacts of the scheme in forecast years. For further detailed discussion on the choice of transport modelling approach please see Local Model Validation Report (August 2020) and Traffic Forecasting Report (August 2020). The following scenarios were modelled.

3.3.1 Core demand scenario

The core demand scenario forms the basis of the economic assessment. Forecast demands for this scenario were developed by applying growth factors to base year demands. The Fairglen Interchange scheme was coded into the Lower Thames Area Model (LTAM) core scenario 2026, 2031 and 2041 forecasts including committed development and infrastructure and the proposed LTC. Total increases in land use were constrained to NTEM at a county level. The LTAM variable demand model and highway assignment models were then run and traffic flows for the affected highway extracted with and without the scheme.

Growth factors to convert the Fairglen 2016 base year demands to 2022 and 2037 forecast demands were derived by interpolating the data extracted from the 2016, 2026, 2031 and 2041 cordoned LTAM model runs with and without the scheme.

3.3.2 Low Growth sensitivity test

A low growth scenario was derived by applying the methodology set out in TAG Unit M4 section 4.2[12] to the VISSIM matrices from the core scenario to produce low growth matrices.

3.3.3 High Growth sensitivity test

A high growth sensitivity test was developed following the same methodology as set out for the low growth above, except using the guidance set out by TAG for high growth scenario testing and applying these to the core scenario matrices.

3.3.4 No Lower Thames Crossing (LTC) scenario

A scenario without LTC was tested with the VISSIM model. A special run of the LTAM including the Fairglen Scheme but excluding LTC was used to determine demand changes. Growth rates from this particular LTAM run were applied to relevant VISSIM runs to produce forecast VISSIM matrices.

3.3.5 Core Sensitivity test

An additional sensitivity test, called the 'Core Sensitivity' test, was requested by the DfT, where travel cost information for additional links to the north of the scheme was extracted from the cordoned Lower Thames Area Model (LTAM) and fed into TUBA. The details of this test are provided in a technical note appended in Appendix G of the EAR.

3.3.6 OBR sensitivity tests

The TAG data book has been updated in 2020 for updated long-term economic and population projections published by the Office for Budget Responsibility (OBR) in March 2020, alongside their updated medium-term economic projections published in July 2020 which reflect their assessment of the impact of Covid-19 on economic growth. In addition, updates have been made to vehicle kilometre splits, fleet fuel efficiency growth projections in and base year electric vehicle consumption. These reflect recently implemented EU legislation on tailpipe emissions and updated input data on diesel sales, ULEV take-up and new

12 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427130/TAG_Unit_M4_Forecasting_and_Uncertainty_November2014.pdf

vehicle fuel efficiency. Historic values have also been retrospectively updated to better align with official statistics.

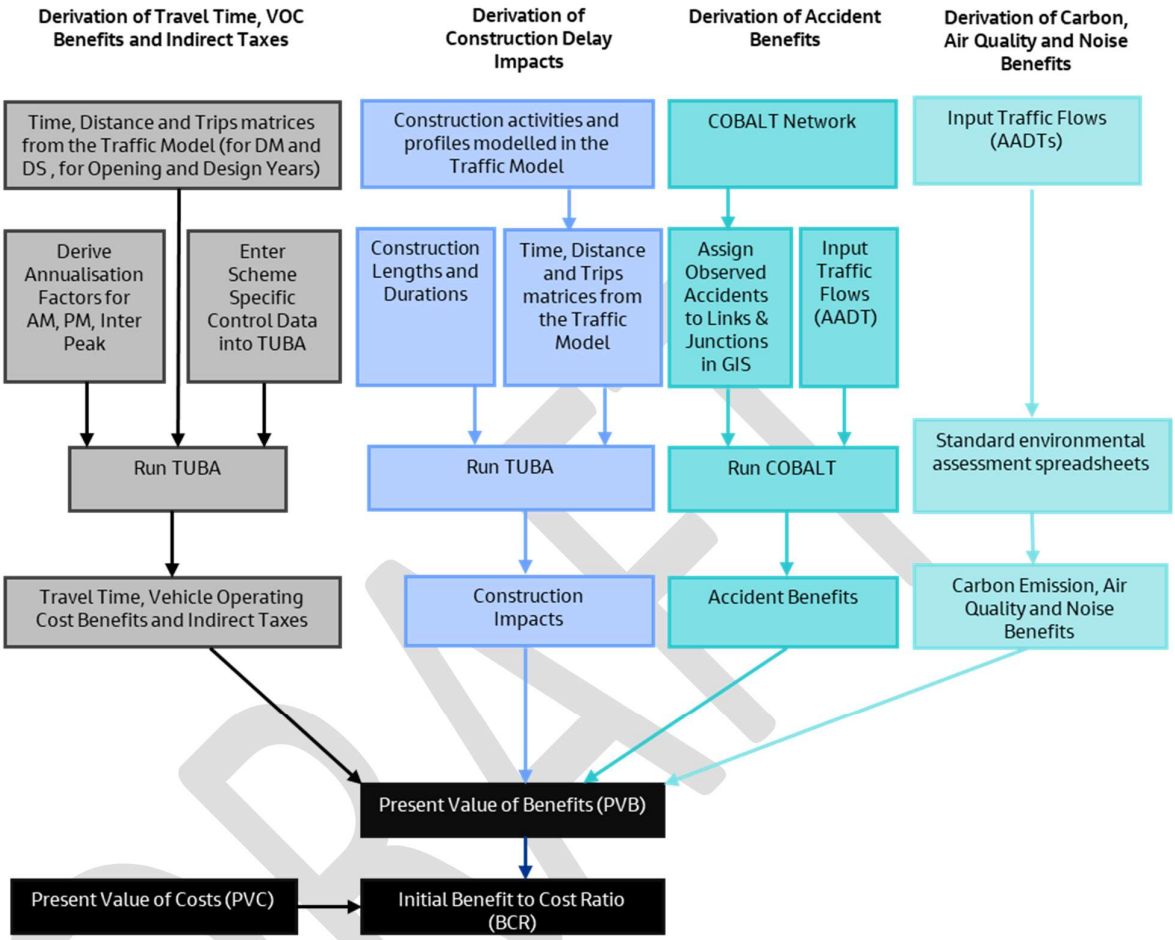
As a result, the DfT has requested further sensitivity tests to understand the impact of the revised OBR economic projection and fleet data on the BCR. Since a new version of TUBA had not been officially released at the time of this study, the DfT provided a draft TUBA economic file based on v1.9.13 of TUBA but including the updated assumptions explained above. The sensitivity tests were undertaken for all scenarios and the results are provided section 3.20.

It should be noted that the economic assessments for all sensitivity tests were undertaken using TUBA only. All other assessment results (such as accidents and environmental impacts) in the calculation of the total PVB and BCR figures are the same as those estimated under the Core demand scenario.

3.4 Overview of Benefits Estimation

Figure 11 summarises the methodology for assessing the established monetised impacts that contribute to the scheme's initial Benefit to Cost Ratio (BCR).

Figure 11: Benefits assessment process



3.5 Transport Economic Efficiency Benefits

The Transport Economic Efficiency (TEE) benefits consist of three key components, set out below:

- Travel time and Vehicle Operating Costs (VOC) benefits as a result of the scheme;
- VOC disbenefits as a result of construction activities; and
- VOC disbenefits as a result of maintenance activities.

Travel time and VOC benefits as a result of the scheme are usually expected to constitute by far the largest proportion of the scheme benefits used in BCR calculation.

The TEE benefits as a result of the scheme are calculated with the use of TUBA. Along with travel time and VOC TUBA considers other Business and Consumer impacts (e.g. user charges), the private sector provider revenues and costs, and the Indirect Taxes elements of the TAG requirements. In the absence of tolled roads in the model, the Fairglen Interchange is not expected to have any impact on user charges or private sector provider revenues.

Travel time saving benefits are derived within TUBA by comparing the overall travel times in the Do Minimum situation with travel times in the Do Something scenarios. It will typically take a shorter time to travel through the study area when the scheme is implemented, and these time savings are converted into a monetary value.

TUBA also calculates VOC changes which occur due to changes in costs associated with such items as fuel, maintenance, and wear and tear. These occur due to changes in speed and distance when the scheme is implemented and can include both positive and negative values depending upon the scheme's impact upon traffic flows and routing.

For the appraisal of travel time and VOC benefits, matrices (tables of trips, travel times and distances between all origins and destinations) from the traffic model are entered into TUBA, along with other scheme specific data.

TUBA assesses travel time savings over the entire modelled area and then applies monetary values (known as Values of Time (VOT) to derive the monetary benefits of those time savings.

VOT parameters and forecasted changes in values are included in the standard TUBA economic file (based on the DfT Databook v1.12 May 2019 and used within TUBA version 1.9.13).

3.5.1 Annualisation factors

In accordance with the TUBA guidance, annualisation factors are required to expand the daily modelled time periods to those that occur within a full year.

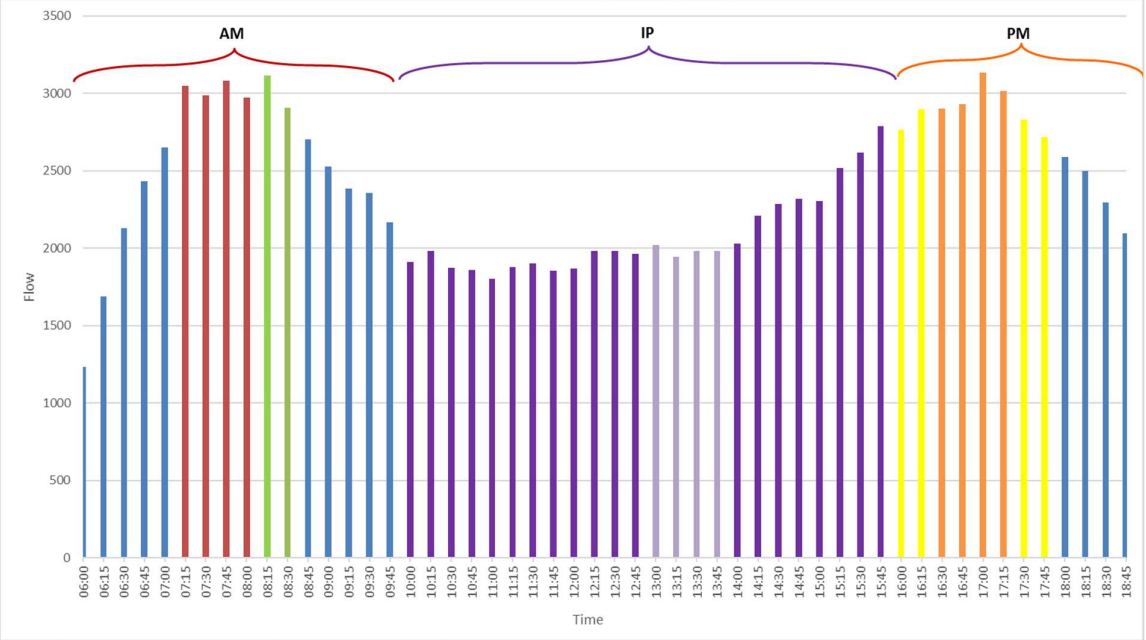
The model models 3 time periods each of which that represent single hours for a typical average, neutral month weekday:

- AM Peak: 07:15 – 08:15;
- Inter peak: 13:00 – 14:00; and
- PM Peak: 16:30 – 17:30.

The annualisation factors have been calculated based on the standard procedures outlined in the TUBA manual and were derived using link flow data collected during the Automatic Number Plate Recognition (ANPR).

The 15-minute interval typical weekday traffic flow profile (see Figure 12) was examined to identify time intervals which should be included in the AM, PM and Inter-Peak time slices for the TUBA analysis. Any time interval with a flow within 10% of the modelled peak hour flow was added to the modelled peak to derive the annualisation factor.

Figure 12: Observed Traffic Flow Profile



The analysis of the traffic flow profile shows that the AM and PM peaks contain 1.5 and 2 hours of traffic within 10% of the modelled peak hour flow respectively. Accordingly, the annualisation factors were taken as 380 (253 x 1.5) for the AM peak and 506 (253 x 2) the PM peak. Similarly, it was established that the 6 hours between 10:00 and 16:00 could be represented by the IP modelled hour giving an annualization factor for the Inter-Peak of 1,518 (253 x 6). The resulting annualisation factors are shown in Table 9.

Table 9: TUBA time slices

Time Slice	Time	Hours	Days	Annualisation Factor
AM Peak	07:15 to 08:45	1.5	253	380

IP Peak	10:00 to 16:00	6	253	1,518
PM Peak	16:00 to 18:00	2	253	506

The weekday off-peak (19:00-07:00), weekends and Bank Holidays have been excluded from the TUBA analysis. This is consistent with TAG guidance, which recommends not including benefits from non-modelled time periods.

Given that the Fairglen Interchange is not only expected to reduce congestion in the peak hours but also provides a faster route between a number of zones in the uncongested situation, the off-peak benefits of the scheme would be positive. The exclusion of off-peak and weekend benefits therefore represents a conservative estimate of the scheme benefits.

3.5.2 TUBA input parameters

The TUBA input for each assessment consists of a standard TUBA scheme file. The common parameters within the scheme files for all of the TUBA runs including sensitivity tests are shown in Table 10 below.

Table 10: TUBA input parameters

Parameter	Value
TUBA Version	1.9.13
First Year	2022
Horizon Year	2081
Modelled Years	2022 and 2037
Current Year	2020 (defines the first year in which the discount rate is applied)
Time Slices	3 time slices as shown in Table 9
Scheme Mode	Road
1st Construction Year	2021
Opening Year	2022
Do Something Costs	As shown in Table 16 and Table 17
Price	Factor Prices
GDP Deflator	100.0 (deflation factor for 2020 applied to all costs except Maintenance which is in 2010 prices outside TUBA) – based on May 2019 TAG Databook
Do Something Scheme Cost Profile	As shown in Section 4.3
User Classes	5 user classes as discussed in the following section. TUBA default journey purpose split for cars was used.

Input Matrices	Time, Distance and Trip skims
Value of Time Method	Method 1 – continuous function, based on distance

3.5.3 Input matrices

Cost skim matrices for time and distance were input into TUBA as weighted average travel time and distance matrices. There are no user charge matrices as there are no tolls in the study area. These matrices consist of the direct outputs from the VISSIM model for the AM, IP and PM weekday time periods for the reference case (Do Minimum) and the scheme (Do Something).

TUBA requires time skim matrices to be input in units of hours and distance in units of kilometres. The factors of 0.00028 (which is 1/3,600) and 0.001 (which is 1/1,000) were used in the TUBA input file to convert time and distance matrices from seconds to hours and from metres to kilometres respectively.

The standard economics file in TUBA used five road based private vehicle types as follows:

- Car – Vehicle Type 1
- LGV personal – Vehicle Type 2
- LGV freight – Vehicle Type 3
- OGV1 – Vehicle Type 4
- OGV2 – Vehicle Type 5

The VISSIM traffic model has demand matrices for Car, LGV, OGV and HGV modes. The LGV matrices have been split into LGV personal and LGV freight, and similarly HGV matrices have been split into OGV1 and OGV2 to be consistent with the standard vehicle types used in TUBA.

Table 11: TUBA vehicle types

Vehicle type	Year	Factors
Car	All	1.00
LGV personal	All	0.12
LGV freight	All	0.88
OGV1	All	0.57
OGV2	All	0.43

As shown in Table 11, the factors to split the traffic model LGV demand matrices into personal and freight are taken from the DfT Databook v1.12 May 2019. The factors to split the HGV demand matrices into OGV1 and OGV2 are derived from count data collected as part of the traffic survey for the Fairglen scheme. Default TUBA journey purpose split factors have been used for cars. It should be noted the VISSIM vehicle categories are car; LGV; MGV and HGV.

3.5.4 Travel time savings and vehicle operating costs

Implementation of the Fairglen Interchange will reduce the travel time for certain journeys passing through the scheme. Although Vehicle Operating Costs (VOC) will increase and decrease depending on the actual movements involved, the overall impact on VOC is positive.

The results of the travel time assessment show that, as expected, there are significant benefits resulting from journey time savings, amounting to £96.7m. The scheme also produces a net VOC benefit of £11.0m. As a result of user savings on VOC there is a net disbenefit of -£4.9m from Indirect Tax Revenue. The results are included within the TEE table, as well as within the AMCB table and the initial BCR. The rest of this section discusses the travel time results in more detail.

Analysis of the user benefits by trip purpose, shown in Table 12 below, indicates that 43% of the benefits come from Business trips, 29% are associated with Commuting trips and 28% with Other trips.

Table 12: User benefits by journey purpose (discounted to 2010, in 2010 prices)

Purpose	Travel Time Benefits	VOC Benefits	Indirect Tax Revenue	Total User Benefits	Share of Total Benefits by Trip Purpose
Business	£39.9m	£7.2m	-£3.1m	£44.1m	43%
Commute	£29.5m	£1.3m	-£0.7m	£30.2mm	29%
Other	£27.2m	£2.4m	-£1.1m	£28.5	28%
Total	**£96.7m**	**£11.0m**	**-£4.9m**	**£102.8m**	**100%**

Analysis of the user benefits by time period, as shown in Table 13, indicates that the scheme provides significant benefits for trips in the PM peak and relatively smaller benefits in the AM peak and Inter-Peak. The reason for higher benefits in the PM peak is that the PM peak is more congested than the AM peak and Inter-Peak and congestion relief at Rayleigh Spur Roundabout is significant due to the provision of the new link. The new link road shifts traffic coming from the A130 to

the A127 (east and west) away from the Rayleigh Spur Roundabout to the Fairglen Roundabout.

Table 13: User benefits by time periods (discounted to 2010, in 2010 prices)

Time Period	Travel Time Benefits	VOC Benefits	Indirect Tax Revenue	Total User Benefits	Share of Total Benefits by Time Period
Weekday AM	£16.2m	£2.0m	-£0.5m	£17.6m	17%
Weekday PM	£71.4m	£6.1m	-£2.4m	£75.1m	73%
Weekday IP	£9.0m	£3.0m	-£1.9m	£10.1m	10%
Total	**£96.7m**	**£11.0m**	**-£4.9m**	**£102.8m**	**100%**

Table 14 below provides a summary of the user benefits split simultaneously by time period and journey purpose.

Table 14: TEE - User benefits by journey purpose and time period (discounted to 2010, in 2010 prices)

Time Period	Business	Commuting	Other	Total
Weekday AM	£8.1m	£5.7m	£3.9m	**£17.6m**
Weekday PM	£30.9m	£23.7m	£20.5m	**£75.1m**
Weekday IP	£5.1m	£0.8m	£4.1m	**£10.1m**
Total	**£44.1m**	**£30.2m**	**£28.5m**	**£102.8m**

The travel time benefits have also been assessed against the level of time saved, as shown in Table 15 below. The table shows that the majority of benefits are associated with journeys with a decrease in travel time of more than 5 minutes. This pattern is similar across all trip purposes.

Table 15: Travel time benefits by time saved (discounted to 2010, in 2010 prices)

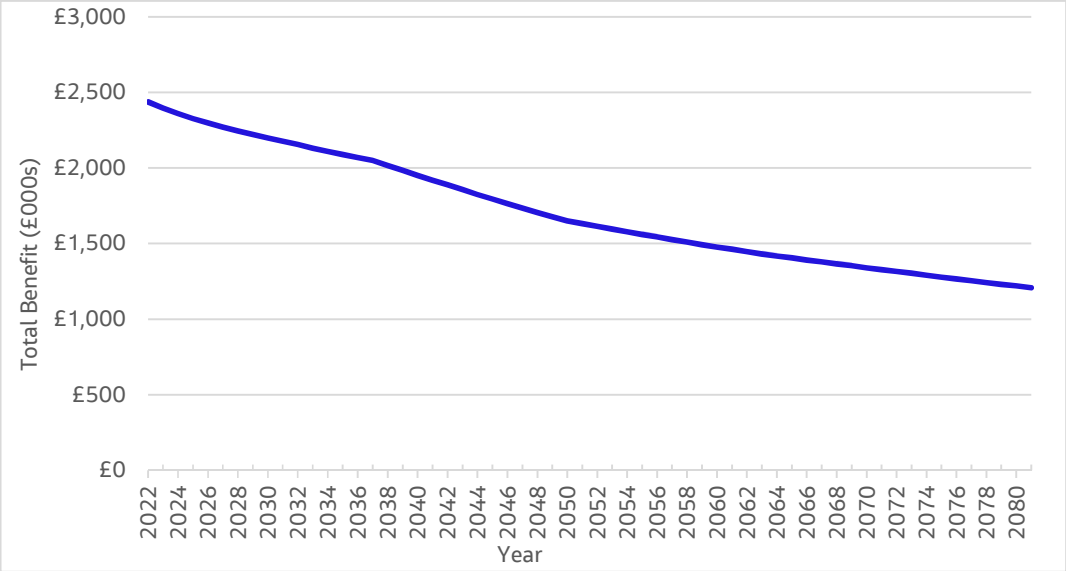
Journey Purpose	Travel Time Benefits by Time Saved			
	0 to 2 Minutes	2 to 5 Minutes	Greater than 5 Minutes	Total
Business	£6.1m	£6.9m	£26.9m	**£39.9m**
Commuting	£2.1m	£7.2m	£20.2m	**£29.5m**
Other	£4.7m	£5.8m	£16.7m	**£27.2m**
Total	**£12.9m**	**£19.9m**	**£63.9m**	**£96.7m**

The benefit profile is used to determine whether the benefits occur earlier or later in the scheme's life. The benefit profile over the 60-year assessment periods is shown in Figure 13. The benefit profile indicates that the overall benefits decrease

over time until the last modelled year (2037) and steadily decline further after that due to the impact of discounting. Although the scheme continues to provide significant journey time savings in the design year, due to increased flow on the eastbound on slip road, the eastbound A127 movement will experience higher delays in the design year; therefore, reducing the overall benefit of the scheme.

In conclusion, the scheme significantly improves the operation of Fairglen Interchange. However, further traffic growth could and over-capacity conditions could gradually nullify the benefits of the scheme, primarily in the AM and PM Peak hours. Accordingly, there is a long-term proposal, potentially to be implemented by 2037, to further improve the Fairglen Interchange[13].

Figure 13: 60-year Profile of Total User Benefits



The geographical distribution of the user benefits is shown in the sector-to-sector analysis in Table 16 . Figure 14 shows the locations of the 5 sectors used in the analysis. The analysis shows that the majority of the benefits are associated with traffic from the A130 southbound (Sector D) and the A1245 southbound (Sector A) as a result of the provision of the new link road and the free flow left turn on the A1245 southbound, which will relieve traffic movement travelling from north to east.

[13] https://www.essexhighways.org/highway-schemes-and-developments/highway-schemes/a127-a130-fairglen-interchange.aspx

It can also be seen that traffic from the A127 eastbound (Sector E) is expected to experience some level of disbenefit. This results from higher flows merging with the A127 eastbound from the interchange. Implementing the scheme enables more traffic to pass through the junctions and merge with the A127 mainline eastbound, generating higher delays and disbenefits. In addition, traffic from the A127 eastbound (Sector E) to the A1245 northbound (Sector A) is also worse off potentially due to the implementation of the new traffic signal on the A1245 in the do something scenario.

Traffic from the A130 northbound (Sector C) towards the A127 eastbound (Sector B) is also forecast to experience a degree of delay at the merge point, while, traffic from the A130 northbound towards the A1245 northbound (Sector A) will benefit from the junction improvements. Traffic from the A127 westbound (SectorB) will also benefit from the scheme.

Figure 14: TUBA benefits sector map

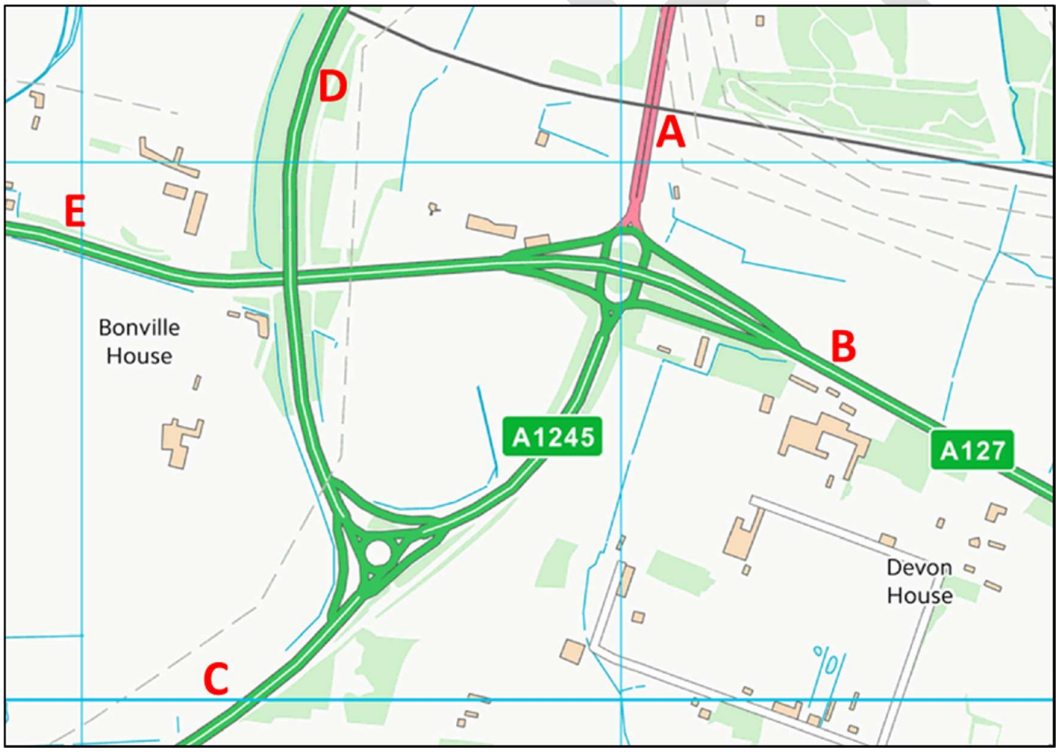


Table 16: TUBA sector to sector analysis

Sector	A	B	C	D	E	Total
A	£0	£9.9m	£11.6m	£0.2m	£9.7m	**£31.4m**
B	£0.8m	£0	£4.0m	£0.4m	£2.6m	**£7.8m**

C	£9.8m	-£3.7m	£0	£2.4m	£2.1m	**£10.5m**
D	£0.4m	£38.1m	£15.7m	£0	£10.6m	**£64.8m**
E	-£4.6m	-£2.0m	-£2.4m	-£2.7m	£0	**-£11.7m**
Total	**£6.3m**	**£42.2m**	**£28.9m**	£0.3m	**£25.0m**	**£102.8m**

3.6 Construction Delays

Delays will be experienced by road users during the construction of the scheme. These delays can be kept to a minimum through the use of effective traffic management but are unlikely to be removed altogether. This results in travel time and VOC disbenefits on the existing network that should be considered as part of the TEE assessments.

A plan for traffic management arrangements during construction has been developed in this study. There will be no lane closures during day time hours. Lane closures will be only implemented between 10pm and 6am, allowing traffic to operate as normal throughout the day. In addition, the majority of the site traffic will travel to and from the site off road on haul routes, thus not interfering with traffic. The only additional traffic associated with the site works will be material and construction plant deliveries.

Overall, the impacts of construction activities on highway users are expected to be insignificant and were therefore not assessed.

3.7 Accident Benefits

3.7.1 COBA-LT

One of the key objectives of the scheme is to improve safety in the vicinity of the Fairglen Interchange. In accordance with TAG recommendations, an appraisal of the accident benefits generated by the scheme was undertaken making use of the DfT's Cost and Benefit to Accidents – Light Touch (COBA-LT) program. COBA-LT version 2013.2 with parameter file 2018.1 (May 2018), which is the latest version at the of this study, was used.

COBA-LT, an industry standard spreadsheet-based program, estimates the number of accidents in Do-Minimum and Do-Something scenarios using forecast flows and appropriate accident rates. Accident frequencies are converted into monetary values by applying Government assumptions about the cost of accidents to society. The difference in the cost of accidents between the Do-Minimum and Do-Something scenarios comprises the accident benefit

associated with the scheme. Accident benefits are discounted to 2010 and summed over the 60-year assessment period.

COBA-LT can assess the accident impacts of a scheme on links and junctions in "Separate" or "Combined" mode. In "Separate" mode, the spreadsheet calculates accident benefits separately for links and junctions; in "Combined" mode the spreadsheet calculates accident benefits using accident rates derived in such a way that junction accidents are included within the link accidents, i.e. link-and-junctions combined. It is possible to use both modes simultaneously for different sections of the network.

For the Fairglen Interchange scheme, all links and junctions modelled in the traffic model were included in the COBA-LT assessment. Coding of links and junctions was carried out in accordance with the COBA-LT User Manual.

Link and junction parameters including speed limits, lengths, road class and junction types were obtained from the VISSIM model and checked using GIS and Google Maps Street View.

All links in the two scenarios (DM and DS) are consistent except the scheme links, which include the proposed link road from the A130 southbound to the A127 via the A1245. Links associated with gyratories ('exploded junctions') within the study area (such as Fairglen Roundabout) were assumed to part of the entire junction.

The classification of junctions depends on the speed limit and their location on major or minor roads. Like the links, all junctions are consistent in the two scenarios except for Rayleigh Spur Roundabout, where the layout and operation of the junction control changes in the Do Something scenario. The two roundabouts have been coded as single rather than 'exploded' junctions.

COBA-LT calculates the number of accidents from either default (national average) or observed (local) accident rates. Observed accident rates were calculated from available Personal Injury Accident (PIA) data (STATS19) for the latest complete five-year period at the time of the full business case development (i.e. 2014-2018).

COBA-LT uses default accident rates for links and junctions without observed accident data for the full five-year period and also links and junctions which not are present in the base year. These rates, based on the May 2018 TAG Databook, are included in the parameter.

The process for assigning observed accident rates to links and junctions is as follows:

- Junction accidents (as identified in STATS19) were assigned to the closest junction within a 30-metre catchment.
- Unassigned accidents from the first step, along with link accidents, were assigned to the closest link within a 100-metre catchment. Real-world 'bendy links' were used to ensure that accidents were assigned to the correct links.

Several checks were undertaken to ensure that the highway network was coded appropriately and observed accidents were assigned correctly. These are summarised below:

- Network coding was checked against Google Maps Street View.
- GIS and visual review were used to check if the characteristics of junctions and links (such as junction and link type, speed limit, etc) were recognised correctly.
- GIS and visual review were used to check that accidents are assigned correctly and are not associated with the network outside study area.

The traffic flows used for accident analysis were the modelled flows from the base and forecast scenarios and are consistent with those used in the TUBA analysis.

COBA-LT outputs the number of accidents and casualties, and the cost associated with them, discounted over the 60-year assessment period for the future situations with and without the scheme, together with the net changes in accidents and casualties. These results are included within the AMCB table and the BCR, but not the TEE table.

3.7.2 Results

The results of the analysis show that there would be an overall increase in accidents within the COBA-LT study area. Table 17 below shows that the number of accidents is expected to reduce on links but increase at junctions due to the new proposed junction on the A1245 and A130. The monetary value of the overall change in accidents would be a disbenefit of £0.974m (2010 prices, discounted to 2010).

Table 18 shows the reduction in the predicted number of accidents and casualties over the 60-year assessment period for the wider study area. There are predicted to be 81 and 179 more accidents and casualties over this period with the scheme in place.

Table 17: COBA-LT Accident Results (£000s, discounted to 2010, in 2010 prices)

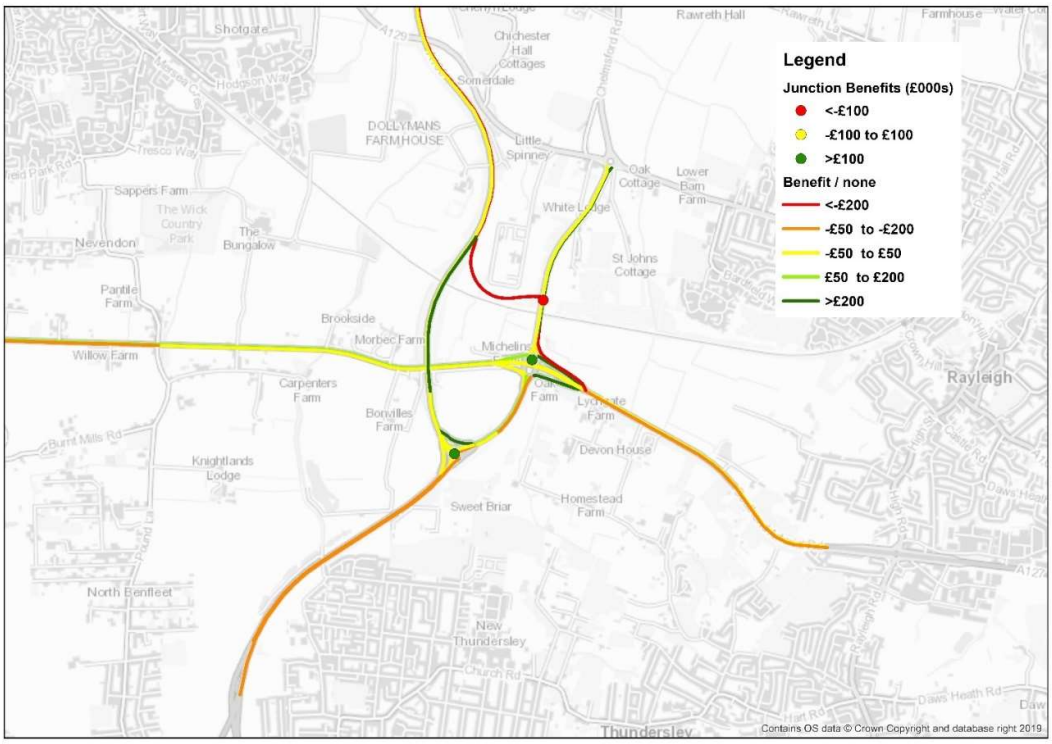
	Links	Junctions	Total Change
Accident Benefits	£4,596	-£5,570	**-£974**

Table 18: Predicted accident and casualty changes over the appraisal period

	Links	Junctions	Total Change
Reduction in number of accidents	64	-145	**-81**
Reduction in number of casualties	98	-276	**-179**
Fatal	3	-1	**2**
Serious	14	-16	**-2**
Slight	81	-260	**-179**

Total accident benefits per kilometre by link are presented in Figure 15 below. As mentioned, the majority of the links, particularly the A130 and A1245, will experience a reduction in number of accidents. In addition, the number of accidents at Fairglen Roundabout and Spur Rayleigh Roundabout is also expected to reduce. However, the reduction in accidents on these are surpassed by the increase in accidents on the new link road and at the new junction, neither of which exist in the DM scenario but are present in the DS scenario. Due to the static and link-based nature of COBA-LT, the addition of flows where they were not previously present would result in higher numbers of accidents without taking into account any other safety measures in place at the new scheme.

Figure 15: COBA-LT Benefits per link for the Core Scenario



3.8 Greenhouse Gas Emissions, Noise and Air Quality Benefits

3.8.1 Greenhouse gases

The Climate Change Act 2008 created a new approach to managing and responding to climate change in the UK. At the heart of the Act is a legally binding target to reduce the UK's greenhouse gas emissions. It is therefore important that the impacts of proposed transport interventions on greenhouse gas emissions, whether they are increased or decreased, are incorporated within the cost benefit analysis in a consistent and transparent way.

The impact on carbon emissions is a function of the change in vehicle-kilometres travelled as well as the change in speed as they relate to fuel consumption. Changes in traffic flows caused by the introduction of the scheme result in changes in greenhouse gas emissions from vehicles, depending on changes in flows, speeds and distance travelled.

The standard Greenhouse Gases Spreadsheet from TAG Unit A3 has been used to calculate the total carbon dioxide emissions (tonnes) for the life of the scheme. The spreadsheet outputs information on carbon dioxide emissions per year. Benefits are output in tonnes and as a monetary value (PVB).

The results output from the Greenhouse Gas emissions spreadsheet for the study area predict a decrease in carbon dioxide emissions of 206,302 tonnes over the 60-year appraisal period. This decrease is due to a decrease in total distance travelled once the scheme is in place. There is no change in traded carbon dioxide emissions as a result of the scheme. The monetary value of the decrease in carbon dioxide emissions over the 60-year appraisal period is a benefit of £9.1m. The results are included within the AMCB table and the BCR, but not the TEE table.

3.8.2 Air Quality

The standard Air Quality Worksheet from TAG Unit A3 has been used to calculate the change in Air Quality for the life of the scheme. The spreadsheet outputs information on PM10 (Particulate Matter < 10µm) concentrations and NOx (Nitrogen oxides) in tonnes per year. Benefits are also output as a monetary value (PVB).

The scheme is anticipated to lead to a small benefit in Air Quality overall. The assessment shows that there is no change in concentrations of PM10, and an increase in concentration of PM2.5, resulting in a monetary dis-benefit over 60 years of -£0.2m. A decrease in NOx emissions over the 60-year appraisal period is predicted, with an associated monetary benefit of £0.4m. The total value of the change in Air Quality is therefore a benefit of £0.2m. The results are also included within the AMCB table and the BCR, but not the TEE table.

3.8.3 Noise

Changes in traffic flows can also result in changes in noise, depending on whether properties are located adjacent to affected roads or not. The standard Noise Spreadsheet from TAG Unit A3 has been used to calculate the change in noise levels during the life of the scheme, the change in numbers of people “annoyed” and the monetary value of those changes (PVB).

The increase in noise during day and night-time occurs as a result of an increase in traffic flows and travel speeds due to a reduction in congestion and redistribution of traffic on the study area road network. The noise increases are all of minor magnitude and considered unlikely to be significant. Noise decreases

also occur at locations around the road network due to redistribution of the traffic as a result of the scheme.

The proposed scheme would result in more receptors experiencing increases in both daytime and night time noise compared to the number of receptors which will experience decreases. In total 10 dwellings in the daytime and 10 dwellings in the night time will experience an increase in noise levels in total and 12 dwellings in the daytime and 17 dwellings in the night time will experience a decrease in noise levels. The results output from the noise spreadsheet show that there is predicted to be a dis-benefit from changes in noise levels, equating to -£0.03m over the 60-year appraisal period. The results are also included within the AMCB table and the BCR, but not the TEE table.

3.9 Journey Time Reliability Benefits

The term reliability is referred in TAG Unit A1.3 guidance as journey time variability (JTV) that individuals are unable to predict. Such variation could come from recurring congestion at the same period each day (day-to-day variability, or DTDV) or from non-recurring events, such as traffic collisions. It excludes predictable variation relating to varying levels of demand by time of day, day of week, and seasonal effects which travellers are assumed to be aware of.

Whilst there is a body of research and tools which focus on the reliability impacts of online improvements, the evidence base for junction improvements is not well established. Accordingly, journey time reliability will be quantified but not monetised. This is a conservative approach

Journey time reliability has been estimated by calculating the standard deviation (SD) of modelled travel time in VISSIM. VISSIM uses an agent-based modelling approach, which means that each individual vehicle is modelled. Therefore, VISSIM doesn't just provide an average journey time; it also provides the journey time for each individual vehicle, which can then be used to calculate the standard deviation for each journey route (i.e. zone to zone in Figure 16). The change in standard deviation of with and without the scheme scenarios has been used to qualitatively evaluate the scheme's impact on journey time reliability.

Figure 16: Model Zone Plan

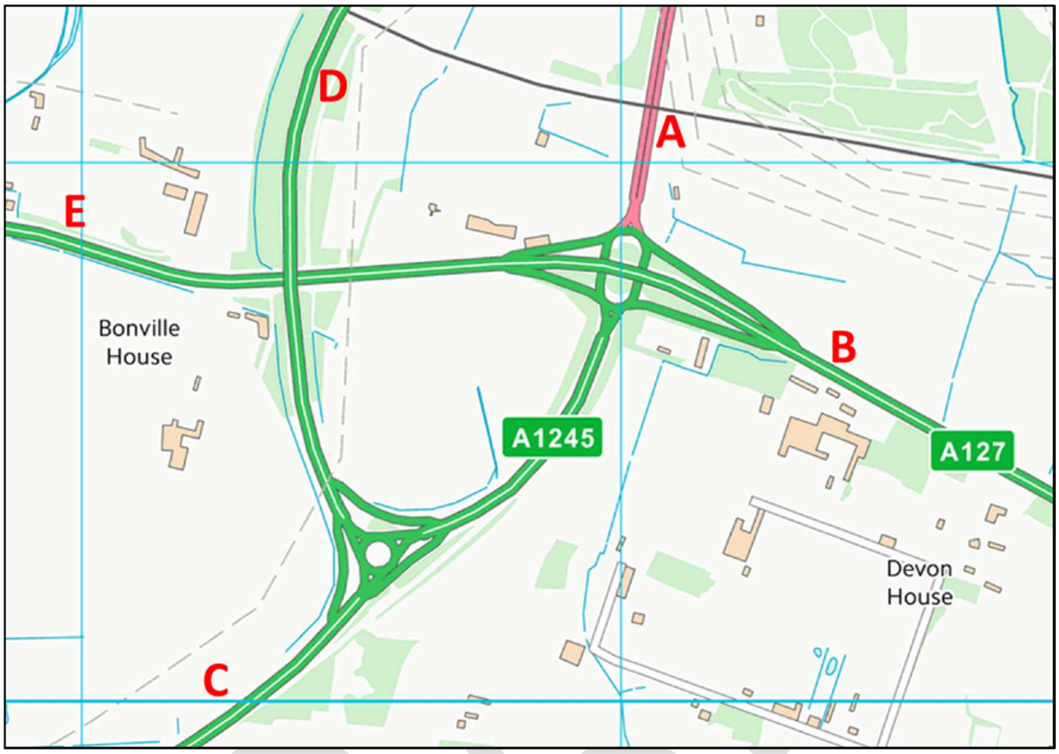


Table 19 and Table 20 provide the results of journey time reliability of the scheme in 2022 and 2037 respectively. The tables show that journey time reliability will improve for the majority of routes in the AM and PM peaks. In the IP there is no noticeable change due to low levels of congestion. There are significant improvements in journey time reliability for traffic from the A1245 north to all destinations in both peaks and years, except for traffic from the A1245 north to the A127 east in the 2037 AM peak which shows slightly higher standard deviation in the DS case. Consistent with the TUBA results, the journey time reliability on the routes from the A127 west will be negatively affected with the scheme in place. This is more noticeable in the PM peak which is the most congested peak. Overall, on average across all routes, there will be an improvement in journey time reliability within the study area with the implementation of the scheme. As a conservative approach, this impact is not monetised and not included in the BCR calculation.

Table 19: Journey Time Reliability – 2022 Standard Deviation (seconds)

No	DM			DS			Difference		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
A_B	193	16	118	86	15	17	-107	-2	-101

No	DM			DS			Difference		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
A_C	232	23	118	95	25	52	-137	+3	-65
A_D	240	25	118	96	27	33	-143	+1	-85
A_E	229	32	123	93	32	75	-137	0	-48
B_A	19	19	45	18	19	79	-1	+1	+35
B_C	19	21	26	20	22	31	+1	0	+5
B_D	35	29	33	32	31	38	-3	+2	+5
B_E	25	27	24	25	27	24	0	0	0
C_A	65	25	160	27	29	140	-38	+3	-20
C_B	70	23	169	71	27	301	+1	+3	+132
C_D	32	34	26	31	35	28	-1	+1	+2
C_E	41	39	140	32	33	80	-9	-6	-59
D_A	62	26	178	29	26	138	-34	0	-40
D_B	68	36	174	61	33	272	-7	-4	+98
D_C	37	42	228	34	43	41	-4	0	-188
D_E	46	54	196	45	54	87	-1	0	-109
E_A	28	30	133	30	31	136	+2	+1	+3
E_B	27	28	121	27	28	88	0	0	-33
E_C	34	36	136	30	37	161	-4	+2	+25
E_D	46	45	133	40	41	154	-6	-4	+21
Average							-31	0	-21

Table 20: Journey Time Reliability – 2037 Standard Deviation (seconds)

No	DM			DS			Difference		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
A_B	227	46	186	306	17	17	+79	-29	-170
A_C	325	68	206	315	26	59	-10	-42	-147
A_D	347	60	178	331	28	98	-16	-33	-81
A_E	343	74	204	297	36	68	-46	-38	-137
B_A	67	32	94	26	21	81	-40	-11	-13
B_C	48	32	101	26	21	50	-22	-11	-51
B_D	60	40	102	70	31	108	+10	-9	+5
B_E	33	27	71	26	27	29	-7	0	-41
C_A	96	28	224	35	29	234	-61	+1	+10
C_B	129	48	221	143	28	226	+15	-20	+4
C_D	34	35	99	34	34	38	0	-1	-61
C_E	51	42	218	34	44	207	-17	+3	-11
D_A	63	25	266	83	27	222	+20	+2	-44
D_B	129	54	280	241	35	361	+112	-20	+81

D_C	44	44	292	60	42	210	+16	-2	-81
D_E	49	52	287	65	54	154	+16	+1	-132
E_A	37	31	70	34	30	129	-3	-1	+59
E_B	61	27	89	28	28	100	-33	0	+10
E_C	78	37	77	53	36	140	-25	-2	+63
E_D	81	47	80	88	45	171	+7	-2	+91
Average							0	-11	-32

3.10 Wider Economic Impacts

Given the limited size of study area covered by the VISSIM traffic model, the assessment of the Wider Economic Impacts of the scheme has been limited to the calculation of output change in imperfectly competitive markets.

This has been taken as 10% uplift of business user benefits calculated in the TUBA assessment as recommended by TAG (Unit A2-2). The value of this uplift is shown below in Table 21. Since there is less certainty around the methods of estimation of the Wider Economic Impacts, these benefits are used to calculate the adjusted BCR and are reported in the AST and the overall Value for Money assessment.

Table 21: Output change in imperfectly competitive markets

	Impact (£000s, discounted to 2010, in 2010 prices)
Business User Benefits (incl. freight) due to time savings, VOC changes, and user charge	£47,169
10% Uplift to account for Output Change in Imperfectly Competitive Markets	£4,716.9

3.11 Maintenance delays

Delays will be experienced by road users during periods of maintenance in the future situations both with and without the scheme. Since the Fairglen Interchange is an existing junction and require future maintenance regardless of the proposed improvements, the maintenance delays have not been monetised in this study. This assumes that it is unlikely that more traffic will be affected or

that higher delays will be imposed on road users due to maintenance works with the scheme in place compared to the situation without the scheme.

3.12 Changes in Indirect Taxes

Indirect taxes relate to the taxation levied on goods and services and include excise duties and VAT. TUBA calculates the changes in Indirect Taxes as a result of changes in the fuel consumption. According to the TAG guidance changes in indirect tax revenues are included as part of the Present Value of Benefits (PVB). Therefore, change in Indirect Taxes, as a monetary value in 2010 prices discounted to 2010, is included within the AMCB and PA tables and form part of the nominator of the BCR.

The change in indirect tax revenues over the construction and the 60-year appraisal periods has been estimated as a dis-benefit of -£4.9m in 2010 prices discounted to 2010. The results are included within both the PA (Table 25) and AMCB (Table 27) tables.

3.13 Non-Monetised Impacts

The second stage of a Value for Money (VfM) assessment builds on the initial monetised impacts and considers qualitative and quantitative information on those impacts which cannot be monetised and how these might contribute to the VfM of the scheme.

The impacts which are difficult to monetise but which have nevertheless been appraised using qualitative and quantitative information and given an overall qualitative assessment score are listed below:

- Impacts on Landscape
- Impacts on Historic Environment
- Impacts on Biodiversity
- Impacts on Water Environment

The analysis of non-monetised impacts has been undertaken in accordance with the methodology recommended within the relevant TAG units and the results have been summarised within the AST (Appendix B – Appraisal Summary Table).

3.13.1 Landscape

The impact assessment on landscape was undertaken using the standard Landscape Worksheet from TAG Unit A3. The output of the assessment was that

the scheme would have a slight adverse impact due to the loss of some woodland and hedgerows.

Assumed replacement mitigation tree and shrub planting would provide a visual screen by year 15 after construction for properties close to the development. The landscape character of the area is already heavily influenced by major road infrastructure, therefore changes to landscape features are unlikely, therefore making the overall impact of the scheme on landscape natural.

3.13.2 Historical environment

The Historic Environment comprises buildings and sites of architectural and historic significance. The impact of the scheme on historic environment has been appraised qualitatively using the standard TAG Worksheet.

Potential adverse physical impacts are predicted on known and unknown archaeological remains that may extend within the footprint of the proposed scheme. A medieval ridge and furrow system is the only recorded archaeological remain within the proposed redline boundary and will likely experience physical impacts during the construction; these impacts can be mitigated by recording and dissemination of the results. There is the potential for remains associated with the Roman occupation and Prehistoric occupation to be encountered during construction, again, this impact can be mitigated by excavation, recording and dissemination of the results.

No physical impacts are predicted on historic buildings or historic landscapes during construction. While there will be changes to the settings of these assets during the construction and operation of the proposed, the existing road network and electrical infrastructure already impacts the setting of historic buildings and landscapes; the changes resulting from the proposed scheme will be result in a negligible impact to the settings.

The overall result for historic environment is a slight adverse impact as set out in the Worksheet in Appendix B – Appraisal Summary Table.

3.13.3 Biodiversity

In common with the other non-monetised environmental impacts, Biodiversity has been assessed using the qualitative and quantitative techniques set out within the TAG and by completing the standard TAG Worksheet presented in (Appendix B – Appraisal Summary Table).

The assessment has shown that temporary and permanent habitat loss associated with site preparation works would impact Priority Habitats, Important Hedgerows and protected species.

Mitigation and avoidance measures would be required to ensure there are no significant negative effects on species and habitats. Through the implementation of mitigation measures there would likely be only a slight adverse impact on any sensitive biodiversity receptors.

3.13.4 Water Environment

The Water Environment Appraisal Worksheet (Appendix B – Appraisal Summary Table) has been completed to assess the potential impact of the scheme for different water environment features.

The proposed scheme would interact with a network of unnamed Ordinary Watercourses and ponds. There would be the potential to alter overland flow paths, physically modify the channels, and for spillages to impact water quality.

The overall result is a slight adverse impact as set out in the Worksheet in Appendix B – Appraisal Summary Table.

3.14 Costs

3.14.1 Overview

This section of the report outlines how cost estimates have been produced for the scheme. Costs used in the economic appraisal of the transport schemes, which form part of the Economic Case in the five-case business case model set out in TAG and HMT[14] Green Book, differ from the costs used in the Financial Case for the scheme.

The estimation of scheme costs is a crucial part of the scheme appraisal. Economic assessment considers both the actual cost of the scheme (design, labour, materials, land etc.) together with any changes in the capital cost of maintenance in future years.

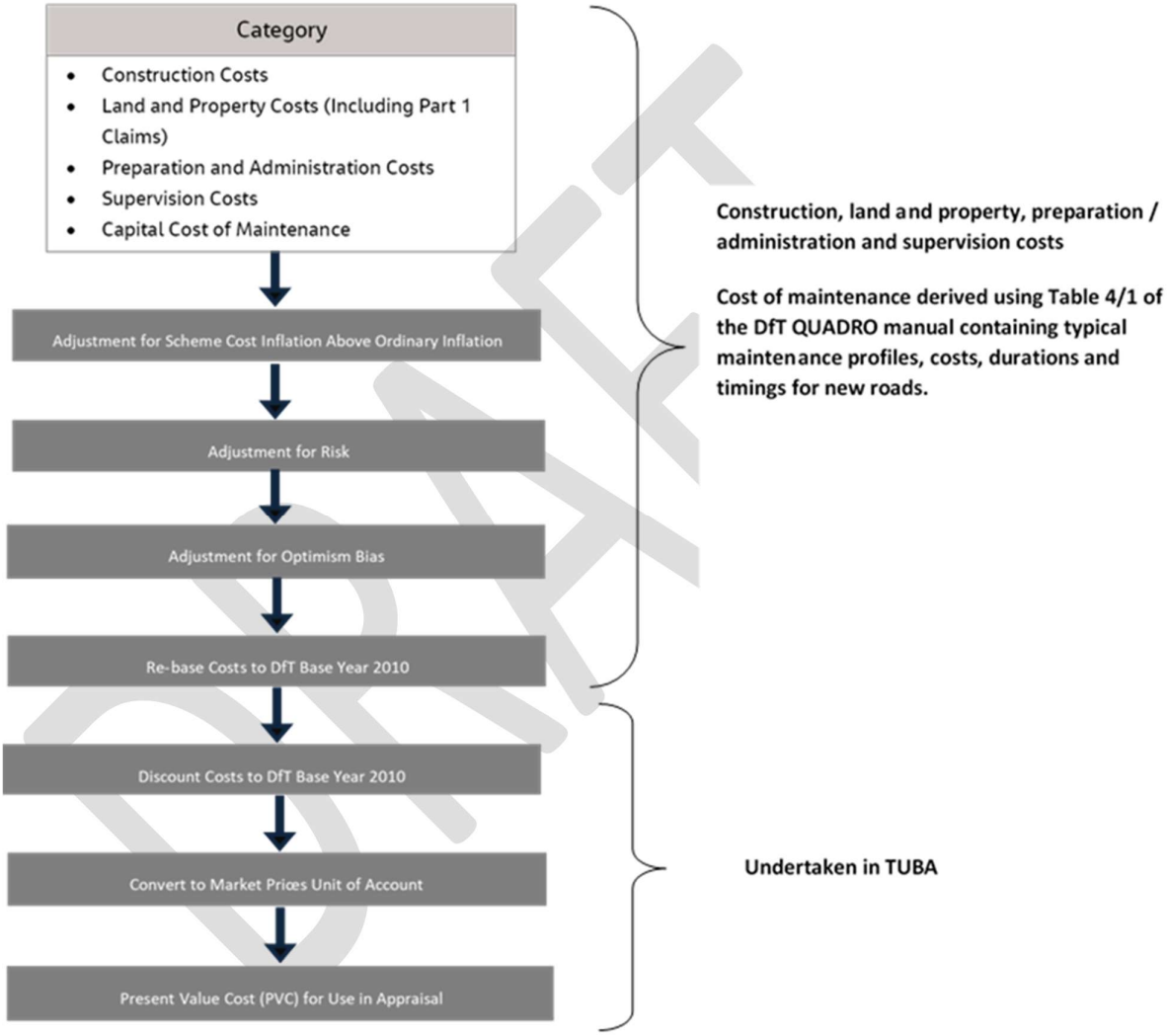
The costs for scheme appraisal are adjusted to the DfT's standard present value year for appraisal (2010) to allow direct comparison with the monetised benefits and the costs are in calendar years. Scheme costs used in the Financial Case

[14] Her Majesty's Treasury

are nominal costs for each year of expenditure and are often set out in financial years.

The typical process to prepare scheme costs for use in economic appraisal is illustrated in Figure 17.

Figure 17: Cost estimation process



3.15 Investment Costs

Base cost estimates for construction, land / property, preparation / administration and supervision, including adjustment for risk have been provided by Essex County Council (ECC) and are presented in Appendix A of the EAR.

The base cost estimates met the following criteria:

- Target construction costs are based on the detailed scheme design.
- Expenditure is given in calendar years.
- Costs exclude both recoverable and non-recoverable VAT.
- Costs exclude any costs that are present in both the Do-Minimum and the Do-Something scenarios.
- To ensure that only the costs which will be incurred subsequent to the economic appraisal and the decision to go ahead, the costs which have been incurred to date were excluded from the total scheme costs for the purpose of VfM assessment.

The cost estimates were prepared in 2020 prices and then inflated to outturn costs (i.e. expected costs in the actual years of expenditure). These costs were then rebased to 2010 prices using the GDP-deflator series as published in the May 2019 TAG databook.

These adjustments have been undertaken by Jacobs and ensured that the costs account for real changes above or below general inflation (BCIS General Civil Engineering Cost index was used for construction and land costs, and RPI used for preparation and supervision costs).

In accordance with TAG guidance (Unit A1-2), a quantified risk assessment (QRA) has been undertaken to consider those risks that may impact upon scheme costs, with an assessment made of their likelihood and the associated financial impact. The QRA was undertaken by ECC and is reported in the Financial Case. In addition, a risk probability analysis has been undertaken and the mean likelihood value was carried forward and added to the Base Costs to derive risk-adjusted cost estimates, required by the guidance.

Lastly, Optimism Bias adjustments have been made. Optimism Bias is the tendency for scheme appraisers to be overly optimistic about key parameters, including scheme costs. As risk analysis improves during the development of the scheme, the level of Optimism Bias adjustment decreases. For the purposes of this economic assessment a 3% Optimism Bias adjustment was applied to the scheme cost as recommended by TAG for the final stage of scheme appraisal (TAG Unit A1.2: Table 8).

Scheme cost estimates, which include 3% Optimism Bias, are outlined in Table 22 below in 2010 factor prices.

Table 22: Outturn investment cost estimates (2010 factor prices, undiscounted)

Item	Scheme Cost (£000)
Preparation	£1,973
Construction	£12,368
Land	redacted
Supervision	£1,549
QRA	£1,233
Total	**£**

3.16 Maintenance costs

The cost of maintenance is the cost of labour, machinery, and materials to maintain the highway network and its assets. When the scheme is in place, the Fairglen Interchange will require additional maintenance that would not occur if the scheme was not built. The maintenance cost estimate has been produced using Table 4/1 of the QUADRO manual 2019 (DMRB Volume 14 Sec 1 Part 2 Chapter 4) containing typical maintenance profiles, costs, durations and timings for new roads.

Similar to scheme costs, an Optimism Bias has been applied to maintenance costs. In this case, an Optimism Bias of 15% has been applied as a conservative approach.

A summary of additional maintenance cost broken down by each new maintenance section is shown in Table 23. A detailed profile of the maintenance costs used is presented in Appendix B of the EAR.

Table 23: Maintenance cost over 60 years (in 2010 prices, undiscounted)

Section	Additional Maintenance Cost (£000)
New Link Road	£887
Dedicated left-turn on north arm	£153
Widening on A1245 SB	£436
Slip Roads widening	£140
Rayleigh Spur Roundabout widening	£360
EB approach to Rayleigh Spur Roundabout	£399
Total	**£2,376**

3.17 Present value of costs

The costs above were entered into TUBA to be summed over the 60-year appraisal period, converted to 2010 prices, discounted to 2010, and converted to the market price unit of account. A summary of the Present Value of Costs (PVC) output by TUBA is provided in Table 24.

Table 24: Present Value Costs (2010 prices, discounted to 2010)

	Discounted Costs (£m)
Scheme Costs	redacted
Additional Costs of Maintenance	£665
Total PVC	

3.18 Public Accounts (PA) table

A summary of the scheme costs is reported in a standard table known as the Public Accounts (PA) table. The PA table for this scheme is presented in Table 25. Note that the PA table includes the effect of the scheme on indirect tax revenues, which is reported as £3.5m.

Table 25: Public Accounts (PA) table (£000s, in 2010 market prices discounted to 2010)

Local Government Funding	ALL MODES TOTAL	ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Revenue	-	-			-
Operating Costs	-	-			-
Investment Costs	-	-			-
Developer and Other Contributions	-	-	-	-	-
Grant/Subsidy Payments	-	-	-	-	-
NET IMPACT	**-**	**-**	-	-	-
Central Government Funding: Transport					
Revenue	-	-			-
Operating costs	£665	£665			-
Investment Costs	Redacted	Redacted			-
Developer and Other Contributions	-	-	-	-	-
Grant/Subsidy Payments	-	-	-	-	-
NET IMPACT			-	-	-

Central Government Funding: Non-Transport					
Indirect Tax Revenues	**£4,878**	**£4,878**	-	-	-
TOTALS					
Broad Transport Budget	**£16,447**				
Wider Public Finances	**£4,878**				

3.19 Value for Money Assessment

3.19.1 Transport Economic Efficiency (TEE) Table

The Transport Economic Efficiency (TEE) is presented in Table 20 below.

Table 26: Transport Economic Efficiency (TEE) (£000s, discounted to 2010, in 2010 prices)

Non-business: Commuting	ALL MODES	ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL	Business Cars & LGVs	Passengers	Passengers	
Travel time	£29,535	£29,535	-	-	-
Vehicle operating costs	£1,345	£1,345	-	-	-
User charges	£0	£0	-	-	-
During Construction & Maintenance	£0	£0	-	-	-
NET NON-BUSINESS BENEFITS: COMMUTING	£30,880	£30,880	-	-	-
Non-business: Other	ALL MODES	ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL	Business Cars & LGVs	Passengers	Passengers	
Travel time	£27,181	£27,181	-	-	-
Vehicle operating costs	£2,442	£2,442	-	-	-
User charges	£0	£0	-	-	-
During Construction & Maintenance	£0	£0	-	-	-
NET NON-BUSINESS BENEFITS: OTHER	£29,623	£29,623	-	-	-

Business	ALL MODES	ROAD		BUS and COACH	RAIL		OTHER
User benefits	TOTAL	Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers	
Travel time	£39,938	£31,583	£8,355	-	-	-	-
Vehicle operating costs	£7,231	£5,919	£1,312	-	-	-	-
User charges	£0	£0	£0	-	-	-	-

During Construction & Maintenance	£0	£0	£0	-	-	-	-
Subtotal	£47,169	£37,502	£9,667	-	-	-	-
Private sector provider impacts					Freight	Passengers	
Revenue	-			-	-	-	-
Operating costs	-			-	-	-	-
Investment costs	-			-	-	-	-
Grant/subsidy	-			-	-	-	-
Subtotal	-			-	-	-	-
Other business impacts							
Developer contributions	-	-		-	-		-
NET BUSINESS IMPACT	**£47,169**						
TOTAL							
Present Value of Transport Economic Efficiency Benefits	**£107,672**						

3.19.2 Analysis of Monetised Costs and Benefits (AMCB) Table

A summary of the economic benefits that contribute to the BCR is reported in a standard table known as the Analysis of Monetised Costs and Benefits (AMCB) Table. This table is presented in Table 27.

Table 27: Analysis of Monetised Costs and Benefits (ACMB; £000s, discounted to 2010, in 2010 prices)[15]

Benefit	PVB
Noise	-£26
Local Air Quality	£201
Greenhouse Gases	£9,091
Journey Quality	N/A
Physical Activity	N/A
Accidents	-£974
Economic Efficiency: Consumer Users (Commuting)	£30,880

[15] *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*

Economic Efficiency: Consumer Users (Other)	£29,623
Economic Efficiency: Business Users and Providers	£47,169
Wider Public Finances (Indirect Taxation Revenues)	-£4,878
Present Value of Benefits (see notes) (PVB)	**£111,086**
Broad Transport Budget	**£16,447**
Present Value of Costs (see notes) (PVC)	**£16,447**
Overall Impacts	
Net Present Value (NPV)	**£94,639**
Benefit to Cost Ratio (BCR)	**6.8**

3.19.3 Benefits to Cost Ratio

The results of the economic assessment for the Fairglen Interchange are provided in Table 28 below, which compares the present value benefit (PVB) of the scheme against its present value cost (PVC). The total established monetised impacts (Level 1 impacts) of the scheme are £111.1m (PVB, 2010 prices and values) and the total calculated cost of the scheme is £16.4m (PVC, 2010 prices and values), resulting in an initial BCR of 6.8.

Including the evolving monetised impacts (i.e. wider economic impacts within the overall scheme benefits) the total calculated benefits would be £115.8m (PVB 2010 prices, discounted to 2010), representing an adjusted BCR of 7.0, which falls in the 'very high' value for money (VfM) category of the DfT's VfM framework.

Table 28: Benefit-cost ratio - Core Scenario

Impact	Core Scenario
Travel Time, VOC User Charge and Indirect Tax benefits	£102,794
Total PVB	£111,086
Total PVC	£16,447
Total NPV	£94,639
Initial Benefit to Cost Ratio (BCR)	**6.8**
Total PVB including Wider Economic Impact	£115,803
Adjusted Benefit to Cost Ratio (BCR)	**7.0**

3.20 Sensitivity Tests

The results of the sensitivity tests are presented in Table 29, together with those for the Core Scenario for comparison purposes.

Table 29: Sensitivity Test Results (£000s, discounted to 2010, in 2010 prices)

		Sensitivity Tests			
Impact	**Core**	Low Growth	Core Sensitivity	No LTC	High Growth
Travel Time, VOC User Charge and Indirect Tax benefits	£102,794	£80,792	£105,927	£106,024	£122,536
Other Impacts (Accidents, AQ, Noise and GHG)	£8,292	£8,292	£8,292	£8,292	£8,292
Total PVB	£111,086	£89,084	£114,219	£114,316	£130,828
Total PVC	£16,447	£16,447	£16,447	£16,447	£16,447
Total NPV	£94,639	£72,637	£97,772	£97,869	£114,381
Initial Benefit to Cost Ratio (BCR)	**6.8**	**5.4**	**6.9**	**7.0**	**8.0**
Total PVB including Wider Economic Impact	£115,803	£92,751	£119,078	£119,122	£137,451
Adjusted Benefit to Cost Ratio (BCR)	**7.0**	**5.6**	**7.2**	**7.2**	**8.4**

As expected, the Low Growth scenario predicts a lower initial BCR than the Core Scenario and the High Growth scenario predicts a higher initial BCR. The Low Growth scenario resulted in an initial BCR of 5.4, while the High Growth and Core scenarios resulted in initial BCR of 8.0 and 6.8, respectively. Considering the wider economic impact benefits results in adjusted BCR of 5.6 for the Low Growth scenario and 8.4 for the High Growth scenario.

The No LTC scenario showed that the initial and adjusted BCR values would increase from 7.0 to 7.2.

Lastly, the Core Sensitivity test showed similar results to the No LTC scenario, with the initial and adjusted BCR values of 6.9 and 7.2, respectively.

The above BCR values categorise the scheme as 'very high' value for money, based on the DfT's value for money framework.

3.20.1 OBR sensitivity tests

As set out in section 3.3.6, using the latest economic projections published by OBR in July 2020 and a draft TUBA economic file supplied by DfT, all TUBA estimates were re-estimated across all scenarios, as set out in Table 30 below. Other impacts, such as accidents, air quality, noise and greenhouse gases (GHG), were only estimated for the Core scenario and assumed to be identical across other scenarios.

The results show that the TUBA benefits dropped by 13-14% across all scenarios, reducing the BCR range of 5.4-8.0 (based on May 2019 TAG data book) to 4.7-6.9 (based on OBR sensitivity parameters). Despite the benefit reduction, the scheme would still deliver very high value for money.

Table 30: OBR Sensitivity Test Results (£000s, discounted to 2010, in 2010 prices)

		Sensitivity Tests			
Impact	**Core**	Low Growth	Core Sensitivity	No LTC	High Growth
Travel Time, VOC User Charge and Indirect Tax benefits	£89,384	£69,718	£92,031	£92,118	£105,075
Other Impacts (Accidents, AQ, Noise and GHG)	£8,292	£8,292	£8,292	£8,292	£8,292
Total PVB	£97,676	£78,010	£100,323	£100,410	£113,367
Total PVC	£16,447	£16,447	£16,447	£16,447	£16,447
Total NPV	£81,229	£61,563	£83,876	£83,963	£96,920
Initial Benefit to Cost Ratio (BCR)	**5.9**	**4.7**	**6.1**	**6.1**	**6.9**
Total PVB including Wider Economic Impact	£101,824	£81,214	£104,591	£104,631	£119,121
Adjusted Benefit to Cost Ratio (BCR)	**6.2**	**4.9**	**6.4**	**6.4**	**7.2**

In addition, relevant TAG appraisal worksheets (i.e. air quality, noise and greenhouse gases) have also been updated with the revised parameters. These new worksheets have been used to undertake the required sensitivity testing to understand their impacts on the monetised impact of air quality, noise and greenhouse gases. Table 31 summarises the results.

Table 31: Comparison of environmental impacts against OBR updates (£000s, discounted to 2010, in 2010 prices)

Impact	Core	OBR Core	Difference	Perc. Difference
Air Quality	£201.40	£191.67	-£9.73	-4.8%
Noise	-£26.30	-£34.05	£7.75	29%
Greenhouse gases	£9,091.10	£9,091.10	£0.00	0%
Total Impact	**£9,318.80**	**£9,316.82**	**-£1.98**	**-0.02%**

3.21 Summary

The proposal is expected to relieve congestion at the Fairglen Interchange by increasing capacity and result in net benefits over the 60-year appraisal period.

The results output from the Greenhouse Gas emissions spreadsheet for the study area predict a decrease in carbon dioxide emissions of 206,302 tonnes over the 60-year appraisal period. The monetary value of the decrease in carbon dioxide emissions over the 60 years appraisal period is a benefit of £9.1 m. The scheme is also anticipated to lead to a marginal benefit in Air Quality overall. The total value of the change in Air Quality is a benefit of £0.2m. The results output from the Noise assessment show that there is predicted to be a dis-benefit from changes in Noise levels, equating to -£0.03m over the 60-year appraisal period.

The total present value of benefits from the implementation of the scheme reported in the AMCB table are £111.1m (PVB, 2010 prices, discounted to 2010) and the total costs of the scheme are £16.4m (PVC, 2010 prices, discounted to 2010), resulting in an initial Benefit to Cost Ratio (BCR) of 6.8.

The scheme also delivers £4.7m of Wider Economic Benefits. Considering these benefits within the overall scheme benefits, the benefits will become £115.8m (PVB, 2010 prices, discounted to 2010), representing the adjusted BCR of 7.0. The amount of benefit from the scheme would categorise the scheme in 'very high' value for money category based on the DfT VfM Framework.

Table 32: Economic Assessment Results Summary (£000s, discounted to 2010, in 2010 prices)

			Costs / Benefits
Benefits	TEE Benefits (Travel Time, VOC, Delays During Construction and Maintenance	Net Consumer - Commuting User Benefits	£30,880
		Net Consumer - Other User Benefits	£29,623
		Net Business User Benefits	£47,169
	Accident Benefits		-£974
	Indirect Tax Revenues		-£4,878
	Greenhouse Gas Emissions		£9,091
	Noise		-£26

	Air Quality	£201
	Total PVB	**£111,086**
	Investment Costs	£16,447
	Total PVC	**£16,447**
Initial Benefit to Cost Ratio		**6.8**
Net Present Value (NPV)		**£94,639**
Other	Wider Economic Impacts	£4,717
Adjusted Benefit to Cost Ratio		**7.0**

4 Financial Case

4.1 Introduction

The purpose of this financial case is to support the application for funding from the DfT, providing evidence that the case is robust and setting out the financial assumptions and cost estimates behind the funding application. The indicative cost of the scheme and the funding requirements are set out, as well as the on-going financial support required to maintain and operate the scheme.

All values presented in the Financial Case are in nominal terms or 2020 prices, unless stated otherwise. The costs presented in this section (rather than those in the economic case) should be used for funding totals.

[please note the prices stated in this chapter are not tendered prices and will be updated once tendered prices are returned]

4.2 Key Financial Assumptions

For the purpose of progressing the financial modelling and understanding the magnitude of the investment and operating costs required, a number of key assumptions were adopted.

4.2.1 General Assumptions

None of the project cashflows are expected to recourse back to longer term general funding commitments on the Council's Revenue or Capital budget.

The financial model assumes all VAT associated with the speed reduction scheme is recoverable and the Central Government and ECC and ECC are under no obligation to pay VAT. All costs presented in this case exclude VAT.

4.2.2 Cost Assumptions

The vast majority of cost estimates have been developed by Essex Highways, however operating and maintenance cost estimates are estimated using the typical maintenance profiles provided in QUADRO.

4.2.3 Optimism Bias

Optimism bias has not been applied in the financial model for the reporting of the Financial Case, as per TAG and Her Majesty's Treasury Green Book guidance. Optimism bias has however been applied to the cost figures supporting the Economic Case as per Green Book guidance.

4.2.4 Inflation

Construction, and land and property costs are inflated using the BCIS General Civil Engineering cost index. RPI has been applied to preparation and supervision costs estimates from the latest TAG Databook.

4.3 Capital costs

A summary of the scheme's capital costs are presented in Table 33. The costs differ from those presented in the economic case due to figures being in 2020 prices and the exclusion of optimism bias in the financial case as per Green Book guidance.

Sunk Costs

As per guidance set out in TAG Unit A1.2, 'sunk' costs represent expenditure incurred prior to the scheme appraisal and which cannot be retrieved. They, therefore, should not be considered in the appraisal and the decision to invest or not.

As of 1st March 2020 (end of financial year 19/20), a total of £7.5m (2020 prices) has been incurred by ECC as set out in Table 33. These costs are considered sunk and have therefore been excluded from the economic case.

Base costs

'Base' costs are defined as the investment required to deliver the scheme excluding sunk costs. They are estimated at £20.5m (2020 prices), as set out in Table 33.

Table 33: Base costs (£000s; 2020 prices; excl. optimism bias)

Category	Sunk costs (£000s)	Base Costs (£000s)	Total Cost (£000s)
Construction	-	£13,738	£13,738
Land and property	redacted	redacted	redacted
Preparation	£7,377	£2,260	£9,637
Supervision	-	£1,749	£1,749
Total			

4.4 Maintenance costs

The cost of maintenance is the cost of labour, machinery, and materials to maintain the highway network and its assets.

Once the scheme is in place, the Fairglen Interchange will require additional maintenance that would not occur if the scheme was not built. The maintenance cost estimate has been produced using Table 4/1 of the QUADRO manual 2019 (DMRB Volume 14 Sec 1 Part 2 Chapter 4) containing typical maintenance profiles, costs, durations and timings for new roads.

Maintenance costs are estimated at £2.6m (2020 prices) over the 60-year appraisal period as set out in Table 34.

Table 34: Maintenance costs (£000s; 2020 prices; excl. optimism bias)

Cost Item	Maintenance cost (£000s)
New Link Road	£974
Dedicated left-turn on north arm	£168
Widening on A1245 SB	£478
Slip Roads widening	£153
Spur RA widening	£396
EB approach to Spur RA	£438
Total	**£2,608**

4.5 Quantified Risk Assessment

A quantified risk assessment (QRA) was undertaken in February 2019 to determine the amount of risk to be applied to the base costs. The Risk Register that feeds into the QRA assessment is a live document and gets updated regularly. It is based on industry knowledge and experience from other schemes which have been constructed. The latest version of the Risk Register is in Appendix A – Risk Register.

Once risks were identified they were assessed and, where possible, addressed through mitigation measures. Those risks that remain and pose a high value risk have were subjected to a Monte Carlo Risk Analysis. The analysis provides a normal bell curve output with the levels of probability for the pre-mitigated estimates. The mean risk value has been estimated to be £1.4m (2020 prices).

It should be noted the initial QRA report was developed in December 2017 and estimated a Pmean of £1.31m (2017 prices). The QRA Register was updated in February 2019 and Monte Carlo Risk Analysis undertaken which estimated a Pmean of £1.36m (2019 prices). The report was not updated for the February 2019 update. It should also be noted that as the tendered prices are returned and this FBC is updated the QRA estimates will become redundant.

4.6 Expenditure Profile

Total expenditure including sunk costs and risk (QRA) are estimated to be £29.3m (2020 prices), as set out in Table 35.

Table 35: Total investment costs (£000s, 2020 prices; excl. optimism bias and maintenance costs)

Category	Costs (£000s)
Base cost	£20,511
Sunk cost	£7,459
QRA	£1,370
Total Cost	**£29,340**

The estimated expenditure profile in FY21 to FY24 is illustrated in Figure 18.

Figure 18: Estimated expenditure profile FY21 to FY24 (£m, nominal prices) – redacted – Redacted

4.7 Funding Arrangements

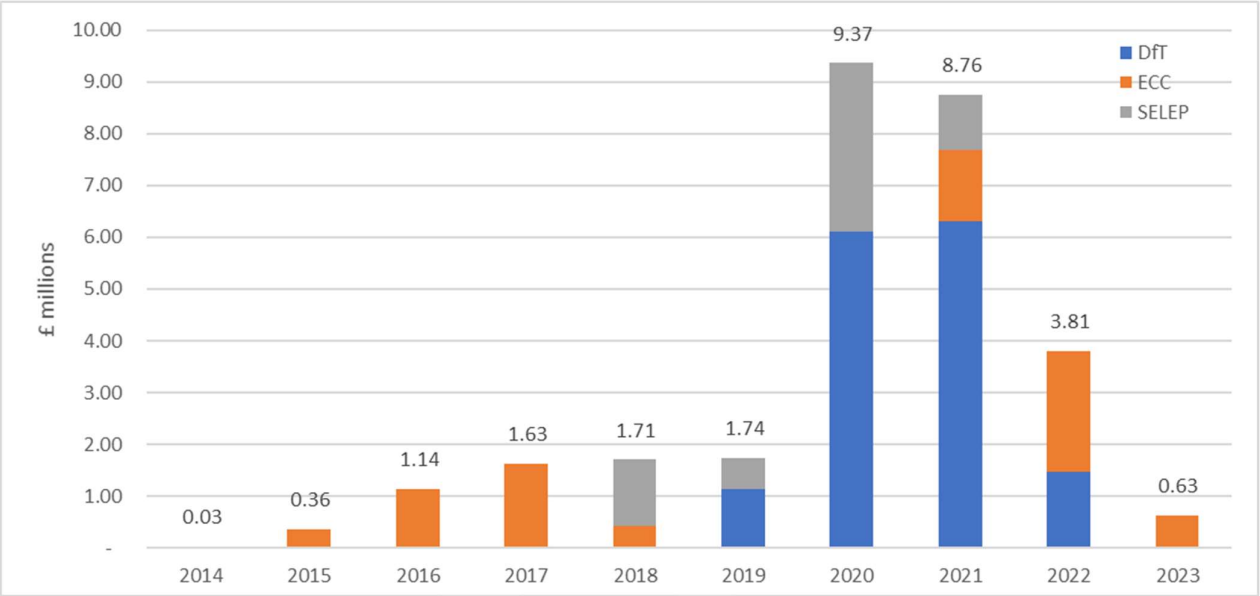
The intended funding sources for the scheme are outlined in Table 36 and illustrated in Figure 19.

Table 36: Available funding by sources (£000s)

Funding Sources	Total (£000s)
DfT	£15,000
ECC	£7,936
SELEP	£6,235
Total	**£29,171**

DfT have retained £15m from Round 1 of the Local Government Fund, whilst ECC secured £2m. SELEP and ECC, through Round 3 of the Local Government Fund, have secured £6.24m and £3.60m respectively. ECC have also provided advanced scheme budget of £1.83m, which was spent between 2014 and 2017 as part of the preparation costs as identified earlier in Table 33. The funding profile is illustrated in Figure 19.

Figure 19: Available funding profile (£ millions)



The identified funding provides £29.171m of budget against total investment (including sunk costs and QRA) of £29.340m, leading to a shortfall of £169,000. The table below sets out the funding available, sunk costs and funding requirement by year.

Table 37: Annual actual and estimated spend and funding profile (£000s, 2020 prices)

		2014	2015	2016	2017	2018	2019	2020	2021	2023	2024	Total
Investment Costs	Sunk Costs	33	387	1,278	1,775	1,808	1,752	426	0	0	0	7,459
	Future costs	-	-	-	-	-	-	4,334	8,115	6,594	1,468	20,511
	QRA	-	-	-	-	-	-	-	622	612	136	1,370
	Total	**33**	**387**	**1,278**	**1,775**	**1,808**	**1,752**	**4,759**	**8,737**	**7,206**	**1,604**	**29,340**
Funding	DfT	-	-	-	-	-	1,125	6,103	6,306	1,466	-	15,000
	ECC	30	361	1,141	1,627	429	-	-	1,381	2,341	627	7,936
	SELEP	-	-	-	-	1,279	614	3,272	1,070	-	-	6,235
	Funding	**30**	**361**	**1,141**	**1,627**	**1,708**	**1,739**	**9,375**	**8,757**	**3,807**	**627**	**29,171**

5 Commercial case

5.1 Purpose

The commercial case details the commercial viability and deliverability of the proposed scheme. This section outlines the required services and associated procurement strategies for this measure, including the mechanisms for management and payment of the procurement exercises used to engage the contractors and suppliers to deliver the scheme. Key milestones in the procurement timeline are highlighted here, whilst detailed implementation timescales are presented in the project plan within the management case.

5.2 Services to be procured

The A127 / A130 Fairglen Interchange is located on the A127 East West Corridor in close proximity to Basildon, where the A127 meets the A1245 at Fairglen Roundabout; and where the A130 meets the A1245 at Raleigh Spur Roundabout. Fairglen Interchange is the collective name for both of the junctions, and forms a strategic connection between the A13, A127, A130 and A1245 Priority Route 1 roads in southern Essex.

The scheme works will consist of:

- Constructing a new one-way 'Southend Link Road' north of the railway line, connecting the A130 southbound with a signalised junction on the A1245, which is restricted to right-turn movements.
- Constructing a new segregated left turn link from the A1245 to the A127 eastbound, and associated new merge arrangement.
- Widening of A127 West bound diverge creating an additional lane on approach to Fairglen Roundabout.
- Provision of additional lane southbound between Fairglen Roundabout and Raleigh Spur Roundabout.
- Improvements at Rayleigh Spur Roundabout, including signal control and widening.
- Constructing a new bridge for pedestrians and cyclists over the A1245 south of Fairglen Roundabout.
- Updating signage and speed limits.
- Design of elements include:
    - Showground retaining wall
    - Fairglen Roundabout, North West retaining wall
    - Fairglen Culvert, precast culvert units

- Screening fence
- Noise fence
- Earthworks slopes (steeper than 1:3).

5.3 Procurement Strategy

The procurement strategy has been followed as per the requirements of Essex County Council.

5.3.1 Output based specification

The commercial case is based on several strategic objectives and outcomes, against which alternative procurement options are assessed. These include:

- Certainty that the scheme can be delivered at the outlined cost and within the available funding requirements.
- Reduce the requirement for further preparation costs with respect to the design of the scheme.
- De-risk construction by including constructability in the design input.
- Deliver the statutory process in a successful and timely manner.

The following procurement strategy objectives have been selected:

- To deliver the scheme within the available funding.
- Ensure that all parties are committed to the delivery of the scheme.
- Ensure that the scheme is delivered at the highest value.
- Reduce and mitigate risks to the lowest level possible.

5.3.2 Procurement route

In the early stages of detailed design ECC were seeking to use the Eastern Highways Alliance Framework (EHA). However, the EHA2 was due to end, which meant a contract had to be awarded by March 2020. Due to the land acquisition process timeline, it was felt using this framework would place too much of a risk on the scheme procurement. This meant ECC would not be able to enter into a contract without having all of the land agreements in place.

EHA3 is not due to be active until October of 2020, so it was felt this was not suitable either. ECC and Jacobs then looked the OJEU route, and deemed this would be a feasible option. However, the tender assessment would require to be significantly more onerous given it would be going out to the open market. This route would have meant a Qualification process, with a following assessment

period, to decide which contractors would be eligible to tender. This would follow a Selection process, with a following assessment period to shortlist the contractors that the Invitation to Tender (ITT) would be issued to. This timescale would be too long to meet DfT business case date criteria of tendered prices and there was little scope to mitigate any delay if this route was selected.

During this time, ECC were registered to use the Crown Commercial Services Framework (CCS). This framework included a South East lot for Highway Infrastructure Works that were valued between £10 and £30m. This lot already had 18 contractors. As these contractors had already passed quality, price, health and safety requirements to be admitted onto the lot, using this framework would be the most efficient and effective approach to deliver the scheme whilst providing competitive rates. Furthermore, some contractors have already indicated they will sub-contract the works to sister or other parts of the business that are based in Essex and the surrounding area if they are successful in providing enterprise and employment benefits to the local area.

5.4 Tender Evaluation Process

This section sets out the tender evaluation process to enable the evaluation and selection of a suitable tenderer. For a detailed description, please see the Tender Evaluation Process Report. The tender evaluation and procurement process will be a joint effort between ECC and Jacobs. They have a long-standing track record for delivering schemes together over the last 8 years.

5.4.1 Evaluation team

The evaluation team will consist of selected project team members from ECC and Jacobs, as set out in the table below (Team is yet to be finalised).

Table 38: Evaluation Team

Roles	Responsibility	Person(s)
Evaluation Lead	To oversee the evaluation process	(Jacobs)
Deputy Evaluation Lead	To oversee the evaluation process in the absence of the Evaluation Lead.	(Jacobs)
Compliance Assessor(s)	To undertake Compliance Assessments as required and determined by the Evaluation Lead	(Jacobs)
Financial Assessor(s)	To undertake Financial Assessments as required and	(Jacobs)

	determined by the Evaluation Lead	
Quality Assessor(s)	To undertake Quality Assessments as required and determined by the Evaluation Lead	(ECC) Jacobs) (ECC)
Moderator	To facilitate the moderation of quality evaluation scores. This is normally the Evaluation Lead, or a person nominated by the Evaluation Lead	TBC (TBC)
Assurance	To oversee general Assurance of the tendering procedure, compliance and moderation and financial credit scoring as required	(ECC)

5.4.2 Evaluation Process

The following evaluation process will be undertaken:

1) **Receipt of responses** – The closing date for tender responses is set for the 4th September 2020 at 12 noon
2) **Distribution of responses** – The ECC Procurement Team will open and verify the submitted tenders, carrying out initial compliance checks. The team will then issue copies of the tender responses to the Jacobs Commercial team via Egress (ECC's secure email system), who will distribute the responses as appropriate to the compliance, financial and quality evaluation teams.
3) **Compliance checks** – All submissions will be checked initially for compliance with the requirements of the tender documentation using a pass/fail assessment.
4) **Full Evaluation** – All tender submissions that pass the compliance checks will be evaluated in accordance with the evaluation criteria. All compliant submissions will be assessed on the grounds of price and quality. A final tender assessment using a price/quality ratio of 50/50 will be undertaken and ranked on the aggregated score. The evaluation criteria and evaluation methodology are set out in detail in the Tender Evaluation Report.
5) **Moderation Meeting** – Following completion of the evaluation process all quality scores, comments and feedback will be issued by individuals to the named Moderator identified for this evaluation process.

   Where sections/questions have been scored by more than one individual those scores will be aggregated. Where there is a significant divergence in

scores between any of the evaluators' scores these will be reviewed at a moderation meeting where every assessor's score, comments and feedback is compared with those scores of the other assessors and a moderated score is to be agreed.

Following completion of the scoring exercise a consensus will be reached regarding the formal scores to be recorded against each of responses evaluated.

6) **Tender Evaluation Report** – The Evaluation Lead will be responsible for producing a Tender Evaluation Report covering instructions, tender submissions, tender evaluations, tender scoring and conclusions. The report will be issued to ECC for approval prior to notification to any application, whether successful or unsuccessful.

5.5 Phasing of Implementation Works

The procurement timescale for the preferred option are included in the overall scheme implementation programme provided in Table 39 below.

Table 39: Implementation Timescales

Activity	Target Date
Scheme out to Tender	June 2020
FBC approval	March 2021
Contract Award	March 2021
Construction Start (for 20 months)	July 2021
Construction Completion	March 2023
Monitoring period	January 2024 & January 2028

5.6 Contractual Arrangements

5.6.1 Crown Commercial Services Framework

This 7-year Framework, which commenced in October 2019, enables public sector organisations to access and deliver a wide range of major and minor building and civil engineering projects.

It has a flexible contract structure designed to provide solutions to suit varying User requirements. The framework is arranged in 11 lots of varying levels of complexity and value of works from £0 - £3m up to £80m+, which are divided into regional sub-lots appropriate to market sector and value range.

Users of the framework have access to all commonly used procurement routes, tendering methods, payment arrangements and standard forms of contract

available. Standard common government boilerplate clauses are included for things such as GDPR and intellectual property rights. Users have the freedom to include additional project or specific contract amendments.

The framework also supports the implementation of government policies and strategies such as prompt payment, SME's and social value.

This scheme will be using Lot 3.2 – Construction Works (£10 - £30m) England South region on a traditional single stage tender under a NEC4 ECC Option A Contract to procure the Works.

5.6.2 Ringway Jacobs Framework

Essex County Council has entered into an Integrated Services Contract with Ringway Jacobs to provide all aspects of Highway Services. The contract includes a framework agreement with Ringway Jacobs to provide additional major projects design capacity and other specialist services to complement the Ringway Jacobs core services. This contract was tendered via the OJEU tender process and was awarded to Ringway Jacobs with a contract start date of 2012.

Ringway Jacobs provide the Essex County Council client with Highways and Transportation expertise across all aspects of the service including transport strategy and transport planning, design services scheme implementation and maintenance services. The contract provides a reach-back ability into the Parent Companies, Ringway (Eurovia) and Ringway Jacobs. The contract is managed via the Contract Board.

The management of the contract incorporates an annual review process including setting and monitoring key performance indicators to provide an ongoing appraisal of efficiency and Value for Money. Collaboration is key to this contract and in April 2015, Essex Highways was one of the first Local Authority/ Service Provider partnerships to achieve BS11000 for its collaborative approach to business relationships. The Essex Highways contract was awarded the Transport Local Authority of the Year at the 2017 National Transport Awards.

5.7 Payment Approach and Mechanisms

The scheme will be let under NEC4 ECC Option A Contract. The payment principles for this contract are well defined within the contract as identified in core clause 5. In summary the Project Manager is responsible for assessing the amount due to the contract at the Assessment Date.

Assessment Dates will be defined in the contract and will be at calendar month intervals. The Project Manager is required to certify the payment within one week of the Assessment Date.

The payment as defined in the contract is composed of:

- The Price of Works Done to Date
- Plus other amounts to be paid to the contractor
- Less amounts to be paid by or retained from the contractor

The contract will have an experienced supervisory staff responsible for measuring and assessing the works done to date.

The Project Manager will be required to report payment progress to the Project Board on a monthly basis.

5.8 Contract Management

The contract management arrangements during the implementation stage will be administered by a Project Manager and Supervisor and a support team applicable to stage of the works at any one time. This will be delivered by an ECC/Jacobs inhouse team. All staff will be NEC4 trained and have a track record in either being PM or Supervisor on complicated or large schemes. Relevant ECC staff are NEC4 PM and Supervisor Accredited. There is a potential for an Assistant PM and Assistant Supervisor if the need is required. This approach is commensurate with schemes of this nature/size.

The roles for the project will otherwise be as set out in the detail within the Project Governance section of the Management Case. This approach will also ensure that the construction is programmed and coordinated.

5.9 Contract Length

At this stage in the programme it is anticipated that the construction contract will start in February 2021, running until October 2022+1 year defect period.

5.10 Risk Management

Risks and associated cost estimates are included in the Risk Register (Appendix A – Risk Register) and will be specifically assessed and assigned depending on which partner is best placed to manage them.

The Risk Register forms a part of the Risk Management Plan which sets out the full risk management process and responsibilities for undertaking risk

management to deliver the scheme. Implementation of a structured, forward-looking and continuous risk and opportunity management process is intended to increase the certainty of cost-effective scheme delivery and operational success.

Further risk identification will be carried out through the means of workshops, reviews, meeting and day-today operation, therefore providing the opportunity to identify and manage as wide a scope of risks as necessary. The register will be a live document whereby new risks identified, and updates will be documented.

6 Management Case

6.1 Purpose

The Management Case assesses whether a proposal is deliverable. It tests the project planning, governance structure, risk management, assurance, communications and stakeholder management, and plans for monitoring and evaluation.

There should be a clear and agreed understanding of what needs to be done, why, when and how, with measures in place to identify and manage any risks. The Management Case sets out a plan to ensure that the benefits set out in the Economic Case are realised and will include measures to assess and evaluate this.

6.2 Project Dependencies

Some of the below paragraph has been redacted

A Risk Register has been developed and is presented in Appendix A – Risk Register

The delivery of the Scheme is dependent on these risks being sufficiently mitigated. The key programme dependencies (and risks) can be summarised as follows:

- Completion of scheme designs
- Funding shortfall
- Political backing and funding from each of the identified funding streams
- Land acquisition for the Scheme
- Utility diversions
- Successful liaison with the local communities ensuring they are included in regular updates through the Scheme's development
- Appropriate mitigation of environmental impacts
- Achievement of planning permissions

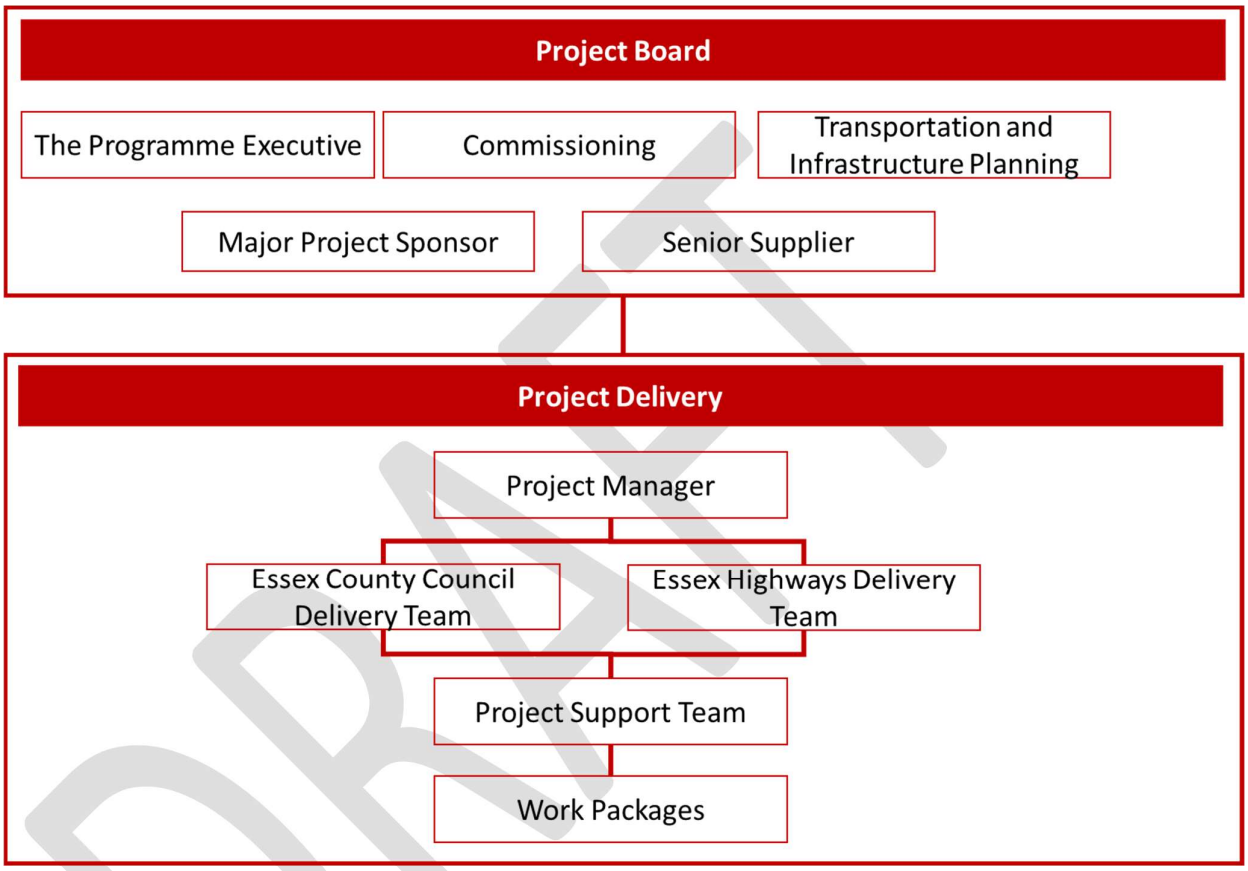
6.3 Project Governance Structure and Reporting

6.3.1 Overall governance structure

The scheme is led by Essex County Council, with Jacobs, commissioned through Ringway Jacobs, undertaking design and consultancy services. The scheme is to be funded through a combination of funding from ECC, DfT and SELEP.

An appropriate governance structure is essential for the successful delivery of the scheme. The structure is set out in Figure 20 below. The roles and responsibilities of the parties indicated in the figure are described in the following paragraphs.

Figure 20: Organisational delivery structure



6.3.2 Project Board

The Project Board is responsible for the direction and overall management of the scheme. The Project Board is chaired by the Senior Responsible Owner and made up of the Executive and Senior User for each of the partner statutory authorities, the Project Assurance Lead and the Business Change Lead. ECC acts as the lead authority for the scheme and provides the project's Senior Responsible Owner.

The responsibilities of the Project Board include:

- Setting the strategic direction of the project, in the context of local policies and the work of the SELEP.
- Defining the scope and setting the timescales for major project milestones.

- Approving the appointment of the Project Manager.
- Providing the Project Manager with the strategy and decisions required to enable the scheme to proceed to programme and resolve any challenges.
- Securing necessary approvals through the partner statutory authorities.
- Approving the project scope of work, programme and budgets, as well as any subsequent changes.
- Signing off completion of each stage of the project and authorising the start of the next stage.
- Monitoring project risks and taking any appropriate action to mitigate risks.

Project Board will consist of members from ECC and Jacobs across a range of services including:

Role	Individual(s)	Organisation
The Programme Executive		ECC
Commissioning		ECC
Transportation and Infrastructure Planning		ECC
Major Project Sponsor		ECC
Senior Supplier		Jacobs
Jacobs Project Manager		Jacobs

6.3.3 Stakeholder group engagement

Historic Consultation Undertaken

Stakeholder Engagement through the following measures were undertaken previously:

- Land-owner / Affected Property owner engagement in February 2017 - this was done through invite only and facilitated early discussions with property owners with regards to how the scheme affected their property;
- Public Information Events in February 2017 – these were held in local facilities near to the improvement scheme and gave early information of the strategy and high-level proposals;
- Land-owner / Affected Property owner engagement in January 2018 – this was done through invite only and facilitated a follow-up to the meetings held in February 2017; and
- A non-statutory consultation on the Fairglen interchange short-term scheme ran from 6th February to 20th March 2018. Detailed information about the proposed interventions was made public via various channels including the

internet and local press, and the public and stakeholders were invited to give feedback. We received 196 responses to the consultation, and the Consultation Report summarises the responses, demographic data, and the issues raised as part of the consultation process[16].

ECC recognises the importance of consultation as a key aspect of its role in working with local communities to ensure that residents, businesses and other stakeholders are able to influence decisions. The approach to consultation on the scheme will be based on future engagement with local authorities, local communities, as well as statutory and non-statutory consultees. This process will be maintained and enhanced during scheme development and delivery.

The approach to communications and stakeholder management will therefore build upon and consolidate the existing approaches, expertise and experience across ECC in facilitating effective consultation and community engagement.

The communications strategy includes:

- Ensure a consistent approach to all external communications activities relating to the scheme.
- Effectively engage with all appropriate stakeholder groups.
- Raise the profile of the scheme, and its impact on the Essex economy, on a local, regional and national level.
- The stakeholders we will engage with but not limited to are:
    - Business and business groups (both existing and future)
    - Residents and wider public
    - Councillors
    - Campaign groups
    - Statutory groups
    - Government at local and national level
    - Developers (house builders and house owners)
    - Investors
    - Partners (DfT and SELEP)

We intend to engage with stakeholders during the monitoring and evaluation of phase. Given that the historic consultation via the digital-media process through ECC's website was successful, it is proposed to carry out a similar digital event. The aim would be to obtain stakeholders' views on how effective the stakeholder engagement throughout scheme development and construction had been. This

[16] Consultation Report Oct 2018: https://www.essexhighways.org/uploads/docs/fairgen-consultation-report.pdf

consultation method would enable the council to reach out to statutory and non-statutory organisations such as general public, affected landowners and other relevant bodies, whom were consulted during the scheme development. This will be used to inform potential lessons learned from effective consultation and to clearly demonstrate its value. For more details please see the Monitoring and Evaluation Report.

6.4 Project Reporting

Responsibility for accurate, timely and appropriate communications within the project team rests with the Project Manager, to ensure that the Project Board is kept up-to-date with project developments. Progress should be reported by means of a Progress Report, produced at monthly intervals, unless otherwise requested. This document will identify costs to date, key risks, milestones achieved since the last report and milestones predicted before the next report. This should be accompanied by an up to date spend profile, programme and risk register.

It is the responsibility of the Project Manager to ensure that the Project Board has sufficient information and is involved in all decisions that affect performance of the project, achievement of the project objectives or deviation from agreed and delegated responsibilities.

6.5 Project Plan (redacted)

6.6 Risk Management Strategy

Risks and associated cost estimates are included in the Risk Register (Appendix A – Risk Registerand will be specifically assessed and assigned depending on which partner is best placed to manage them. Future risk management activities and updates to the risk register will take place as part of ongoing ECC scheme delivery. These will be informed by regular meetings and risk workshops which are to be aligned to key programme design and delivery phases. The membership of these meetings will vary and would be dependent upon the particular project phase.

The risk register will be maintained throughout the project as a live document and reviewed on an ongoing basis. The most significant risks will have Risk Management Plans developed. Risks can also be identified at any time outside of these formal lines of communication and should be highlighted to the project manager if this occurs.

6.7 Monitoring and Evaluation

A monitoring and evaluation plan has been developed and is contained within Monitoring and Evaluation Report. The plan sets out the approach that will be used to track and assess the progress of the scheme in meeting and continuing to meet the key performance metrics and wider benefits anticipated.

The proposed monitoring and evaluation strategy for the Fairglen Interchange scheme follows the requirement for the standard monitoring, which is proportionate to the size and level of investment in the scheme as per DfT guidance and a summary is presented in Table 40.

Table 40: Summary of monitoring and evaluation plan

Group	Metric	Measurement & evaluation approach
Scheme Build	Programme	The scheme delivery process will be monitored against the proposed delivery programme put forward as part of the Best and Final Funding Bid / confirmation of funding.
	Stakeholder management	The evaluation of Stakeholder management will report the approaches adopted, such as holding workshops, for engaging with statutory bodies and non- statutory stakeholders. It will also focus upon the effectiveness of engagement.
	Risk management	The effectiveness of the risk management process will be evaluated at key stages in the delivery process e.g. planning application / consent, funding / business case submissions, Gateway Reviews and during construction. This will be used to inform the overall impact of risk upon the delivery process, the appropriateness of risk assumptions within the scheme cost estimates and use of Optimism Bias uplift within the scheme appraisal.
	Scheme benefits	A comparison will be made between the scheme as originally proposed at Programme Entry versus that evolving during the Scheme Build process. This will identify whether, for example, de-scoping has occurred to keep within budgets, resulting in some beneficiaries losing out.
Delivered Scheme	Implemented Scheme	Document full description of implemented scheme; plans of the delivered scheme; plans of individual elements as required. Design team to work alongside construction team to identify and document outturn deliverable against the planned deliverables
	Changes to scheme	Identification of any changes to the scheme since funding approval. For example, changes to route and/or design of the scheme and details of the reasons for any such changes.
	Intended beneficiaries	A qualitative assessment of whether the scheme has reached the intended beneficiaries e.g. road users, pedestrians, cyclists, and developers and residents in the area. Comparison of drawings undertaken in the FBC stage against delivered scheme designs.
	Changes to mitigation	Identification of changes to mitigation measures (e.g. on landscape, noise mitigation, etc.) with a clear description of the changes and the reasons for implementation (or non-implementation).

Group	Metric	Measurement & evaluation approach
Costs	Outturn construction costs	Outturn investment costs broken down into key elements as put forward for the Major Scheme funding bid.
	Risks	Details of the manifestation of identified risks within each element of the scheme cost estimate.
	Cost savings	Identification of those cost elements with savings, and identification of the reasons for those cost savings.
	Cost over-runs	Analysis of those cost elements with overruns, and identification of the reasons for those cost overruns.
	Outturn maintenance costs	Comparison of outturn maintenance or other capital costs with those forecast analysis of any variations from forecast and any unanticipated costs identified.
Scheme Objectives	NMUs improved connectivity	Monitoring the number of pedestrian/cyclists in the first and final year can be also useful in assessing the scheme's success in achieving this objective.
	Reduced journey time	Journey time data (TrafficMaster Data) at peak times will be obtained for the baseline scenario, i.e. pre construction period, first year and final year to establish if the improvements at the Fairglen Interchange delivered the predicted outcomes to improve journey times at this location.
	Improved safety at the Interchange	The accident and casualty rates will be monitored annually using the STATS 19 accident database. It is proposed that STATS 19 data is obtained for the five years before construction and annually for each year in the monitoring period.
Travel Demand	Traffic volumes	Data collected in 2019 will be used for the baseline condition. New data will be collected for the settling down period post-construction (up to 12 months) and the longer-term impact (4 to 5 years after opening). There are three permanent sites in the study area which will be used for the post-opening assessment.
	Pedestrians and cyclist counts	Pedestrian and cycle counts will be undertaken at the proposed bridge and proposed crossing facilities at the Rayleigh Spur Roundabout. The counts would be undertaken on a weekday. Data will be analysed for Weekday AM and PM to determine level of pedestrian and cycle using the scheme.

Group	Metric	Measurement & evaluation approach
Travel Times and Reliability	Journey times surveys	Changes in journey times on the key routes passing the Fairglen Interchange will be measured using TrafficMaster data. Analysis of the data will be used to demonstrate that the scheme has reduced travel times on several key routes.
Economy	Accessibility	Qualitative assessment of how the scheme has improved access to strategic development sites in South Essex.
	Travel times	Changes in journey times will be evaluated using TrafficMaster data on various key routes. Data will be collected pre-construction and post-scheme opening (both within 1 year and 4 to 5 years after opening).
	Facilitating future growth	An assessment of built out rate for housing and the number of jobs for employment developments in the area will be undertaken to assess the impacts of the Fairglen Interchange scheme on facilitating the future growth.
Carbon	Traffic volumes	Traffic volumes will be monitored using the ATCs collected at the locations. Data will be collected pre-construction and post-scheme opening (both within 1 year and 4 to 5 years after opening). The data will be used to determine changes in traffic patterns as a result of the scheme.
	Traffic speeds	Changes in journey times will be evaluated using TrafficMaster data for the Travel Times and Reliability metric. From this, the ratio of peak hour to free-flow speeds can be derived.

6.8 Benefits Realisation Plan

The objectives and success indicators for the Scheme proposal are set out in the strategic case. Ensuring that these benefits are realised will be central to the success of the Scheme. A Benefits Realisation Plan will be developed as part of further business case development to confirm the principal benefits of the Scheme and set out in Table 41 below.

Table 41: Benefits Realisation Plan

Benefits	When delivered	Responsibility for delivery	Measurement approach
Accommodate/ manage future travel demands to facilitate proposed housing and employment growth in south Essex	Completion of full scheme	ECC	Measure traffic volumes pre and post scheme to determine traffic volumes using the scheme.
Ensure good connectivity to South Essex via key transport corridors	Completion of full scheme	ECC	Measure journey times pre and post scheme.
Improve opportunities for residents and employees in south Essex to access alternative modes and encourage their use	Completion of full scheme	ECC	Measure usage of other modes pre and post scheme.
Protect and enhance the natural, built and historic environment	During design and completion of full scheme	ECC/LPA through planning conditions	All current and emerging legislation and polices to be considered/ adhered to. Full consultation with stakeholders during the process. Air quality and noise surveys pre and post scheme.
Improve connectivity for non-motorised users through Fairglen / A130 Interchange	Completion of full scheme	ECC	Measure usage of other modes pre and post scheme.
Improve safety at Fairglen / A130 Interchange through	During design and completion	ECC/Ringway Jacobs/Jacobs	Refer to appropriate DMRB standards and utilise Road Safety Audits during

Benefits	When delivered	Responsibility for delivery	Measurement approach
appropriate geometric design, signage, speed limits and visibility	of the full scheme.		development of the design. Monitor accidents and compare with pre-scheme baseline.
Manage congestion at peak times to ensure reliable journey times through Fairglen / A130 Interchange	Completion of full scheme	ECC	Measure traffic volumes pre and post scheme to determine traffic volumes using the scheme. Measure journey times pre and post scheme.
Ensure ECC assets are appropriate for future highway network	During design	ECC/Jacobs	Refer to appropriate DMRB standards during design.
Keep Fairglen / A130 Interchange operational through improved maintenance provision and incident management	Completion of full scheme	ECC	Monitor incident response rates, and time lost due to clear up during these.

6.9 Evidence of successful project delivery

This section outlines evidence of recent and similar projects delivered by Essex County Council. A scheme-specific outline of project governance structure, programme, stakeholder communications and risk management plan are presented. These are based on established structures and processes that are currently in place for scheme currently being managed by ECC within the County. Collectively, the information demonstrates the presence of a clear management case for the scheme and that the proposals are deliverable.

The report includes three notable examples of ECC recent projects that either have been delivered or are nearing completion.

6.9.1 A414 Hastingwood to Southern Way Dualling & Hamburger

In 2009 Essex County Council successfully obtained £9.9m funding from the Homes & Communities Agency to dual the section of A414 between M111 J7 and the A1169 Southern Way. The A414 is Harlow's main link with the M11 and is used by around 50,000 motorists daily.

The scheme was comprised of the following improvements:

- Dual carriageway between M11 J7 and Southern Way.
- Right turn lane into London Road.
- Replacement underpass to provide pedestrian/cycle access to Latton Common.
- Extended underpass at Southern Way.
- Improved cycling and walking facility on western side of A414 between M11 J7 to Southern Way.
- Energy efficient lighting.

Located at the junction of the A414 with Southern Way, the 'Hamburger' layout allows the major flow of A414 traffic to travel straight across the roundabout under signal control. The Southern Way A414 scheme was delivered through the term contract with Ringway through the 'Essex County Council Highways Improvement Works'.

The scheme was completed in Spring 2011 and early benefits realisation studies found that the scheme was successful in delivering additional capacity, alleviating congestion and reducing journey times.

6.9.2 Sadler's Farm Junction Improvement

The A13/A130 Sadler's Farm junction forms part of the strategic highway network serving Thames Gateway South Essex. The scheme is an essential element of the long-term strategy for Basildon and the Thames Gateway contributing to targets for the area relating to congestion, accessibility, safety, air quality and enhanced maintenance.

Summary of the scheme:

- The creation of a dual (two-lane) carriageway link road connecting the A13 west and the A130 north.
- Widening of the A13 between Sadler's Farm Junction and Pitsea (dual two lanes to dual four lanes).
- Widening of the A130 north between the Sadler's Farm junction and Rayleigh Spur Roundabout (dual three-lane).
- Widening of the A13 (London Road) from Sadler's Farm to Tarpots Junction to four full-width lanes.
- Signalisation of Tarpots Junction.
- Public Realm works at Tarpots Junction.

- Construction of four new bridges at Church Road, Sadler's Farm, London Road and Sadler's Hall to the north of London Road.
- Additional works included the extensions to existing subways, lighting, bus priority provision and improvements to cycling and pedestrian routes.
- Overall budget for the scheme was £63m and it was funded by DfT through the Regional Growth Fund. The scheme was opened in 2012.
- The procurement strategy was Early Contractor involvement and managed by ECC. Supported by Atkins. The main works Contractor was Birse Civils supported by Mouchel.

6.9.3 Basildon Enterprise Corridor

The Basildon Enterprise Corridor comprised of road capacity improvements along Cranes Farm Road and East Mayne, together with improvement to the A1245/A127 Fairglen and the A127/A176 Noak Bridge junctions.

A suite of measures to improve traffic flow and capacity including:

- Road widening to dual carriageway standard.
- Automate queue detection and advance warning signs on the slip lanes.
- Dedicated left turn lanes.
- Widening of roundabout approaches.
- Improved signage and improvements to existing footpath and footbridge.
- Installation of full-time responsive traffic lights.
- Safer walking routes north and south of the roundabout junctions.
- Junction improvements for reduced congestion.
- New freight routing strategy.
- New and upgraded crossings.
- Cycleway improvements.

The overall budget for the scheme was £15m and was funded by ECC and Government funding from the Community Infrastructure Fund. The scheme was opened in 2011.

7 Appendix A – Risk Register – redacted

8 Appendix B – Appraisal Summary Table

Appraisal Summary Table			Date produced:	24	8	2020	Contact:	
Name of scheme:							Name	
Description of scheme:							Organisation	
							Role	Promoter/Official

Impacts		Summary of key impacts	Assessment					
			Quantitative			Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme generates significant journey time savings of £39.9m, for business trips, due to reduced congestion at the A127 Fairglen Interchange particularly by introducing a new link road from the A130 to the A1245 as well as the free flow left turn from the A1245 north to the A127 east. The time benefits are highest (67%) at the level with more than 5 minutes of travel time saving. The scheme also produces a benefit of £7.2m through a decrease in Vehicle Operating Costs for business users, adding to the scheme net benefit for VOC (£11.0m). The impacts of construction activities on the highway users are expected to be insignificant, since there will be no lane closure during day time hours. Moreover, since the A127 Fairglen Interchange is an existing junction, with the scheme in place, it is unlikely that more traffic will be affected, or higher delays are imposed to the road uses due to maintenance works, compared to the situation without the scheme. Therefore, user impacts during construction and maintenance activities are not monetised.	Value of journey time changes(£): £39.9m Net journey time changes (£) 0 to 2min: £6.1m 2 to 5min: £6.9m > 5min: £26.9m			N/A	£47.2m	N/A
	Reliability impact on Business users	Journey time reliability (JTR) has not been monetised for the A127 Fairglen Interchange. The increased capacity would lead to more predictable journey times, reduce driver stress, and create a more reliable route for business users. Based on the comparison of modelled journey time standard deviation between the Do Minimum and Do Something scenarios, it is expected that the scheme's impact on the JTR will beneutral or positive on majority of the routes. Overall, on average across all routes, there will be slight improvement on JTR on the study area routes with the implementation of the scheme.	N/A			Slight Beneficial	N/A	
	Regeneration	N/A	N/A			N/A	N/A	
	Wider Impacts	Increased capacity at the A127 Fairglen Interchange will result in shorter and more reliable journey times on majority of the routes passing through the scheme. Reduced congestion would allow developments to proceed and lead to economic growth in the area, as well as benefit seasonal tourism. As per TAG Unit 2.2 (paragraph) 4.3.1, the additional welfare effects are estimated by applying a 10% uplift factor to the business and freight user benefits (from TUBA). The result of this uplift is £4.7m.	£4.7m			N/A	£4.7m	
Environmental	Noise	The scheme would result in negligible effects in the noise environment for the majority of receptors in the study area with no significant adverse effects predicted. 4 properties are predicted to experience significant benefits in the short-term and 3 properties in the long-term. No instances of noise levels greater than 80 dB LAeq,16h have been predicted.	Households experiencing increased daytime noise in forecast year: 10 Households experiencing reduced daytime noise in forecast year: 10 Households experiencing increased night time noise in			Not applicable (ref: Unit A3, para 2.4.2)	£26,345	N/A
	Air Quality	Likely to result in an overall beneficial monetary value. Upper and lower bounds estimate £942,297 and -£9,051 variation on NPV. The scheme aims to improve congestion around the interchange and generally results in lower emissions around the junction. Note that the emission factors post 2030 assume the same emissions per vehicle as per 2030 (as per Defra EFT) and therefore represent a worst-case approach - this is in line with WebTAG guidance.	Change in PM2.5 emissions over 60 year appraisal period (tonnes) = 3 Change in NOX emissions over 60 year appraisal period (tonnes) = - 83				$PM_{2.5}$ = - £231,938 NO_X = £433,327 Total = £201,390	N/A
	Greenhouse gases	Likely to result in an overall beneficial monetary value. Upper and lower bounds estimate +/- £4,884,872 variation on NPV. The forecast traffic data is for 2037, however the latest year that best practice tools (Emission Factor Toolkit V9.0) have CO_2 emissions data for is 2030. By 2037, improved vehicular technologies should see the contributions become smaller than currently predicted reducing the Carbon impact of the scheme. The carbon emissions have been calculated for the whole of the traffic reliability area.	Change in non-traded carbon over 60y (CO2e): -206,302 Change in traded carbon over 60y (CO2e): 0				£9,091,096	

Impacts		Summary of key impacts	Assessment			
			Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
	Landscape	The majority of the proposed scheme is within the existing highway boundary. However there would be loss of some woodland and hedgerows.The proposed link road would occupy an area of existing grassland, scrub and trees adacent to Rayleigh Main Substation. Due to the proximity of the existing highway infrastucture and the retention of views across or through new road elements, there is unlikely to be a decrease in the openness or change in the character of the landscape due to the scheme proposal. Assumed replacement mitigation tree and shrub planting would provide a visual screen by year 15 after construction for properties close to the development. The landscape character of the area is already heavily influenced by major road infrastructure, therefore changes to landscape features are unlikely.		Neutral		
	Townscape	N/a- The scheme is not within an urban environment		N/a		
	Historic Environment	Potential adverse physical impacts are predicted on known and unknown archaeological remains that may extend within the footprint of the proposed scheme. A medieval ridge and furrow system (Asset 15) is the only recorded archaeological remain within the proposed redline boundary and will likely experience physical impacts during the construction; these impacts can be mitigated by recording and dissemination of the results. There is the potential for remains associated with the Roman occupation (Asset 3) and Prehistoric occupation (Asset 5) to be encountered during construction, again, this impact can be mitigated by excavation, recording and dissemination of the results. No physical impacts are predicted on historic buildings or historic landscapes during construction. While there will be changes to the settings of these assets during the construction and operation of the proposed, the existing road network and electrical infrastructure already impacts the setting of historic buildings and landscapes; the changes resulting from the proposed scheme will be result in a negligible impact to the		Slight adverse (negative) effect		
	Biodiversity	Temporary and permanent habitat loss associated with site preparation works would impact Priority Habitats, Important Hedgerows and protected species. Priority Habitats that would be impacted include arable field margins, broad-leaved woodland, hedgerows and watercourses. Protected species would also be impacted by temporary and permanent habitat loss and site works required for construction of the Proposed Scheme. Species known to be present in the working footprint include bats, breeding birds, GCN and reptiles. Badger have been recorded in proximity to the scheme but recent surveys indicate the setts are now vacant. For the purpose of this assessment badger are therefore considered present. Water vole have not been confirmed within the working footprint of the scheme but have been considered in this assessment asfollowing the precautionary approach as survey data could not confirm absence. Mitigation and avoidance measures required to ensure there are no significant negative effects on species and habitats. Through the implementation of the proposed mitigation measures set out there would likely be no negative impact on any sensitive biodiversity receptors.		Slight adverse (negative) effect		
	Water Environment	Study area: The proposed scheme would interact with a network of unnamed Ordinary Watercourses and ponds. There would be the potential to alter overland flow paths, physically modify the channels, and for spillages to impact water quality. Flood Risk: The proposed scheme would intersect areas already at risk of surface water and fluvial flooding, placing the proposed scheme and consequently surrounding receptors at high risk of flooding. Increases in the impermeable surface area would like increase the volumes and rate of surface water runoff. Mitigation would be provided through compensatory flood storage and the implementation of a drainage strategy. Geomorphology: During construction, suspended solids could be introduced to surface water bodies. Mitigation would be provided through adherence to the OEMP. Operational impacts would be limited to construction of a new embankment and culvert associated with the Link Road and embankment widening elsewhere resulting in lengthening of existing culverts. Adherence to best practice culvert design is proposed to limit impacts to hydromorphology. Water Quality: During construction, suspended solids/polluting substances could be introduced to surface water bodies. Mitigation would be provided through adherence to the OEMP. A SWMMP will be produced to monitor potential adverse impacts to the chemical and physical quality of selected surface water courses during and immediately after construction.		Slight adverse (negative) effect		

Impacts		Summary of key impacts	Assessment					
			Quantitative			Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Social	Commuting and Other users	The scheme generates significant journey time savings of £56.7m, for commuting and other users, due to reduced congestion at the A127 Fairglen Interchange particularly by introducing a new link road from the A130 to the A1245 as well as the free flow left turn from the A1245 north to the A127 east. The time benefits are highest (65%) at the level with more than 5 minutes of travel time saving. The scheme also produces a net benefit of £3.8m through a decrease in Vehicle Operating Costs for business users, adding to the scheme net benefit for VOC (£11.0m). The impacts of construction activities on the highway users are expected to be insignificant, since there will be no lane closure during day time hours. Moreover, since the A127 Fairglen Interchange is an existing junction, with the scheme in place, it is unlikely that more traffic will be affected, or higher delays are imposed to the road uses due to maintenance works, compared to the situation without the scheme. Therefore, user impacts during construction and maintenance activities are not monetised.	Value of journey time changes(£) £56.7m Net journey time changes (£) 0 to 2min: £6.8m; 2 to 5min: £13.0m; > 5min: £36.9m			N/A	£60.5m	N/A
	Reliability impact on Commuting and Other users	Journey time reliability (JTR) has not been monetised for the A127 Fairglen Interchange. The increased capacity would lead to more predictable journey times, reduce driver stress, and create a more reliable route for commuting and other users. Based on the comparison of modelled journey time standard deviation between the Do Minimum and Do Something scenarios, it is expected that the scheme's impact on the JTR will beneutral or positive on majority of the routes. Overall, on average across all routes, there will be slight improvement on JTR on the study area routes with the implementation of the scheme.	N/A			Slight Beneficial	N/A	
	Physical activity	The scheme is expected to have a positive impact on physical activity. As part of the scheme, a segregated shared use foot bridge and path for Non-Motorised Users (NMU) will be provided connecting both the A127 Fairglen junction and Rayleigh Spur roundabout to the existing footpath. Uncontrolled and signalised pedestrian crossings will also be provided at the junction approaches at Rayleigh Spur roundabout. Provision of these facilities and a more pleasant environment for these road users during operation could increase cycling and walking levels, and improve physical activity of the users.	N/A			Slight Beneficial	N/A	
	Journey quality	Views from the road would not be expected to be significantly different from existing views. Once in operation the scheme would be expected to reduce journey times for motorised-traffic on the A127 Fairglen Interchange. Improvements to Public Right of Way (PRoW) with the provision of shared use path facilities could result in journey times for Non-Motorised Users (NMU) being improved.	N/A			N/A	N/A	
	Accidents	COBALT analysis indicates that there would be a reduction in accidents due to the scheme on majority of existing links and on both Fairglen and Rayleigh Spur Roundabouts. The analysis, however, shows that overall there will be slight increase in accidents largely due to the introduction of the new link road and the new signalised junction on the A1245 north. There will be a reduction of 2 fatal accidents during the 60-year appraisal period f the scheme.	Change in total number of accidents: +81 Change in number of casualties: Fatal= -2 Serious= +2 Slight= +179			N/A	-£0.97m	N/A
	Security	There is no expected change in perceptions of security with the scheme.	N/A			N/A	N/A	N/A
	Access to services	There is no expected change in access to services as a result of the scheme.	N/A			N/A	N/A	N/A
	Affordability	The scheme does not propose any changes to any form of Public Transport and its associated fare structures. However, the scheme is expected to result in a decrease in Vehicle Operating Costs. Overall the impact is considered slight beneficial.	N/A			Slight Beneficial	N/A	N/A
	Severance	The level of severance would not significantly change as a result of the scheme. New footpaths will be produced and where required, uncontrolled/signalised crossing facilities will be integrated into the scheme to prevent severance in the area. Existing roads would be incorporated into the scheme, allowing for crossing points within the design to facilitate travel between the two areas at either side of the scheme.	N/A			Slight Beneficial	N/A	N/A
	Option and non-use values	The scheme would not involve the loss or introduction of a new mode of transport, therefore option values are unaffected. The alternative modes of transport available to households would be based around rail and bus services.	N/A			N/A	N/A	
Public Accounts	Cost to Broad Transport Budget	For the purposes of the Economic Assessment and the generation of the BCR, costs and contributions are discounted to 2010 prices and exclude the costs already incurred. The scheme is funded through central government funds.	Central Government costs are £16.45m			Neutral	PVC = £16.45m	
	Indirect Tax Revenues	There would be a decrease in tax being paid to the Exchequer due to reduction in VOC.	Central Government Wider Finances: £4.88m			Not Applicable	PVB = £4.88m	