CONNECTED SOUTHAMPTON

Transport Strategy 2040

Southampton Zero Emission Bus Region Area (ZEBRA) Proposal

Full Business Case

Southampton City Council
Go South Coast
University of Southampton
With **AECOM** & **Evenergi**

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Connecting Southampton 2040

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Project Overview

This Full Business Case (FBC) has been prepared to support Southampton City Council's (SCC) application to the Department for Transport's (DfT) Zero Emission Bus Regional Area (ZEBRA) funding source.

The FBC sets out the case for why there should be investment in zero emission buses in Southampton now. It sets out that the proposal is to deliver zero emission buses to operate on the UniLink bus services between Southampton City Centre, the University of Southampton, University Hospital Southampton, Southampton Airport, and areas of Portswood and Swaythling.

SCC has worked with bus operator Go South Coast (GSC) and the University of Southampton (UoS) to develop this FBC following an Expression of Interest submitted in June 2021 which was successful in moving forward to the next phase co-developing the bid with the DfT.

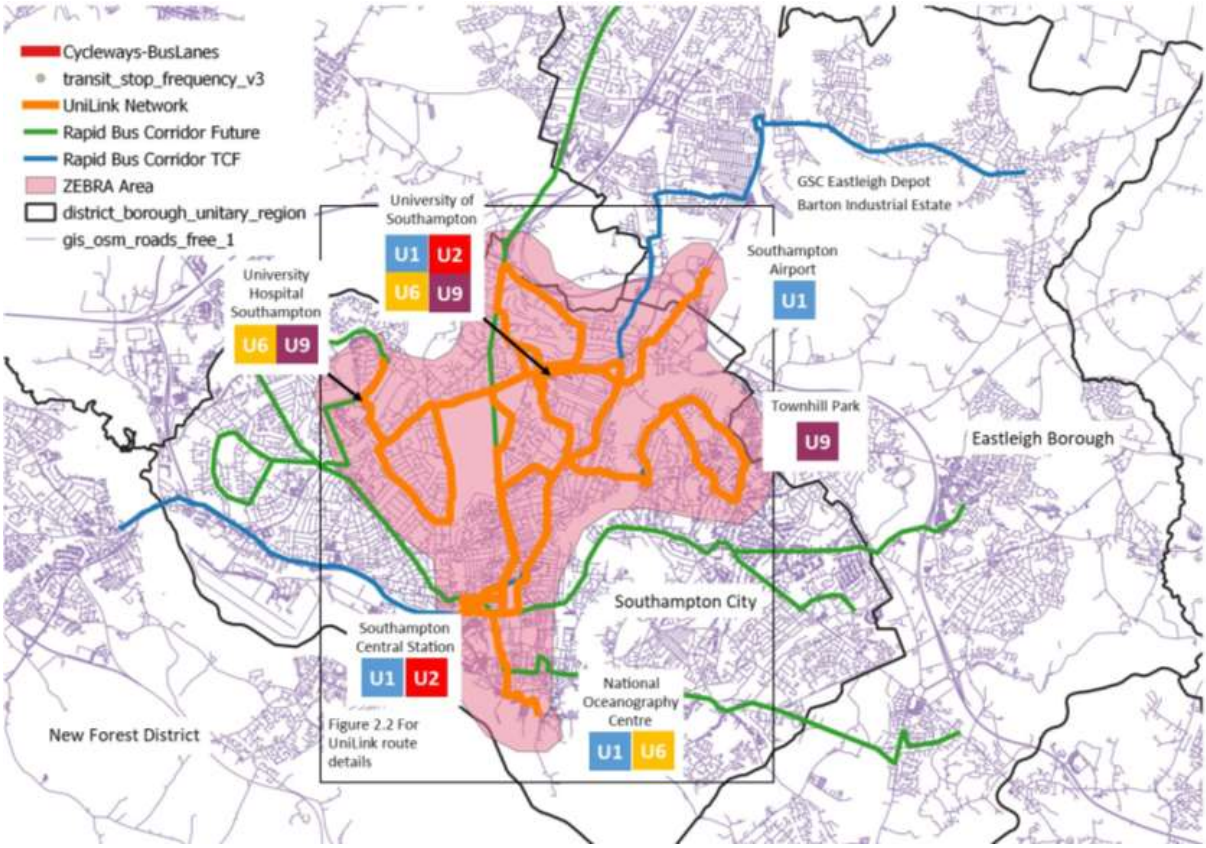


Figure 1 The Southampton ZEBRA Area

Why Southampton Now?

Southampton is at a key point in its journey to be net zero by 2050. The City Council, partners such as bus operators and the University are committing to be carbon neutral in the coming years. The UniLink network is a distinct bus network within Southampton that is contracted by the University of Southampton that provides a network of four bus routes that are available to students and the wider public.

Southampton has some acute air quality problems, being identified by DEFRA as one of the initial areas required to develop a Clean Air Plan by 2020. This has been adopted by the Council and introducing the first zero emission buses would start the transition from existing diesel fleets to zero emission. It would help with supporting the introduction of zero emission buses as part of the Government's commitment to introduce 4,000 zero emission buses,

improving the transport experience for the user with highest specification vehicles that will encourage more people to use the bus, and reduce health inequalities by improving air quality along some of Southampton's busiest roads.

This is an opportunity for Southampton to be at the vanguard of transition to zero emission buses, and the learning from this project can be shared with other operators, the Department and neighbouring authorities. Southampton is about to enter an Enhanced Bus Partnership that will include a commitment to introduce zero emission buses in the city by 2030.

Changes from EOI Stage

Since the submission of the EoI in June 2021 there have been changes to the Southampton ZEBRA project. The total number of buses and the routes chosen remain the same.

Following market engagement, modelling and further investigation into local electrical grid capacity the total value of the bid has increased from £16.329m to £22.588m – an increase of £6.259m. This will be an additional £3.567m of ZEBRA grant ask, and [redacted] of local match funding from bus operators, the Council and the University.

This increase has been the result of:

- Market engagement with five bus manufacturers to identify the proposed vehicle that will be used, confirmation of the specifications with them and issuing of a formal quotation. The initial price was based on initial enquiries by GSC. The confirmation of the high specifications to meet local operational needs and PSVAR requirements for the buses (double doors, next stop audio & visual announcements, USB, WiFi, livery etc) has increased the price;
- In depth real world modelling in liaison with Wrightbus has identified that a larger battery pack ([redacted]) is required to best meet the requirements of the Southampton operation. GSC have taken the opportunity to model several of the routes in both differing weather conditions and passenger loads to provide confidence the battery capacity of the vehicle can operate the routes without requirement for opportunity charging and completing an 18hr day operation on one charge without the need to swap for a diesel;
- Detailed assessment by SSE and the DNO into the off-site electrical connections to GSC's Eastleigh depot identified that further infrastructure work is required, and that there is a local network constraint to supply. This requires additional funding as it will help to increase the local electricity supply and pump prime any further investment in electric buses in GSC's fleet that operate from Eastleigh. The connection request is subject to an application to the National Grid, due to existing constraints which cannot be qualified unless a connection application is made. The total cost of the on-site infrastructure has increased to £[redacted]. This work is required to be done to provide the necessary power supply to the GSC's Eastleigh depot for the 16 chargers.
- This has had an impact on the BCR, which is now calculated to be 0.19. This is primarily been affected by the increases in the infrastructure costs. While representing a poor value for money category we feel that the wider benefits of the project to air quality, bus experience in Southampton, and improving people's lives outweigh this.

The impact of this is summarised in Table 1

	EoI Costs (£ms)				FBC Costs (£ms)			
Element	**Total**	**DfT Ask**	**GSC**	**Third Party**	**Total**	**DfT Ask**	**GSC**	**Third Party**
Buses	14.944	5.208	[redacted]	[redacted]	18.297	6.588	[redacted]	[redacted]

Infrastructure	1.385	1.031	[redacted]	4.291	3.217	[redacted]	
Total Project Cost	**16.329**	**6.239**	**10.082**	**22.588**	**9.806**	**12.784**	

Table 1 Southampton ZEBRA Changes from EoI

Strategic Case

The Southampton ZEBRA project is aiming to deliver the following using ZEBRA funding, bus operator funding and third party match funding:

- 32 all-electric double deck double door zero-emission Wrightbus Streetbus BEV buses to operate on the UniLink bus network in Southampton. These would replace the existing 32 Euro VI double decker buses that are currently used;
- 16 dual aspect electric bus charge points and associated management system at Go South Coast's bus depot in Eastleigh; and
- Provision of electrical infrastructure suitable to connect the depot and chargers to the National Grid, with this being provided by Scottish & Southern Electric (SSE).

Further to this the partners are committed to deliver the following with funding not provided by ZEBRA:

- Battery replacement for the 32 ZEBRA funded buses in year 8 (GSC funded).

SCC would be the grant administrator and GSC would lead on the procurement of the vehicles and charging infrastructure.

The strategic context and case for change for the Southampton ZEBRA project is:

- Southampton is a growing city with bold ambitions for the future, however there are pockets of deprivation that are affected by poor health inequalities which can be exacerbated by poor air quality. Investing in buses, including on existing routes, will support levelling up within Southampton by connecting people with where they want to go in a clean way;
- There is an air quality problem in Southampton, the Council has been mandated to reduce NOx emissions in the city in the shortest possible time, investing in zero emission buses forms part of the policy approach set out in the Corporate Plan, LTP, and Greener City Plan;
- The UniLink network connects the City Centre with the University, Port, Airport, main hospitals and some of Southampton's deprived areas, and with ZEBRA investment, 14% of Southampton's bus network would be zero emission by 2023, which carries 20% of the city's bus patronage;

- This supports the Government's ZEBRA objectives by introducing 32 zero emission buses in Southampton as part of the 4,000 new zero emission buses, which will be the start of the transition to zero emission making a real step change in provision and decarbonisation of transport. It will provide evidence on how to introduce zero emission buses and supporting the UK bus manufacturing industry with introducing a newer model;
- This will continue the close partnership working between the City Council, the local bus operators and the University of Southampton – ensuring that partners work together to a shared vision;
- The University of Southampton is one of the UK's top research universities and a member of the Russell Group. Over the coming decade the University is planning to invest approximately £300m in its estate to improve the quality of the teaching spaces and student experience. This is particularly key in the recovery from the Covid pandemic. The University has strong links with the National Oceanography Centre (NOC) in the Port's Eastern Docks and University Hospital Southampton;
- The project will seek to improve transport for the user with buses are a new model with larger batteries than standard to ensure longevity, they will be of the highest quality with USB charging, WiFi, Tap On Tap Off readers for capped fare, disabled and dementia friendly vehicles with double doors that aid with fast loading and unloading reducing dwell time at stops;
- The new buses will be supported by a package of bus priority measures, bus stop upgrades, real time information provision and integration with other modes through the Southampton TCF programme for Portswood and at Southampton Central Station by 2023, and the launch of the Solent MaaS project (the first outside an ITA) in 2022; and
- This is an innovative bid that will make use of the University as an academic assessor and that the learning from the project can be shared across with Government, other local authorities and bus operators.

Economic Case

The project has been appraised using the DfT's Green Bus Model (GBM) to provide a core appraisal benefit-cost ration (BCR).

The core appraisal BCR as taken from the GBM is **0.19**. However, this is not considered to reflect the 'true' value of the scheme.

There are aspects within the GBM which are contrary to existing Government guidance on transport appraisal, which have the impact of reducing benefits and increasing costs;

- JAQU guidance is that a real year on year growth in damage cost valuations of 2% per annum should be included, but this is set to the default GM selection 0% - assigning this to 2% would increase the damage cost related benefits; and
- TAG guidance is that contingency costs should not be included in the economic case, but this instruction for this submission has been to include contingency costs, increasing the net scheme costs.

From a scheme costs perspective, the approach which has been identified to take is to include all infrastructure costs. However, some of these infrastructure cost items will have lifespans significantly beyond the lifespan of the proposed fleet renewal iteration. Government has imposed a ban on the sale of new diesel car and van vehicles from 2030 and is currently consulting with respect to HGVs and buses. Southampton is pursuing an Enhanced Bus Partnership, which stems from the adopted BSIP with a goal of having a zero emission bus fleet by 2030. It is clear that the medium to long term trend will be an industry-wide transition to electric vehicles – what this current funding scheme does is to help bring forwards that industry transition. Therefore, the infrastructure which supports this proposal and lasts beyond the current fleet, will represent a cost saving for future bus services which have otherwise had to install the same infrastructure at a later

date. Similarly, some of the grid strengthened and charging spare capacity will support other electricity users. On this basis, it is estimated that only 46% of infrastructure costs are attributable solely to the proposed fleet upgrade. This alone increases the BCR to **0.46** and an NPV of -£5.3m.

There are broader benefits also to be taken into consideration, some of which are generic for the replacement of older diesel powered buses with newer electric vehicles.

Government guidance is that "*impacts on noise are fully considered in decision making for any policy, programme or project*", identifying that the annual social cost of urban road noise in England is £7 billion to £10 billion, compared to an impact on climate change of £1 billion to £4 billion. In this context, noise related costs associated with road traffic may therefore be twice the climate related impact.

Government's carbon emissions cost impact unit values are estimated via a "target-consistent" carbon valuation approach. They are estimated by considering the level of marginal abatement costs required to reach the targets that the UK has adopted at a UK and international level, as such, the scheme's carbon impact estimation reflects the scheme's climate impact.

The carbon related benefit associated with the core scenario of this proposal, as estimated within the GBM, is £5.3m and the NPV in the core scenario is -£9.85m. However, while the GBM includes approximations for carbon cost change and other monetised impacts, there is no approximation for noise impact change. Inclusion of noise abatement benefits could have a significant impact on the NPV. A high level estimate of the monetary benefit associated with transferring from diesel to electric vehicles as within this proposal, suggest it could largely offset the negative NPV amount in the core scenario. Under the infrastructure cost adjustment test, the NPV improves to -£5.3m, making it increasingly likely that a positive NPV and BCR > 1.0 could be achieved with the monetisation of noise abatement benefits.

Softer impacts such as ride quality improvements associated with reduced noise, increase the perceived value of travelling by bus, which can in turn result in a transfer from car, reducing congestion and environmental impacts associated with car use, as well as increasing bus revenue.

With respect to the Southampton scheme, an increase in demand has the future potential to be used to increase the use of the identified vehicles, which would in turn could increase the average distance travelled per annum per bus, which is a key variable within the GBM's determination of the end BCR. Southampton's submission currently has a lower than average bus distance per annum value for the proposed scheme routes, which suggests potential scope for this to be increased in the future.

Additional considerations are the strategic benefits which investment in Southampton's first electric buses would bring;

- Southampton has sought to comply with Government's instruction with respect to a Clean Air Plan and achieving NO^2 concentrations at Government target levels within the shortest possible time – this proposal will support with that goal.
- Further, Southampton has areas of higher than average deprivation levels, with low car affordability, so the local population is at a relative disadvantage of being able to support Government's aims to reduce transport emissions individually – investing in electric buses in Southampton will therefore support the Government's 'levelling up' agenda.
- The routes are of strategic importance from a business perspective, linking key ports and airports, which can foster high value jobs growth.
- Southampton University plays an important role in transport related research. Without local case studies and partners to work with in respect to the exploration of the impacts of electric buses, it risks hindering the University's beneficial contribution in

further developing the knowledge around this field. That could in turn hinder future development and value for money associated with such projects in general.

- The grant ask represents approximately a third of the total costs, with the remainder being contributed by the operator, University and Southampton Council, this high local contribution represents the confidence in the schemes true value.

Sensitivity testing shows a range of potential BCR values, with the upper end indicating a value of **1.14**. If noise abatement benefits, were included with the scenario of offset infrastructure costs, it is likely that without any additional reconsideration of benefits, such as the Government's recommended real growth in health damage impact values, a BCR of over 1.0 could be realistically achieved.

Taking the above into account, as well as the wider Strategic Case discussion, the scheme is therefore considered to be able to achieve at least low value for money and potentially greater.

Commercial Case

Procurement of the directly owned assets (the vehicles, charging infrastructure (in depot and on-street), and the electrical connection) will be carried out by GSC using their own in house corporate procurement process, policies and specification. Due to the significant levels of funding the operator is providing to the project this will need to be in line with their own procurement policies and approvals. This will consider wider Go-Ahead Group (GAG) objectives to ensure flexibility, bulk procurement benefits and fleet-wide management benefits.

All the vehicles and infrastructure assets will be owned by GSC as the bus operator. This will include maintenance and renewals. This route has been chosen as this reduces the risk and timescales for the Council compared to owning and leasing the vehicles.

The vehicles are specific to the UniLink fleet and at the end of the contract (currently 2027) they would be transferred to the new operator, or would be absorbed into the wider GSC Southampton fleet. This would ensure that the zero emission benefits are retained in Southampton.

There will be three separate tender projects for each depot to meet the ZEBRA requirements. These are:

1) Procurement of New Electric Buses (EBs) – all double deck double door buses;
2) Procurement of Electrical Charging Equipment – DC smart chargers to better enable fast electric charge; and
3) Procurement of power supplies and associated civils works – through co-development with IDNO provider to minimise DNO risk.

For the buses GSC will use their existing New Vehicle Framework Agreements that are agreed annually with all UK bus manufacturer suppliers. GSC intend to run mini tenders using these frameworks to maximise value for money but are using the current quoted prices mechanism to inform this submission.

To deliver the 32 all-electric zero-emission buses and the 16 in depot chargers Go South Coast, University of Southampton and SCC have carried out market engagement with bus manufacturers, Direct Network Operators (DNOs), infrastructure suppliers and neighbouring Local Authorities (Hampshire County and Eastleigh Borough Councils).

Market engagement for procurement at the local level will be run in conjunction with Go-Ahead Group Procurement and Property teams to ensure all necessary governance and compliance issues are addressed. There is a separate contract being signed with an electric supplier and once this is signed the supplier will confirm compound requirements, and these will be appropriately developed into a tender pack. The provision for future expansion will also be considered.

Financial Case

The Southampton ZEBRA proposal costs total £22,588,000 with [redacted] for purchase of the 32 all electric double deck buses and [redacted] for the infrastructure of 16 In-Depot chargers plus on and off site electrical connections and [redacted] for ongoing costs.

The total ZEBRA Grant funding requested on this proposal is £9,805,720 with [redacted] allocated to vehicles and [redacted] to infrastructure.

Match funding from the bus operators, Southampton City Council and the University of Southampton totals £12,782,820. This matching fund is split bus operator Go South Coast [redacted]), Southampton City Council [redacted]), and the University of Southampton [redacted]) respectively. Go South Coast is committed to the underwriting of the additional funding required over and above the ZEBRA grant to purchase electric buses for the respective services.

Numbers in Tables are subject to rounding so may not add.

Element	Description	ZEBRA Ask	Bus Operator Funding	SCC Funding	UoS Funding	Total Cost
		£m				
Vehicles	32 Wrightbus Streetdeck Electroliner BEV (454kWH) Double Deck Electric Buses	6.588	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	16 in Depot SWARCO chargers and on & off site electrical connections	3.217	[redacted]	[redacted]	[redacted]	[redacted]
Total		**9.805**	**12.784**			**22.588**

Table 2 Funding Summary

The funding includes

- Battery replacement costs of £[redacted] at 8 years funded by GSC; and
- Diesel bus costs (to be used in grant calculations) of [redacted].

Local Contributions and Third Party funding is from Southampton City Council and the University of Southampton.

<u>Zero Emission Buses</u>

The project is aiming to deliver 32 all-electric double door double deck buses on the UniLink network in Southampton. Extensive market engagement (as set out in 4.4.1) has been carried out by GSC with four UK bus manufacturers. The chosen vehicle will be a Wrightbus [redacted] with Wheelchair access via ramp. Buses have cost of [redacted]. A total cost for 32 buses of [redacted], with 3% risk contingency this increases to [redacted] An equivalent ICE diesel double decker costs £[redacted]. This provides a gap of [redacted] between cost of a replacement ICE diesel and the electric bus.

This is excluding battery replacement costs at year 8.

Bus Price	No of Buses	Total (inc. 3% risk)
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]

Table 3 Bus Price Breakdown

Infrastructure

The project will deliver 16 dual outlet DC in-depot rapid charging chargers at GSC's Eastleigh depot.

GSC have carried out market engagement with charging infrastructure suppliers. The chosen supplier is SWARCO and product [redacted]. Each charger charges two buses and this can take 3-4 hours to get to full charge. These cost [redacted] inclusive of commissioning, delivery, service plan and 'E-connect Fleet' app. This is a total of in depot charging of [redacted].

On and off-site connections have been discussed with the DNO – SSE – and have provided costs for both electrical connections required. The off-site connection is [redacted] and on-site is [redacted]. This includes project management costs for SSE, surveys, design of site and infrastructure specifications, construction and installation of the chargers, installation of data comms, and then commissioning of all units and comms.

The total infrastructure cost is [redacted] – inclusive of 3% risk contingency.

Infrastructure	£m	Note
In Depot Chargers (16 double chargers)	[redacted]	Supplier (SWARCO) estimate
Off-site electrical connection	[redacted]	Based on 'All Electric Bus Towns' bid + 25% contingency
On-site electrical connection	[redacted]	SSE estimate based on discussions with National Grid and a risk based quotation that is in advance of an application to get a firmer cost which is being progressed following submission of Business Case.
Total Cost	**4.290**	
ZEBRA Grant Request (75%)	3.217	
Local Match Funding (25%)	1.072	

Table 4 Infrastructure Cost Breakdown

If GSC were to lose the UniLink contract the vehicles, chargers and infrastructure at the depot would transfer to the new operator, or by agreement with the Council and University would be redistributed within their Southampton operations.

Financial risks have been considered in the development of the financial model. These include future patronage in recovery of Covid, utilisation, governance, energy costs & supply, delay of start, approvals and reputation.

Management Case

A Southampton ZEBRA governance structure has been developed to allow for decision making and approvals for the delivery of the buses and infrastructure. Southampton City Council will be the Accountable Body, and all partners good experience in delivering transformative transport projects in Southampton to timescale and specification;

The Senior Responsible Officer (SRO) the Head of Green City & Infrastructure and the ZEBRA project lead will be based within the Green City & Infrastructure Service. There will be a ZEBRA Steering Board for strategic direction and will be chaired by the SCC Executive Director for Place and has senior representation from SCC, bus operator and the University of Southampton. A Project Board will manage the day-to-day running of the project and will be made up of team members from SCC, University and bus operators including members from the project team, finance, legal and communications & marketing. This demonstrates that the project team is experienced, resourced and has access to expertise to deliver the project.

An approvals and assurance process is in place to deliver the project within SCC and GSC.

A robust and systematic risk management strategy has been developed to identify, analyse, plan and manage risk which will be applied throughout the life of the Southampton ZEBRA project.

The current risk register contains a total of 22 live risks which remain open.

The risk register provides a snapshot of the risks at the current stage of development of the project and will be kept under continuous and regular review throughout the project development.

An ambitious project plan has been developed showing the delivery timescales for the charging infrastructure and new energy infrastructure. There are clear interdependencies between each of these which are brought out in this section.

The key dates are:

- Award of funding March 2022;
- Procurement and finalisation of specifications for buses and chargers, including outcome of MOD application to National Grid May 2022;
- Manufacturing of buses June-August 2022;
- Delivery of the chargers and electrical connection Summer 2022; and
- Phased delivery of buses August-October 2022.

This plan is ambitious and has been designed to coincide with the start of the 2022/23 Academic Year at the University to maximise the impact of the new vehicles at a crucial point in people's lives embedding sustainable travel habits.

A robust monitoring & evaluation plan has been developed that will provide the evidence and learning to the DfT. This will be led by the University of Southampton's Transport Research Group and will assess against wider ZEBRA, DfT and local objectives, and understanding of how a zero emission fleet can be introduced that can support their wider roll out in Southampton and rest of country.

1 Introduction

1.1 Overview

This Full Business Case has been prepared to support Southampton City Council's (SCC) bid to the Department for Transport's (DfT) Zero Emission Bus Regional Area (ZEBRA) funding source.

The Business Case sets out the case for investment to replace the entire UniLink bus fleet in Southampton. This will replace existing Euro VI diesel buses with 32 brand new all-electric double deck double door Wrightbus Streetbus BEV buses. The project includes 16 new dual point SWARCO in depot chargers and on and off-site electrical connections at the bus operator, Go South Coast, depot in Eastleigh. The details on why the project is required, what it will deliver, how it provides value for money, how it will be delivered and managed is set out in this document.

The Business Case has been prepared in partnership between:

- Southampton City Council,
- the University of Southampton (UoS),
- Go South Coast (GSC) – who are part of the Go-Ahead Group and operates the UniLink brand (contracted by University of Southampton), as well as the Bluestar, Quay Connect and Salisbury Reds services in and around Southampton, and
- The Department for Transport (DfT).

1.2 Five Case Business Case Model

The HM Treasury 'Five Case' business case process has been undertaken for the Southampton ZEBRA project, covering the following:

1 Strategic Case – setting out the reasons and rationale why the project is required, its justification, the case for change based on problems it is trying to solve, the objectives, and identifies the core project options;
2 Economic Case – presents the Value for Money using the Green Bus Tool;
3 Commercial Case – presents how the promoting authority, SCC, will comply with regards to procurement, risk, contracts, and human resources;
4 Financial Case – presents the costs and how the project is going to be funded, including match funding from other parties; and
5 Management Case – presents the project programme, the governance and monitoring arrangements in place to give the project sufficient direction and assurance.

Using this 'Five Case' approach will provide DfT with the confidence and assurance that through the business case Southampton's proposal is a viable and worthwhile project, and that guarantee has been provided regarding the ability for SCC to deliver the scheme.

2 Strategic Case

2.1 Overview

This section will set out the Strategic Case for why the DfT should invest in the Southampton ZEBRA project. It defines the geography and scope of the Southampton ZEBRA project, Southampton's transport network and its bus network.

It will:

- Define the geography of the Southampton ZEBRA project and Southampton's existing transport networks, travel patterns, and bus network (2.3 and 2.4);
- How this fits with wider transport and air quality policies (2.4);
- It sets out the strategic case for change and Southampton's ambition identifying what the drivers are, how the project will delivery on them and how it fits with local transport ambitions (2.5);
- It sets out the scheme context, objectives and how these align with local and DfT objectives (2.6);
- The identification of the preferred option (2.7); and
- The level of support from stakeholders (2.8).

2.2 Project Summary

Southampton City Council (SCC) is working with bus operator Go South Coast (GSC) and the University of Southampton (UoS) to submit a Business Case to the Department for Transport's (DfT) ZEBRA (Zero-Emission Bus) Fund. This follows an Expression of Interest submitted in June 2021 which was successful in moving forward to the next phase co-developing the bid with the DfT.

Through the Southampton ZEBRA proposal we will be delivering the following using ZEBRA funding, bus operator funding and third party match funding:

- 32 all-electric double deck double door zero-emission Wrightbus Streetbus BEV buses to operate on the UniLink bus network in Southampton. These would replace the existing 32 Euro VI double decker buses that are currently used;
- 16 dual aspect electric bus charge points and associated management system at Go South Coast's bus depot in Eastleigh; and
- Provision of electrical infrastructure suitable to connect the depot and chargers to the National Grid, with this being provided by Scottish & Southern Electric (SSE).

Further to this the partners are committed to deliver the following with funding not provided by ZEBRA:

- Battery replacement for the 32 ZEBRA funded buses in year 8 (GSC funded)

SCC would be the fund administrator and GSC would lead on the procurement of the vehicles and charging infrastructure.

Existing UniLink Euro VI double decker buses [redacted]

The UniLink network, is a contracted bus service let by the University of Southampton consisting of 4 bus routes (3 high frequency and 1 low). It is currently operated by Go South Coast (part of the Go Ahead Group as shown in Figure 2.0) and provides a service that is open to all (public and students) providing connections from the University to City Centre, Central Station, the General Hospital, National Oceanography Centre, Portswood District Centre, and the Airport.

The University of Southampton have provided UniLink bus services since 2001 and Go South Coast have been contracted to operate the network since 2008, with the current contract running until 2028. Whilst Uni-link was initially provided to connect University residential and academic campuses in Southampton, all routes are operated commercially and are open to public passengers. The contract focuses on providing a high quality service, and includes a commitment by both the University and Go South Coast to prioritise carbon reduction and technology innovation when developing services. It includes a 5 year fleet refresh cycle to ensure we operate modern, efficient, low emission vehicles. It is a strategic aim for the University and the contract to operate a zero emission fleet as soon as practicable, and we hope that this application provides an opportunity to do so sooner than previously expected.

Go South Coast (GSC) is the current contracted operator of the UniLink services. GSC also operate Bluestar, Quayconnect and Salisbury Reds services in Southampton. There maybe references to Go Ahead at a group level.

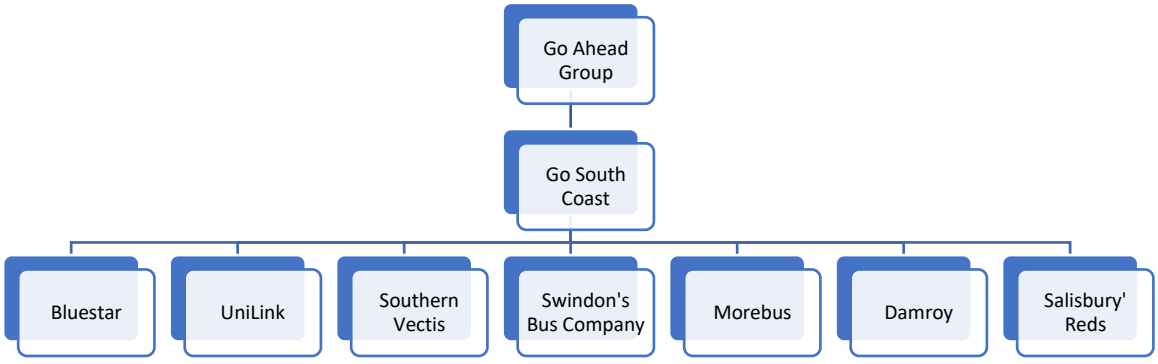


Figure 2.0 Go South Coast Structure

The proposal would mean that 14% of buses in Southampton would be zero-emission carrying 20% of the overall patronage. Learning and evidence from this would enable further business case and investment by all operators to fully zero-emission Southampton's bus fleet by 2030.

All UniLink routes operate through Air Quality Management Areas (AQMAs) such as Town Quay, Bevois Valley and Winchester Road. The new buses would be carbon-neutral from power generation to use and help with Southampton achieving air quality and carbon reduction targets for 2030. Southampton has a been identified as needing to improve its air quality in the quickest time possible and investing in zero emission buses is part of the approach to achieving this outcome.

Buses form an important role for getting people around with some of the city's most deprived communities located close to the UniLink bus routes. People living in these communities are often those who are most adversely affected by poor air quality increasing their health inequalities.

The ZEBRA buses are supported by the investment in new bus priority, integrated ticketing, and interchanges being delivered currently through the Southampton Transforming Cities and Solent Future Transport Zone programmes.

The project would support the delivery of the Government's target for 4,000 new zero-emission buses and decarbonisation of the bus fleet by 2030. The decarbonisation of Southampton's bus fleet is an ambition and part of the vision for the Southampton Bus Service Improvement Plan (BSIP) and emerging Enhanced Partnership Plan to continue to grow the number of people using buses in the city. It supports the Greener City Plan and the Connected Southampton 2040 (Local Transport Plan) aspirations and objectives.

2.3 Introducing Southampton

2.3.1 Southampton ZEBRA Project Area

The proposal will deliver 32 new double deck double door all-electric buses to operate on the UniLink bus services in Southampton. These will operate between Southampton City Centre, the University of Southampton, University Hospital Southampton, Southampton Airport, and areas of Portswood and Swaythling.

The proposal is within the Southampton City Unitary Local Transport Authority (LTA) Area and includes all the UniLink network. UniLink is a network of four bus routes operated by Go South Coast (GSC) on behalf of the University of Southampton (UoS). They are public bus services that are open to all – students, staff, and members of the public.

Part of the UniLink service U1 and GSC's depot are within the Hampshire County Local Transport Authority area in Eastleigh Borough.

The area covered by the Southampton ZEBRA project is focused on the UniLink network in Southampton. It covers a roughly triangular area of central Southampton between the River Itchen and A3057 Shirley Road, extending to city boundary close to the M27. The UniLink network, U1, U2, U6 and U9, connects University of Southampton with the City Centre, Central Station, National Oceanographic Centre, University Hospital Southampton, Southampton Airport, and residential areas of Bassett, Swaythling, Portswood and Townhill Park.

The UniLink network, location of depot, main destinations and the wider geography is shown on Figure 2.1 and 2.2.

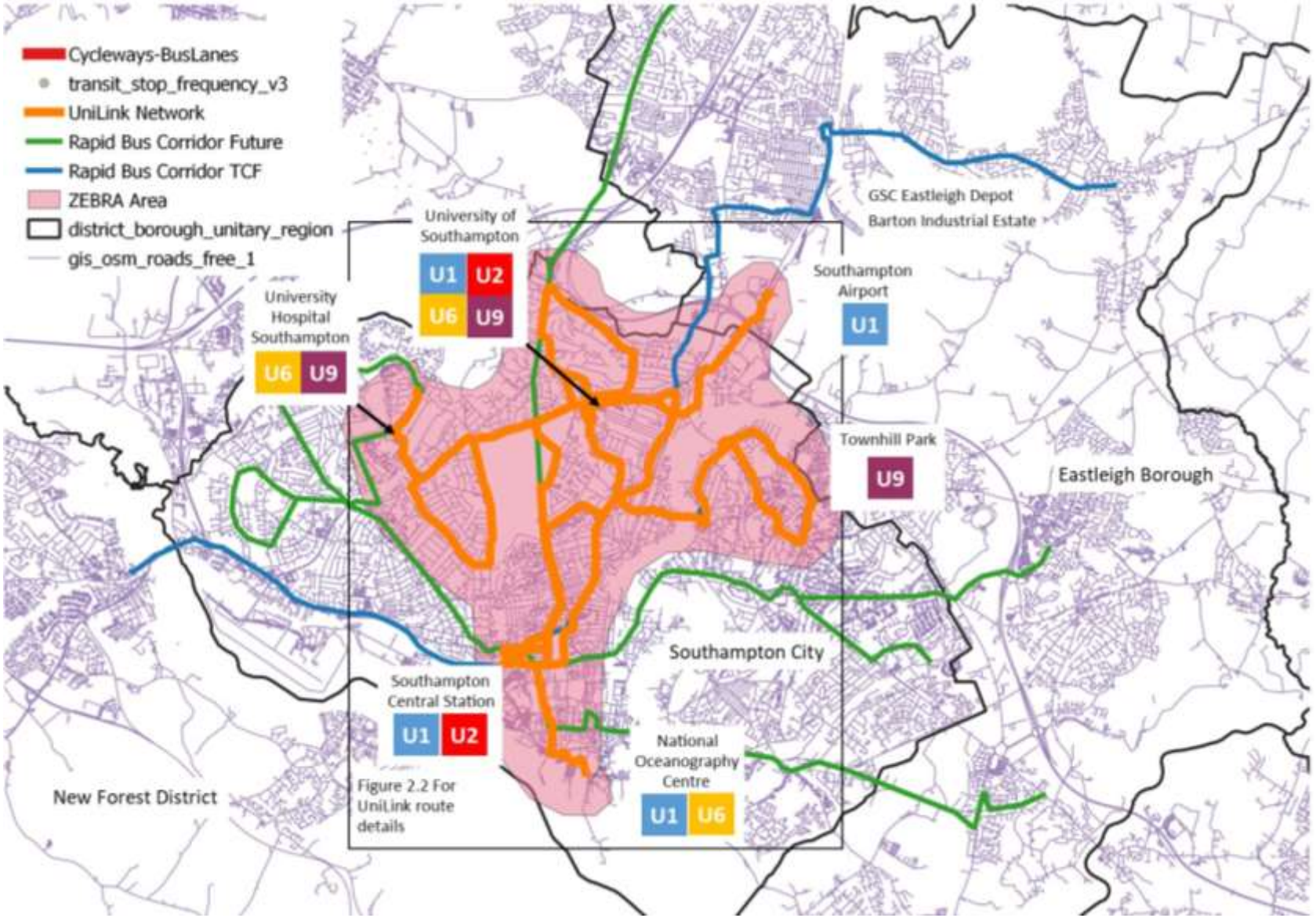


Figure 2.1 Southampton ZEBRA Area

Figure 2.2 UniLink Network Map

The location of the main economic drivers for Southampton that are served by the UniLink services as part of this bid, is shown in Figure 2.3 and located on Figure 2.1. All of these routes shown are included in the ZEBRA proposal.

<table>
<tr><th colspan="2">Southampton's Economic Drivers</th></tr>
<tr><td> 
The Port of Southampton is the UK's 3rd largest employing 15,000 people. Part of Solent Freeport
In 2019 it handled:
1.8m people on cruises,
Over 33.1mt of cargo in 4,074 vessel movements – 1.87m containers and 760,000 vehicles,
and 5m ferry passengers to the Isle of Wight
All worth £71bn to the UK
National Oceanography Centre located in Eastern Docks</td><td> 
Southampton Airport handled 1.78m passengers in 2019 flying to 40 destination in UK and Europe.
Contributes £160m to UK economy.
Linked to City Centre via U1 bus
1.84m people use Southampton Airport Parkway station.
Part of Solent Freeport</td></tr>
<tr><td>U1</td><td>U1</td></tr>
<tr><td> 
University Hospitals Southampton NHS Trust provide health care services to 1.9m people, plus specialist services to 3.7m people
Major centre for teaching & research.
Staff of 11,500 treating around 150,000 inpatients, 624,000 outpatients annually.</td><td> 
The Universities of Southampton and Solent provide 35,000 students and 8,000 employees.
University of Southampton is a leading research-intensive institution centred on Highfield Campus and National Oceanography Centre (NOC).
University of Southampton owns the UniLink bus brand.
Solent University is a fast growing city centre university focused on creative industries.</td></tr>
<tr><td>U6 U9</td><td>U1 U2 U6 U9</td></tr>
</table>

2.3.2 Southampton

Southampton is a major city on the south coast with a population of 260,000 over 51.8km². Southampton is an urban unitary authority surrounded by Hampshire County Council (HCC) as neighbouring LTA. Southampton is a major employment, retail, healthcare, education and cultural centre for a wider City Region. This wider Southampton City Region 'Travel to Work Area' has a workday population of 445,000, and encompasses parts of neighbouring

tier-2 authorities in Hampshire - all of Eastleigh Borough, part of New Forest and Test Valley District Council areas.

The wider City Region extends into Hampshire incorporating Totton, the Waterside (area of New Forest alongside Southampton Water), Chandler's Ford, Eastleigh, Hedge End and Hamble.

The built-up area crosses the boundary creating a contiguous urban area set on the coast which has shaped people's journeys and the economic geography. This results in a significant amount of cross boundary journeys to and from Southampton. As Southampton doesn't have 360° access these journeys into the city are funnelled along a limited number of corridors and bridges.

The coastal geography has helped to shape Southampton's economy with the water providing the prosperity through the Port, but it also constrains the economy and how people move about. The Rivers Itchen and Test form barriers to people's common journeys, which presents a significant barrier between the east and west of the city. The River Itchen is only crossed by six road bridges – one of which is the M27 and another a narrow listed structure, meaning there are only four suitable bridges for buses. The width of the River Test estuary has supported the development of the Port, but it means that travel from west of Southampton is funnelled across one bridge – Redbridge Causeway.

The city is also home to two leading Universities – the University of Southampton as a leading research and teaching facility and Solent University a fast growing institution. University Hospital Southampton (UHS) is a leading teaching hospital providing health care facilities for Southampton, central South England, and specialist support for the Channel Islands.

Following the deindustrialisation of Southampton and its growth in the second half of the 20th Century, this has led to a dispersed residential and workplace geography. Post-war local authority housing estates were created in the City Centre or on the outskirts and further suburban development in Bitterne, and outside of Southampton. The development of the M3, M27 and M271 opened access to large tracts of new development primarily accessed by car. This has resulted in newer employment centres being out of the city.

In the City Centre there has been a growth in mixed use developments with the retail sector leading through the opening of West Quay, which has attracted up to 16m visitors a year. The City Centre is also location of University of Southampton Mayflower Halls, a range of private student halls, and the main Solent University campus on East Park Terrace.

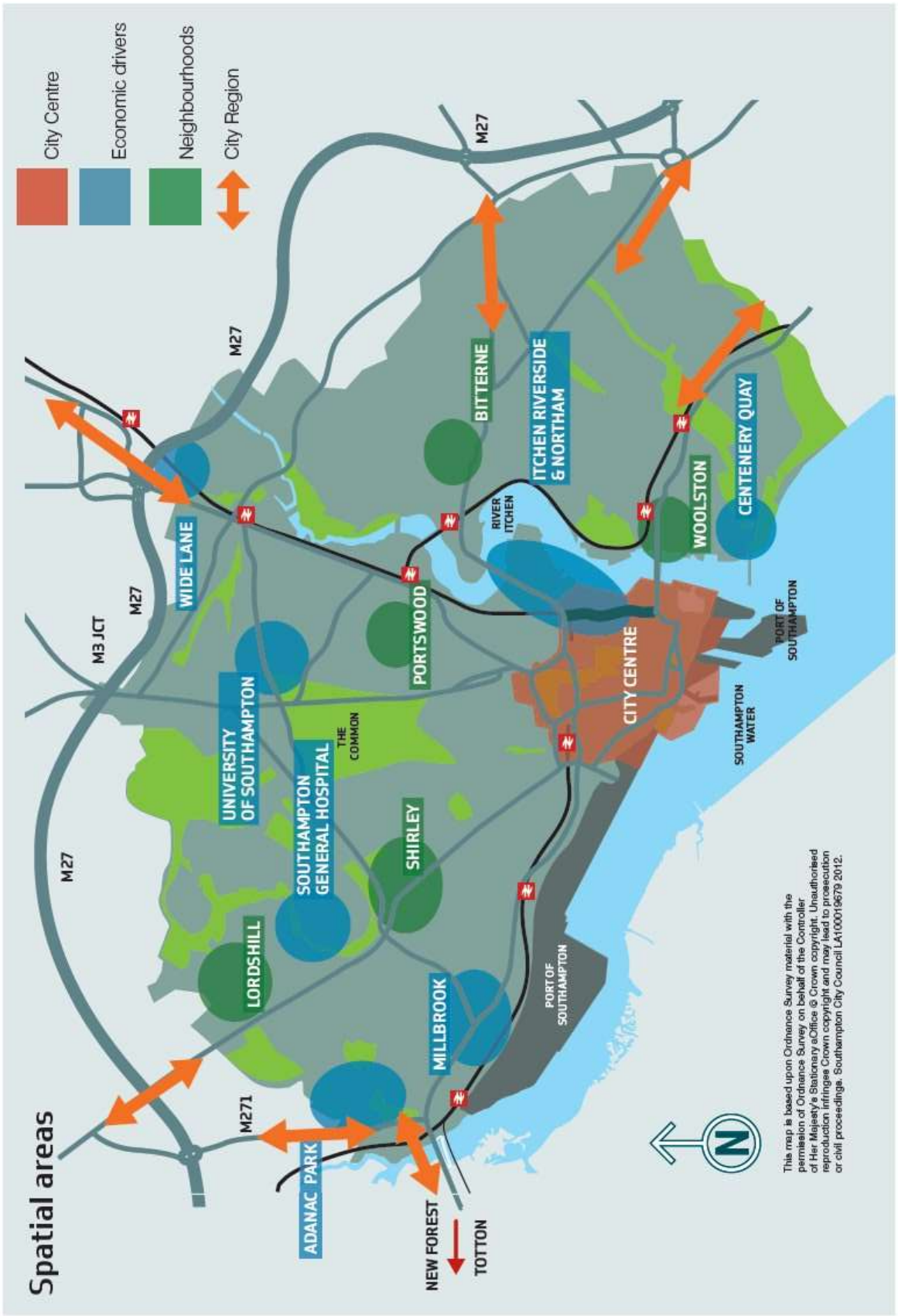


Figure 2.3 Main Spatial Areas and Destinations in Southampton City

2.3.3 Southampton's Connections

Southampton's location on the south coast and is well connected to the rest of the South East, UK and internationally. It is served by the Strategic Road Network M27 and M3 motorways which link to Portsmouth, Bournemouth, London, and via A34 corridor to Midlands and the North. It has direct rail connections locally to Portsmouth, Winchester, Eastleigh and Fareham, and nationally to Bournemouth, Bristol, London, Reading, Gatwick Airport, Brighton, the Midlands and North.

Figure 2.4 Southampton's Connections

It is also home to two of the UK's International Gateways – regional Southampton Airport and the Port of Southampton. The Port is the UK's third largest cargo port and the leading cruise Port for the UK. Located on the busy Shanghai-Rotterdam shipping lanes it handles £72bn worth of trade and is the leading export Port to non-EU markets. The Port is also one of the gateways to the Isle of Wight.

2.3.4 Southampton's Travel Patterns

Travel to Work

Southampton has strong cross boundary travel flows, with as many people living in the city and travelling out for work, as coming into the city for work. Based on 2011 Census and transport modelling (Solent Sub-Regional Transport Model 2019) the strongest flow is

between Southampton and Eastleigh – with 24,000 2-way flows daily – 7% of those journeys are by bus. With 60% of commuting trips less than 3 miles, there is scope for a greater proportion of these journeys to be made by bus and sustainable modes rather than by car.

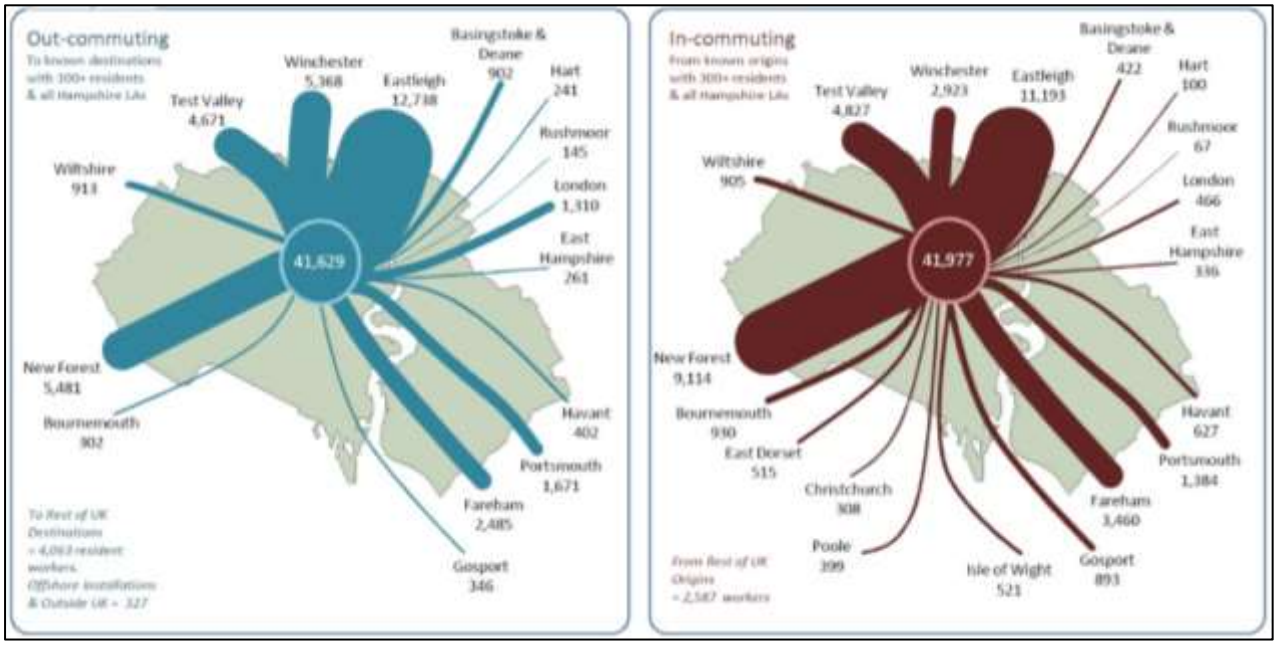


Figure 2.5 – In and Out commuting from Southampton (2011 Census)

Travel to work mode share for bus to the University Highfield Campus is 11.7% and Hospital 12.8%.

Mode and Person Trip Split

Southampton is above the England and South East averages for bus mode share for all trips to work, with 9% of all trips to work in Southampton being made by bus[1]. This is shown in Figure 2.6. This mode share for bus compares to cities such as Bristol, Exeter and Derby, however, it is lower than cities such as Oxford, Brighton, Nottingham and Reading.

[1] 2011 Census

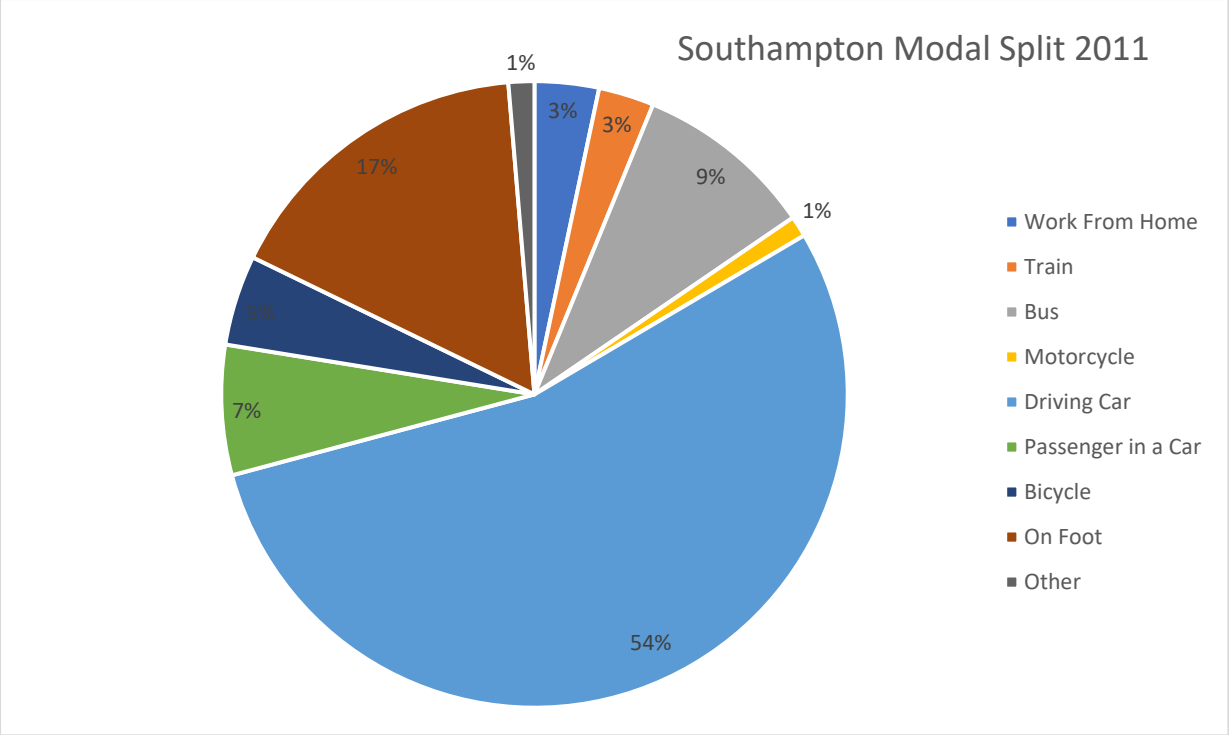


Figure 2.6 – Southampton Modal Split Travel to Work (2011 Census)

Each morning, over 29,000 people would travel into the City Centre on all corridors, with 56% of people travelling in a car, 18% of people on bus, 2% cycling, 10% by motorcycle, ferry and rail, and 13% walking[2]. Of the main corridors shown in Table 2.1, buses carry most people on the Shirley Road corridor (59%) and a high proportion across the Itchen Bridge. The Avenue and Bevois Valley corridors are served by the U1, U2 and U6 services.

Main Corridor	Total	Light Vehicles	Bus	Active Travel
Mountbatten Way	4,918	99%	0.6%	0.04%
Shirley Road	3,115	39%	59%	2%
The Avenue	2,906	75%	19%	6%
Bevois Valley	1,250	78%	19%	2%
Northam Bridge	5,102	84%	15%	>1%
Itchen Bridge	3,517	66%	30%	4%
Total	20,808	76%	22%	2%

Table 2.1 – Person Modal Split on main corridors into Southampton City Centre (2019 SCC Traffic Counts)

The Covid pandemic has impacted on bus travel and modal split in Southampton. The increase in home working has had an impact on the usage of bus as around 28% of people living in Southampton worked from home during 2020[3]. Bus usage dropped considerably with buses in Autumn 2020 carrying 60% of their pre-Covid patronage levels.

Vehicle Speeds

[2] 2019 SCC AM Peak Modal Split Surveys

[3] ONS 2020 Home Working Survey

Based on DfT Traffic Speed statistics Southampton is the 9th slowest city outside of London. Vehicle speeds on A roads in 2019 averaged 17.6mph compared to a South East average of 28.3mph.

City	2016	2017	2018	2019
Southampton	17.5	17.1	16.9	17.6
Portsmouth	17.8	17.7	17.7	18.0
Bournemouth				
Brighton	16.7	17.1	16.7	16.8
Plymouth	20.8	20.3	20.7	20.8
Bristol	15.3	15.6	15.3	15.9
South East	28.1	28.2	28.0	28.3

Table 2.2 Average Vehicle Speeds on A Roads (DfT CGN0501b)

Table 2.3 shows where the local delay is on the A road network in Southampton with average speed and average vehicle delay per second per mile. The UniLink network runs along A33N (The Avenue & Bassett Avenue), A35 (Burgess Road & Winchester Road), and A335 Bevois Valley Road.

Local A Road Delay 2019 Southampton	Road	Average Veh Delay (Sec/mile)	Average Speed (mph)
	A35	217.75	9.57
	A33 N	81.75	19.32
	A3057 N	90.45	15.88
	A3057 S	130.39	12.25
	A335 N	51.09	22.48
	A335 S	90.6	15.45
	A3035 W	121/93	13.46
	A3035 E	146.07	11.67
	A3024 W	75.37	17.07
	A3024 E	127.37	12.93
	A3024 W	75.37	17.07
	A334	83.43	16.89
	P'wood		21.0
	Ring Road	168.83	10.55

Table 2.3 Local A Road Delay 2019, DfT Road Congestion Statistics

2.4 Southampton's Bus Network

Bus services and usage in Southampton are well above the England average, and Southampton is seen as an area that has bucked the national trends of declining levels of bus mileage, patronage and use per head.

Bus passengers contribute over £275m[4] to the Southampton economy, when they reach their destination such as the City Centre. As well as travelling to work or school, bus users make retail and leisure trips - spending on average £30 per retail trip and £26 per leisure trip. Bus is the dominant public transport mode and provides connections to the City Centre, local District Centres, health care, education facilities and across the wider City Region.

2.4.1 Bus Usage

Southampton residents and workforce made 20.7m journeys in 2019/20 on 38 bus routes in the city. Bus passenger numbers had increased by 9% since 2009/10 where 18.6m journeys were made.

Southampton was the 7th highest in England for bus journeys made per head of population – with 80.5 in 2019/20, and strong for a non-ITA area or where there is a single municipal bus operator (e.g. Reading).

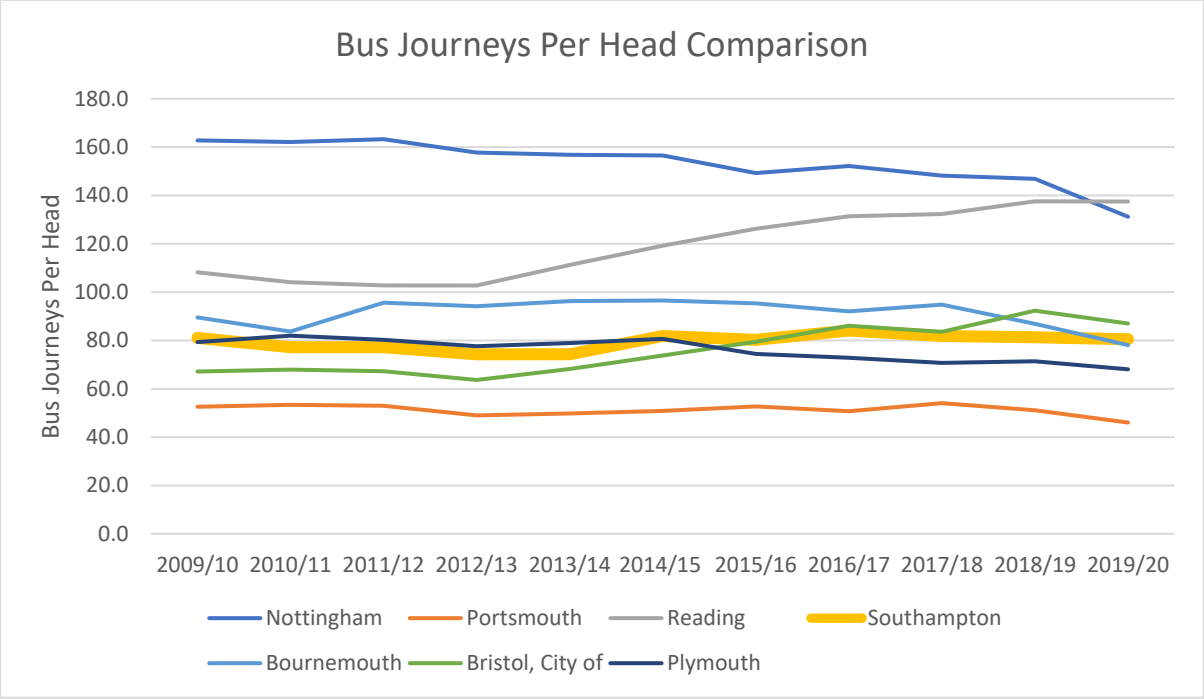


Figure 2.3 – Comparison of Southampton Bus Journeys Per Head with other LTAs5

The trend in Southampton shows that bus journeys have held up compared to 2009/10 and not declined compared to the other cities. Southampton remains one of the few places where the number of bus journeys made is either increasing or at a stable level.

In 2019/20 there were 5 million elderly and disabled concessionary passenger journeys, accounting for 23% of all journeys, with 77% being made by fare-paying passengers – compared to 72% for the South East as a whole. Students are a significant market for Southampton with the UniLink services that provide access to the University of Southampton's campuses from areas where students live.

In 2020/21 there were 7.32m bus passengers carried in Southampton, a decline of 64% from 2019/20. During 2021/22 bus usage in Southampton has recovered and in November 2021 patronage was at 88% of pre-pandemic levels.

[4] Southampton BSIP based on pteg The Case for the Urban Bus

[5] DfT Bus Statistics BUS0110, March 2021

2.4.2 Bus Network

Southampton's network is based on a hub and spoke network centred on the City Centre. It covers local intra-urban routes linking suburbs with District Centres then to the City Centre, and inter-urban routes that link the City Centre to surrounding towns and villages in Hampshire. There are 38 bus services in Southampton, covering 3.5m miles per year – over 4 times to the moon and back. 71% terminate in the City Centre, however there are five high frequency cross-city services enabling quicker connectivity. This has created a largely radial pattern with high volumes of buses on those corridors and very little linkage between them. This does mean people are funnelled into the City Centre to either continue their journey on the same service, change to another, or interchange with rail or ferry.

The network is operated by two main bus operators – Go South Coast (GSC) and First Southampton. Between them they operate 95% of all bus services in Southampton.

- GSC operate as Bluestar with 14 bus services operating inter and intra urban routes in Southampton, and Salisbury Reds on 1 inter urban service
- GSC work in partnership with the University of Southampton to run the 4 UniLink services connecting the University to halls of residence, campuses, Port of Southampton Eastern Docks, University Hospital Southampton and the Airport,
- GSC also partner with Red Funnel to operate the QuayConnect service between Southampton Central Station and Town Quay for the Isle of Wight ferry,
- First, operating as CityReds, provide 8 services operating inter and intra urban routes in Southampton, and 2 Solent inter urban services to Portsmouth and Gosport.

There is a smaller operator Xelabus who runs 8 services which are either contracted or supported services. A new smaller operator, Southampton Minilink (SML), has registered to start running a local service to Harefield.

The bus network is shown in Figure 2.6 and Table 2.4 sets out the individual bus services, their destinations, frequency and operator.

Service	Route	Frequency (bus per hour)			Operator
		Mon-Sat	Evening	Sunday	
Quay Connect	Central Station-Town Quay	2	2	2	Bluestar
1	Southampton-Totton	4	2	2	City Red
1	Southampton-Winchester	4	1	2	Bluestar
2	Southampton-Eastleigh	4	1	2	Bluestar
2	City Centre-Millbrook	7/8	3	4	City Red
3	Southampton-Hedge End-Eastleigh	1	Limited	6/day	Bluestar
3	Thornhill-City Centre-Shirley-Lordshill	7	2	4	City Red
4	Southampton-Romsey	2	90mins	1	Bluestar
6	Southampton-Hamble	2	1	1	City Red
6	Southampton-Lymington	1	-	2hrly	Bluestar
7	City Centre-Townhill Park	6	3	4	City Red
7	Woolston-City Centre-Shirley-Lordshill	2	-	1	Bluestar
8	Southampton-Hythe & Calshot	1	Limited	4/day	Bluestar
8	Southampton-Hedge End	2	1	1	City Red
9	Southampton-Hythe & Fawley	3	1	2	Bluestar
9	City Centre-Sholing	2	2	7/day	City Red
11	Southampton-West Totton	3	-	1	Bluestar
11	City Centre-Woolston-Weston	6	1	4	City Red
12	Southampton-Calmore	3	1	1	Bluestar
13	City Centre-Harefield	2	1	1	City Red
13A	City Centre-Harefield	-	-	1	SML
16	City Centre-Townhill Park	4	1	2	Bluestar
17	Weston-City Centre-Adanac Park	6	2	4	Bluestar

18	Thornhill Park-City Centre-Millbrook	7/8	2	4	Bluestar
Hoppa 1	Bitterne-Midanbury	3/day (M, W, F)	-	-	Xelabus
Hoppa 2	Bitterne-Sholing	3/day (M, W, F)	-	-	Xelabus
Hoppa 3	Bitterne-Harefield	2/day (M, W, F)	-	-	Xelabus
U1	City Centre/NOC-University-Airport	7/8	3	4	UniLink
U2	City Centre-University	6	3	3	UniLink
U6	City Centre-University-UHS	3	1	1	UniLink
U9	Townhill Park-University-UHS	2/day	-	-	UniLink
X4	Eastleigh-Mansbridge-Hedge End	1	-	-	Xelabus
X4/X5	Southampton-Fareham-Portsmouth/Gosport	4	1	1	Solent
X7	Southampton-Salisbury	1	-	-	Salisbury Red
X10	Southampton-Bishop Waltham	1	-	-	Xelabus
X11	City Centre-Shirley-Lordshill	1	-	-	Xelabus
X12	City Centre-Shirley	6/7 per day	-	-	Xelabus
X21	City Centre-Southampton Science Park	3/day	-	-	Xelabus

Table 2.4 Bus Services in Southampton

Most parts of Southampton benefit from frequent services to and from the city centre but there are also good services to places like the University Hospital Southampton, the universities, District Centres, and surrounding towns and villages in Hampshire. The District Centres of Shirley, Portswood, Woolston and Bitterne act as nodes for the bus network, with both local city routes and inter-urban routes serving these centres before branching off to serve suburbs or into the wider City Region. This means that these centres are well served and support local people in accessing the goods and services there, maintaining them as thriving local hubs.

All of buses in Southampton are at least Euro VI compliant following either investment in new Euro VI vehicles or through the Clean Bus Technology Fund have retrofitted their vehicles to Euro VI standard.

Figure 2.7 Southampton Bus Network (2019) SCC

2.4.3 Bus Operators and Fleets

This section summarises the operations of each bus operator covering services, destinations, and fleet. It sets out the market share for each operator based on annual patronage and bus services operated.

There are approximately 230 buses operating across 38 bus routes in Southampton.

All vehicles across all operators are currently at least Euro 6 compliant, either new buses or retrofitted. Operator investment over past decade has seen fleet age reduce with initiatives like Wi-Fi, USB charging, next stop announcements, level boarding introduced in advance of many other areas of England. With the ZEBRA proposal 14% of the fleet, carrying 20% of the patronage in Southampton, will be zero emission. The Southampton BSIP ambition is to fully zero-emission Southampton's bus fleet by 2030, or earlier if the business case and this ZEBRA project is successful.

Go South Coast – Bluestar & UniLink

Go South Coast (GSC), part of the Go-Ahead Group, are the largest bus operator in Southampton running 51%, or 19 of the 37 bus services, and carry 70% of the annual patronage. Go South Coast operate the Bluestar, UniLink, QuayConnect and Salisbury Red services in Southampton.

They operate a network of services serving the suburbs of Southampton and beyond to several towns and urban areas outside of the city. This is shown in Figure 2.7 and summarised in Table 2.5.

Service	Route	Frequency (bus per hour)			Operator
		Mon-Sat	Evening	Sunday	
Quay Connect	Central Station-Town Quay	2	2	2	Bluestar
1	Southampton-Winchester	4	1	2	Bluestar
2	Southampton-Eastleigh	4	1	2	Bluestar
3	Southampton-Hedge End-Eastleigh	1	Limited	6/day	Bluestar
4	Southampton-Romsey	2	90mins	1	Bluestar
6	Southampton-Lymington	1	-	2hrly	Bluestar
7	Woolston-City Centre-Shirley-Lordshill	2	-	1	Bluestar
8	Southampton-Hythe & Calshot	1	Limited	4/day	Bluestar
9	Southampton-Hythe & Fawley	3	1	2	Bluestar
11	Southampton-West Totton	3	-	1	Bluestar
12	Southampton-Calmore	3	1	1	Bluestar
16	City Centre-Townhill Park	4	1	2	Bluestar
17	Weston-City Centre-Adanac Park	6	2	4	Bluestar
18	Thornhill Park-City Centre-Millbrook	7/8	2	4	Bluestar
U1	City Centre/NOC-University-Airport	7/8	3	4	UniLink
U2	City Centre-University	6	3	3	UniLink
U6	City Centre-University-UHS	3	1	1	UniLink
U9	Townhill Park-University-UHS	2/day	-	-	UniLink
X7	Southampton-Salisbury	1	-	-	Salisbury Red

Table 2.5 Summary of Go South Coast Bus Services

- Bluestar – 14 intra and inter urbans services to Millbrook, Lordshill, Shirley, Portswood, Townhill Park, Bitterne, Thornhill Park, Weston and Woolston; and to Totton, the Waterside (Marchwood, Hythe, Fawley), Lymington, Chandlers Ford, Winchester, Romsey, Eastleigh and Hedge End
- UniLink – a contracted bus service let by the University of Southampton to operate 4 services to University of Southampton, University halls of residence, Southampton Airport, National Oceanography Centre, Port of Southampton Eastern Docks,

Portswood, Swaythling, and University Hospital Southampton – these are all open to students (via their halls fees) and the general public;
- QuayConnect – 1 service between Southampton Central Station and Town Quay for the Isle of Wight RedJet service; and
- Salisbury Red – 1 service to Salisbury.

GoSouth Coast operate 160+ buses in a combination of single and double deck. All buses are at least Euro VI compliant, with 49 older buses retro-fitted with clean bus technology between 2016-2018 to make them compliant. Half of the fleet is Euro VI new, with all the UniLink fleet Euro VI new. The UniLink fleet operators Alexander-Dennis Enviro 400MMC which entered service in 2018. The average age of a bus within the Go South Coast fleet is 3 years.

Total Bus	Total	Double Deck	Single Deck	Euro VI Retro	Euro VI	WiFI	USB	Next Stop
Bluestar	131	89	42	49	66	106	109	108
UniLink	32	32	0	0	32	32	32	32

Table 2.6 – Bus Fleet – GSC

The Southampton Area depots are located in Totton (New Forest District) and Eastleigh (Eastleigh Borough) in Hampshire. These are shown on Figure 2.9. GSC is a leasee of both the depots. The Eastleigh depot is the larger with capacity for 94 buses on the Barton Park Industrial Estate which is located off B3037 Bishopstoke Road in Eastleigh. Barton Park - a former Pirelli factory - accommodates a wide variety of industrial and commercial uses.

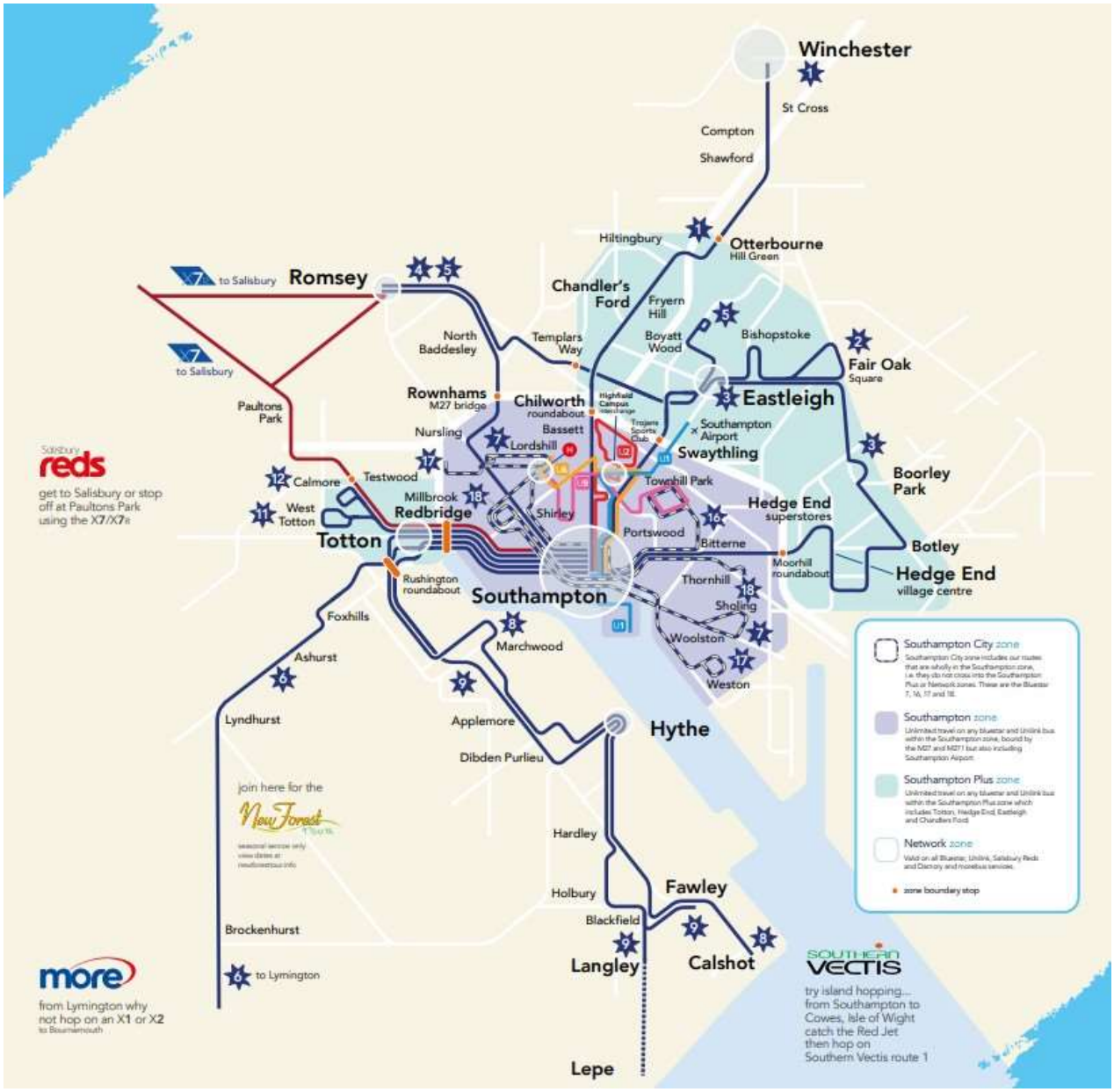


Figure 2.8 Go South Coast (UniLink and Bluestar) Network Map

Figure 2.9 Go South Coast's Southampton Area Depots

CityRed (First Group)

CityRed, part of First Group, are the second largest operator in Southampton running 27%, or 10 of the 37 bus services and carrying 28% of the annual patronage. As set out in Section 2.2.2 they operate the CityRed and Solent services.

They operate a network of services serving the suburbs of Southampton and beyond to some towns and urban areas outside of the city. See network map in Figure 2.10 and summary in Table 2.6.

Service	Route	Frequency (bus per hour)			Operator
		Mon-Sat	Evening	Sunday	
1	Southampton-Totton	4	2	2	City Red
2	City Centre-Millbrook	7/8	3	4	City Red
3	Thornhill-City Centre-Shirley-Lordshill	7	2	4	City Red
6	Southampton-Hamble	2	1	1	City Red
7	City Centre-Townhill Park	6	3	4	City Red
8	Southampton-Hedge End	2	1	1	City Red
9	City Centre-Sholing	2	2	7/day	City Red
11	City Centre-Woolston-Weston	6	1	4	City Red
13	City Centre-Harefield	2	1	1	City Red
X4/X5	Southampton-Fareham-Portsmouth/Gosport	4	1	1	Solent

Table 2.6 First Southampton Bus Network

- CityRed – 8 intra and inter urbans services to Millbrook, Lordshill, Shirley, Portswood, Townhill Park, Bitterne, Harefield, Thornhill Park, Sholing, Weston and Woolston; and to Totton, Hedge End, Netley and Hamble; and
- Solent – 2 inter urban services to Fareham, Gosport and Portsmouth.

Figure 2.10 CityRed & First Network Map Southampton

They operate 65 buses mostly single decker from a purpose built depot in Portswood area of Southampton.

Total Bus	Double Deck	Single Deck	Euro VI Retro	Euro VI	WiFI	USB	Next Stop
65	6	59	42	23	52	10	65

Table 2.7 – Bus Fleet – First CityRed & Solent

Xelabus

Xelabus are the smallest operator in Southampton running 22%, or 8 of the 37, of the bus services but carry less than 1% of the annual patronage. The majority of Xelabus services are either contracted to a third party such as Southampton Science Park or supported by SCC as socially necessary services.

They operate a network of 8 services serving some suburbs of Southampton and beyond into Eastleigh. Four are contracted from SCC to provide local services to Shirley and Bitterne District Centres on specific days. One is an inter urban service to Bishops Waltham and is partially commercial.

Service	Route	Frequency (bus per hour)			Operator
		Mon-Sat	Evening	Sunday	
Hoppa 1	Bitterne-Midanbury	3/day (M, W, F)	-	-	Xelabus
Hoppa 2	Bitterne-Sholing	3/day (M, W, F)	-	-	Xelabus
Hoppa 3	Bitterne-Harefield	2/day (M, W, F)	-	-	Xelabus
X4	Eastleigh-Mansbridge-Hedge End	1	-	-	Xelabus
X10	Southampton-Bishop Waltham	1	-	-	Xelabus
X11	City Centre-Shirley-Lordshill	1	-	-	Xelabus
X12	City Centre-Shirley	6/7 per day	-	-	Xelabus
X21	City Centre-Southampton Science Park	3/day	-	-	Xelabus

Table 2.8 Xelabus Bus Services in Southampton

Xelabus are also contracted to provide school and college buses to higher education establishments in and around Southampton, such as Itchen College in Sholing and Barton Pevril in Eastleigh.

They operate mostly single decker buses from a depot in Eastleigh adjacent to Go South Coast's.

2.5 Alignment with wider transport strategy

This section sets out how the Southampton ZEBRA project aligns with Government priorities and any existing national, regional and local transport policies and strategies.

2.5.1 National Policy

Bus Back Better - National Bus Strategy

The National Bus Strategy (NBS) was released by Department for Transport in March 2021. It acknowledges that buses play a key role in delivering wider priorities:

- Buses can play a greater role in enabling access to work, with 44% of bus trips are for work or education, compared to 27% of solo journeys;
- Buses can help drive better employment outcomes for disabled people, and in cities outside of London 77% of jobseekers don't have access to a car;
- Affordable bus travel helps ensure that work pays and can be sustained for everyone;
- Buses can improve productivity more widely, for instance reduce congestion and emissions which affects all road users;
- Buses can be key to levelling up the economy; users are disproportionately from less advantaged social groups and places. Improved services and vehicles will strengthen communities, sustain city and local centres, and connect disabled and isolated people.

The NBS provides clear evidence that making buses more attractive helps to encourage people away from their cars. Buses are vital to ensuring the UK meets its Net Zero for

carbon and states that buses are driving the green transport transformation. In congested and polluted areas, substantial mode shift away from cars is required now if air quality targets and broader climate goals are going to be met.

The zero-emission buses for UniLink are part of the jigsaw to meeting this and making sure Southampton benefits. This will help to deliver on the NBS commitment to introduce 4,000 ZEBs in England, and on the Southampton BSIP ambition to have the whole Southampton bus fleet zero-emission by 2030. Rapid change and profile raising will put the bus forward as a transport mode that is attractive and encourage people away from their car for trips in and around Southampton. The zero emission buses are part of the approach along with bus priority works commencing through TCF with future plans in the BSIP, bus stop accessibility, real-time information, launch of a Solent Mobility as a Service product, innovative fares and offers, and working with the bus operators to continue to invest in zero emission buses in Southampton and Hampshire.

Moving to being a zero emission city is an integral part of our LTP4 and BSIP for making it better to get around, and aligns with the NBS view that 'zero emission buses meet the needs of passengers and communities, and attract people from other forms of transport'. This will mean that Southampton is moving towards a net zero carbon transport network.

Transport Decarbonisation Plan

The Decarbonisation of Transport Plan, published by the DfT in July 2021, sets out a 'world-leading commitment' to end the sale of new polluting buses by 2040 as part of overarching strategy to meet net zero for UK emissions by 2050. It sees buses as 'having a crucial role to play in achieving net zero and driving the green transformation. Increasing the share of journeys taken by public transport - particularly in congested areas'.

It acknowledges that:

- Only 2% of England's buses is currently zero-emission, successful bid for Southampton would make 14% of the local fleet zero-emission with aim to get to 100% by 2030. The remainder of the fleet would be low-emission at Euro VI.
- 3% (3.1mt) of 2019 domestic greenhouse gas emissions came from buses and coaches;
- Zero emission vehicle manufacturing would support 7,000 jobs and generate £1bn of GVA to the UK economy by 2050 – Southampton's bid would use UK bus manufacturers and supplier of charging infrastructure; and
- Transitioning to zero-emission bus would save between 35 and 37m tonnes of CO^2 between 2020 and 2050.

The Decarbonisation Plan sets a date for the phasing out of sale of new non-zero emission buses for 2030 and local bus operators in Southampton are committed to not purchasing new non-zero emission buses from 2022. This is part of the approach in the BSIP to have all buses in Southampton zero-emission by 2030. This would go alongside further decarbonisation of transport in Southampton with 90% of the SCC vehicle fleet being zero emission by 2030, continued investment in a electric vehicle charging network in public car parks and supporting residents with on-street charging, and further support to introduce zero emission taxis.

This project enables Southampton to get ahead of the market using some of the 4,000 pledged zero-emission buses, and starting implementing zero-emission buses now to meet net-zero quicker. This will support jobs locally with apprenticeships, training and job security at local bus operators, but also strengthen the UK zero-emission bus supply chain and manufacturers.

Levelling Up

A strategic priority for the Government is to Grow and Level Up the UK's economy.

Although Southampton is in the South East it is behind the South East average for productivity and deprivation. Wages in Southampton are £60/week lower than neighbouring boroughs such as Eastleigh, and there is a 18% gap in productivity to the South East average.

There are pockets of deprivation, as shown in 2.4.3, in Southampton which are among the top 10% most deprived areas in England. Analysis of the Lower Super Output Areas (LSOAs) in Southampton identify that:

- 18 LSOAs (12%) are in the 10% most deprived LSOAs in England, of these 3 are in the central wards of Bevois and Bargate – served by all the UniLink buses, and
- Further 24 LSOAs (16%) are in the 20% most deprived LSOAs in England and are spread across Southampton– including Swaythling and Townhill Park served by all UniLink services.

This means that 28% of all the LSOAs in Southampton are in the 20% most deprived areas in England.

There is also disparity in quality of life within Southampton itself, healthy life expectancy varies by 6 years for males between the wealthiest and poorest wards.

The Southampton ZEBRA project supports Levelling Up Goals[6] for good health & well-being, infrastructure for opportunity, harness the energy transition and achieving equality through diversity and inclusion.

The UniLink buses provide access for people from these deprived areas to the Airport, Port, Universities, Hospitals, Port, and City Centre where there are services, jobs and opportunities. This will allow local economic levelling up by connecting the deprived communities with the city's economic drivers. The UniLink network serves the deprived communities in Bargate and Bevois wards directly connecting them to the University, Hospital and City Centre. These connections provide the ability for residents to reach these destinations, particularly as these areas have the highest levels of non-car owning households. Therefore, providing a necessary connection that has the ability to level up these communities against other areas of Southampton.

2.5.2 Sub-National and Regional Policy

TfSE Transport Strategy

The Transport for South East (TfSE)'s 30 year Transport Strategy (2019) sets a vision to 'be a leading global region for net-zero carbon transport networks'. With a view that carbon emissions in South East should be reduced to net zero by 2050 at the latest with improved air quality, reducing the impact and need to travel. As well as improving connectivity between major economic hubs, ports and airports.

The Transport Strategy acknowledges that for local short distance journeys within a city and as the first or last mile of a longer distance buses play an important role. They identify challenges and solutions for local journeys and that buses are vital to meeting them:

- Significant issues with air quality and safety on many urban corridors used for local journeys – develop high-quality public transport services on urban corridors and reallocate road space to cleaner transport modes
- Integration between transport modes could be better – develop integrated transport hubs, develop integrated passenger transport systems, integrated ticketing arrangements
- Public transport is not always affordable for everybody – help to reduce public transport fares in long-term to make them value for money

[6] Levelling Up Goals

The Southampton ZEBRA project aims to support this vision by kickstarting zero-emission buses in Southampton that provide connectivity between the City Centre, University campuses, the Port's Eastern Docks and Southampton Airport.

TfSE are also developing a sub-national Decarbonisation Plan through a Decarbonisation Forum to identify further pathways to decarbonisation.

Solent Economic Recovery Plan

In 2021, the Solent Local Enterprise Partnership (LEP) published an Economic Recovery Plan from the Covid pandemic. This aims to build a positive growth agenda for the Solent region following the pandemic. The LEP's long-term strategy for growth and prosperity set out in Solent 2050 looks to be a 'global leader in maritime and climate change adaptation, with towns and cities that are fantastic places to live, trade, and with opportunities for all our communities to flourish'.

The plan has seven priorities including pioneering approaches to climate change adaptation and decarbonisation. This is through a recovery investment package prioritising zero-carbon projects such as walking & cycling routes and public transport.

This has included support for the Port of Southampton's latest cruise terminal which includes ship-to-shore power as part of the pathway to net-zero.

The ZEBRA project will support this with the first zero-emission buses in Southampton, and in Solent.

Solent Freeport

Centred on the Ports of Southampton and Portsmouth and Southampton Airport, the Freeport is aiming to create 52,000 jobs across UK improving productivity in Solent and additional £3.57bn GVA uplift. The Freeport has links to the Universities with links to maritime, autonomy and green growth. The Freeport sites in the Port and at the Airport will create local job opportunities adjacent to communities in Southampton that are in the most 10% most deprived in England. The Freeport supports levelling up connecting with the industrial heartlands of the Midlands and North with the international gateways.

The ZEBRA proposal supports this with zero-emission bus services between the University and Freeport sites at the Airport and Port. This enable people working in those areas to get to work, and as the services connect to areas with higher unemployment, such as Bevois ward, provide opportunities for people to access the newly created jobs.

Solent Transport - Transport Strategy

Solent Transport is a partnership between SCC, Hampshire County Council, Portsmouth City Council and Isle of Wight Council. In 2013 a set of 14 joint LTP policies was agreed between all the authorities which guides the development of their transport networks to 2031.

The policies include:

- Delivering improvements in air quality
- Ensure investment in bus, and where practical better infrastructure and services

2.5.3 Local Policy

Connected Southampton 2040 (LTP4)

Adopted in March 2019, Connected Southampton 2040 is a long-term transport strategy for Southampton as our fourth Local Transport Plan.

It sets a vision to make Southampton a modern, liveable and sustainable place to live, work and visit by investing in better and innovative transport. Over the next 20 years it aims to secure a successful future for the city and improve the quality of life for all its residents.

It is a strategy that looks at how to ensure the city thrives while thinking differently about transport to plan for clean, green and sustainable growth.

To meet this challenge the strategy is focused around three strategic goals – all of which are relevant for all-electric buses:

- A Successful Southampton – improving transport to support the sustainable economic growth of Southampton. By investing in transport this will enable people and goods to get around quicker and safer;
- A System for Everyone – making Southampton a safe and attractive place to live, improving people's quality of life and ensuring that everyone can access transport; and
- A Better Way to Travel – supporting people to change how they move around the city by widening their health and green travel choices and helping Southampton to become a zero emission city.

Within each strategic goal are a series of themes that set out how the goal will be delivered. These are set out in Table 2.9 with the most relevant to all-electric buses highlighted.

Successful Southampton	A System for Everyone	Changing the Way People Travel
A Connected City	A Safe City	**A Healthy & Active City**
A Resilient City	**An Equitable City**	**A Zero Emission City**

An Innovative City	An Attractive City	

Table 2.9 Relevant Connected Southampton 2040 Themes to ZEBRA

These strategic goals, vision and objectives in Connected Southampton 2040 are closely aligned to the DfT's strategic priorities for growing and levelling up the economy, reducing environmental impacts, and improving transport for the user.

Starting the transformation of the bus fleet to all-electric in Southampton will be an effective method of achieving the city's and DfT's visions.

In Southampton 61% of all trips to work into, within and out of the city are made by private vehicle. This varies by destination and direction as shown in Table 2.10 and Figure 2.11.

	Live & Work in Southampton	Commute into Southampton	Commute out of Southampton	Live in Eastleigh, Work in Southampton	Live in Southampton, work in Eastleigh
Private Car	48%	81%	85%	82%	80%
Bus	14%	5%	6%	7%	7%
Walking & Cycling	35%	4%	8%	5%	9%

Table 2.10 Trips to Work by mode and destination (Census 2011)

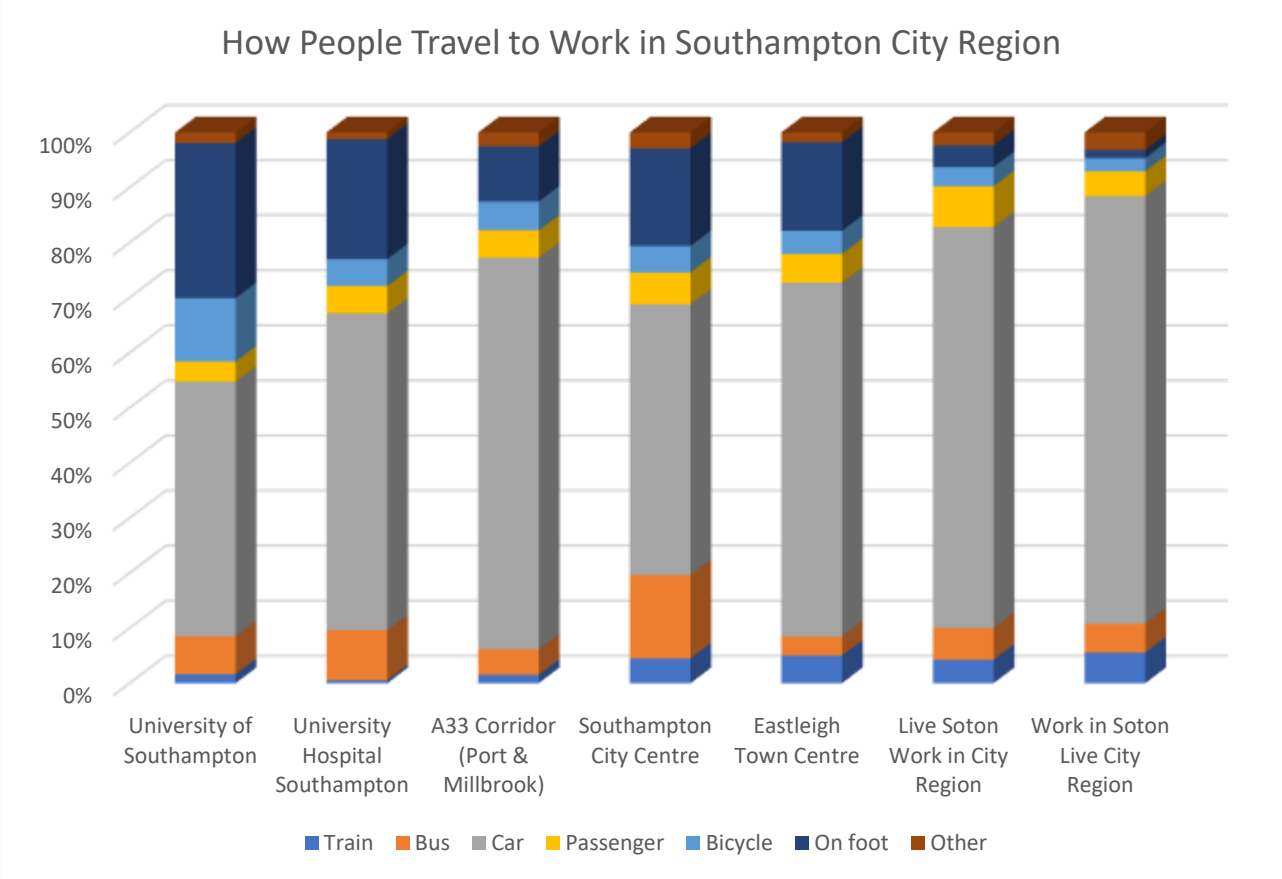


Figure 2.11 Method of travel to work in Southampton City Region Destinations (Census 2011)

To achieve sustainable economic growth we need to balance the mode split and increase bus, walking and cycling mode share particularly for commuting in and out of Southampton

into the City Region. Connected Southampton 2040 sets out some big ideas for improving transport in Southampton to meet the aim of 11% change in mode share.

- Southampton Mass Transit System (SMTS) – a plan to transform the public transport system in Southampton and the City Region. This will allows people to travel around and across Southampton on a united system of different public transport modes under one united system that allows people to make and pay for their journeys seamlessly

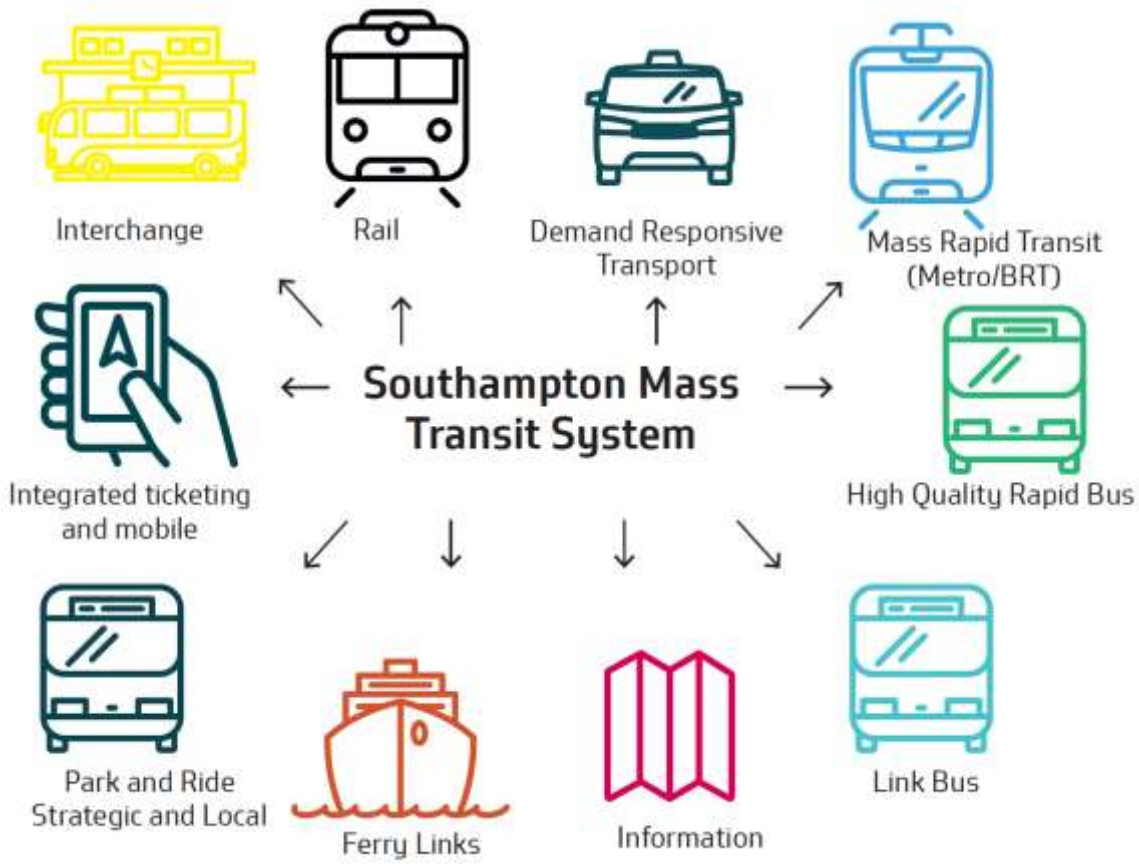


Figure 2.12 Southampton Mass Transit System (SMTS)

- A Liveable City Centre – over time the City Centre will be changed into a place where more people will want to live, work and visit. Transport is part of this making it easier for the SMTS to get around with new public transport hubs at destinations including Southampton Central Station, City Centre and Town Quay;
- Park & Ride – plan to establish a network of strategic Park & Ride and Local Mobility Hubs that serve the places people work and go for leisure or retail including the City Centre, Hospital and University;
- Southampton Cycle Network – develop a network of high quality cycle routes ranging from high quality Cycle Freeways to Quietways connecting people from their front door to where they want to go and interchange with other modes;
- A Zero Emission City – moving towards becoming a clean and healthy zero emission city by reducing traffic emissions through support of alternative non-carbon fuels and intelligent management of traffic.

The Southampton Transforming Cities (TCF) Programme is a first step in this connecting Totton & Waterside and Eastleigh to Southampton with improved cycle, walking and public transport corridors. The ZEBRA project would layer on this with the zero-emission buses, the operate on 2 of the TCF corridors, that support the objectives and provide another step in the decarbonisation and creation of a high-quality public transport system.

The UniLink services are a self-contained network of distinct routes that are already operating. By 2030 the approach in the LTP and BSIP is to have all buses in Southampton being zero-emission. This includes the wider GSC operated network (Bluestar, Salisbury Reds and Quay Connect), First's City Red network and the smaller operator Xelabus. This proposal would provide vital evidence and business case work to enable the others and the LTA to prepare, secure funding for, and deliver further zero-emission buses.

Corporate Plan 2021-25

The Southampton City Council Corporate Plan 2021-25 sets out how the Council will achieve the vision of Southampton as a City of Opportunity. It has ambitions for growth to be at the forefront of the journey to net carbon zero by 2050, UK City of Culture bid 2025, and Freeport Status. This including building on Southampton's unique location and transport links to grow the local economy. Aspiration for Southampton to lead the way in using technology to reduce air pollution.

The Plan has five areas and these are the most relevant to the ZEBRA project

- Growth – deliver a transport plan that provides a range of options to travel across the City while developing the Southampton Mass Transit System including improved rail, Park & Ride or trams – with a strategy and delivery plan, and agree an Enhanced Bus Partnership by April 2022;
- Our Greener City – deliver Electric Vehicle (EV) charging across our estates and introduce new EV buses into the city. The first phase of electric charging points to be installed by April 2022.

ZEBRA supports this with the specific priority to introduce the first zero emission buses into Southampton on a journey to make the entire fleet zero emission as soon as possible.

Greener City Plan 2030

The Southampton Greener City Plan 2030, adopted in 2020, sets out an ambitious vision to tackle some of the most challenging environmental issues in Southampton. This includes 60 actions to deliver it in response to the climate emergency the Plan commits to achieving net zero emissions in the Council's commercial buildings by 2030, increasing the proportion of renewable energy generated and the proportion of zero and low emission vehicles used.

The Plan has five sections, with three relevant to buses:

- Sustainable energy and carbon reduction – 90% of Council fleet will be zero-emission by 2030
- Delivering clean air – 100% of taxi and private hire fleet and bus routes to be serviced by low emission or clean air compliant by 2023, and work to deliver infrastructure to support zero emission public transport by 2030
- Sustainable travel – 15% of journeys by bike by 2027, delivering Active Travel Zones, and be in the top 10% of UK cities for number of public EV charging units by 2025.

To date delivery on the Greener City Plan has invested over £22m to tackle climate change and address ecological decline. In the first year (to March 2021):

- 30 new electric vehicles added to the SCC Fleet,
- Over 42% of Southampton's taxi and private hire fleet are now low emission vehicles,
- Introduced 6 School Street schemes around schools,
- Planted over 500 trees and created 7 new wildflower meadows,
- Installed over 1 mile of dedicated segregated cycle lanes making a total of 52.6, miles – and more being prepared through TCF,
- Launch of the Voi E-scooter trial, and

- Working with local haulier company Meachers on the Sustainable Distribution Centre (SDC) and the NHS to support on delivery and storage of PPE supplies reducing the number of HGVs delivering in Southampton.

The programme will continue with further EVs added to the city fleet, delivery of the sustainable travel infrastructure through TCF, and further incentives to make all taxis and private hires low or zero emission.

The ZEBRA project would support the delivery of the Greener City Plan with 32 new vehicles and the charging infrastructure, that would be available for other buses, to support zero emission public transport by 2030. As the project progress and with experience and learning the remainder of the bus fleet can be transitioned to zero emission over that time. It also ensures that all buses remain compliant with Euro VI requirement by 2023.

AQAP & NO^2 Plan

Southampton adopted its first Air Quality Action Plan (AQAP) in 2009 which sets out a series of measures to improve air quality in the city. Primarily these were focused on the Air Quality Management Areas (AQMAs) but also have benefits across the whole city. This aimed to reduce air pollution to below national objective limits in the shortest time possible and improving air quality related health impacts across Southampton.

In addition, in 2015 Southampton was identified by DEFRA in the National NO2 Plan as one of 5 cities outside of London where the international limit value for NO^2 was not expected to be met by 2020. Through a Ministerial Directive this instructed the Council to introduce a formal Clean Air Zone by 2020 or sooner. This was added to in 2017 with New Forest District Council required to devise plans for improving air quality where the NO^2 exceedenace is breached. This was an extension of the area identified in Southampton. Further feasibility work identified that a citywide Clean Air zone could not be implemented by 2019 and that there wouldn't be a discernible impact on air quality. The NO^2 Plan was published in 2018.

The AQAP and NO^2 Plan were prepared to improve air quality in Southampton to meet the national limit values. The AQAP and NO^2 Plan have transport and non-transport measures identified including Council's own activities and measures in the LTP. Some initiatives relevant to this bid include:

- Early measures to improve cycling with new cycle facilities on SCN1, 3 & 5
- Retrofitting to all city buses to make them lower emission at Euro VI standard – 145 buses were retrofitted to Euro VI or equivalent
- A low emission taxi grant scheme to move the taxi fleet to zero emission
- Develop an Electric Vehicle Action Plan (EVAP) that looks at implemented off-street public charging in public car parks to start a network
- Continue My Journey related workplace and school engagement with businesses and pupils to encourage greater up take of active travel

The EVAP is taking a strategic approach to respond to increases in electric vehicle (EV) ownership and to incentives to support those who make the switch. It identifies a range of activities including the scope of infrastructure required to support the transition to EV. This includes a joint procurement framework with Hampshire County Council and Portsmouth City Council for on and off-street EV charging points, installing a network of charging points in public car parks and then on-street (the first is being delivered through TCF), and supporting initiatives such as free car parking or free passage on the Itchen Toll Bridge.

The ZEBRA project supports all of this by continuing to reduce the amount of emissions from buses to zero and providing learning about developing infrastructure for electric buses which can be learnt with other modes such as taxis.

Cycle Strategy

In 2017, Southampton approved its 10 year cycle strategy as a supporting document of Connected Southampton 2040. It sets out a vision to transform cycling in Southampton so that it becomes a true cycling city, creating a liveable, integrated, thriving and mobile city where safe cycling is the norm. Through a clear strategy it sets out activities to meet rising demand for cycling so its potential is realised, making travelling by bike a real alternative to the car.

The strategy is focused around three themes with the ambitious target that over 10 years to increase cycling's mode share by 10% each year by delivering and promoting cycle improvements along 10 corridors. This would increase cycling's person mode share from 5.5% in 2017 to 15.8% in 2027 with 20,000 new cycle trips a day. The three themes are:

- Better Cycling – making Southampton a better place to cycle by delivering the Southampton Cycle Network (SCN) connecting people from their front door to where they want to go along a network of cycle routes and facilities, that is integrated with other modes of transport;
- Safe & Easy Cycling – implementing schemes and initiatives that make the city's environment safe including Legible Cycling wayfinding, cycle training and security; and
- Inspiring Cycling – promoting the benefits of cycling so to change people's travel behaviours and habits.

Figure 2.13 – Southampton Cycle Network

The SCN identified several main corridors for cycling, many of which follow multi-modal corridors such as Shirley Road or Portswood Road. Since 2017 the Council has implemented three of the corridors with segregated cycle and multi-modal facilities as part of the 10 year plan. Examples include:

- SCN1 between City Centre and Totton with new two-way segregated cycle lane,

- SCN5 on The Avenue between the City Centre and Southampton Common and University – this include Southampton's first Copenhagen style segregated cycle lanes, and
- SCN3 to Bitterne and Bursledon that included junction changes with bus priority, a combination of quietways and two-way segregated cycle paths.

These have seen increases in the numbers of people using them, with increases in cycling of between 10 and 20% on before conditions. Further cycle routes are being delivered as part of the Southampton TCF and Active Travel Fund programmes.

The Council will now be developing a combined Local Cycling & Walking Strategy & Investment Plan (LCWIP).

Economic & Green Growth Strategy

The Council is preparing an Economic & Green Growth Strategy for growing the economy as the city emerges from the Covid-19 pandemic. It sets a vision to build on Southampton's ongoing economic growth and Green City agendas to restore and renew our economy as a green, fairer and healthier city.

The focus is on:

- People, employment and skills – bring quality local jobs to people and reduce inequalities,
- Supporting and growing local businesses – greener business, business innovation and growth,
- Growth through sustainable place shaping – green development, regeneration and growth, physical infrastructure, improving city and district centres, and creating a digital city;
- Growing an International City – global gateway, Freeport, cultural City – City of Culture, and strengthen international relationship.

The ZEBRA project will support this by providing access to jobs by great transport and support the green development of the city.

2.5.4 ZEBRA and Policy Alignment

The Southampton ZEBRA bid aligns with national, sub-regional and local policy objectives around green growth, decarbonisations, introducing zero-emission buses, levelling up and improving the transport user experience.

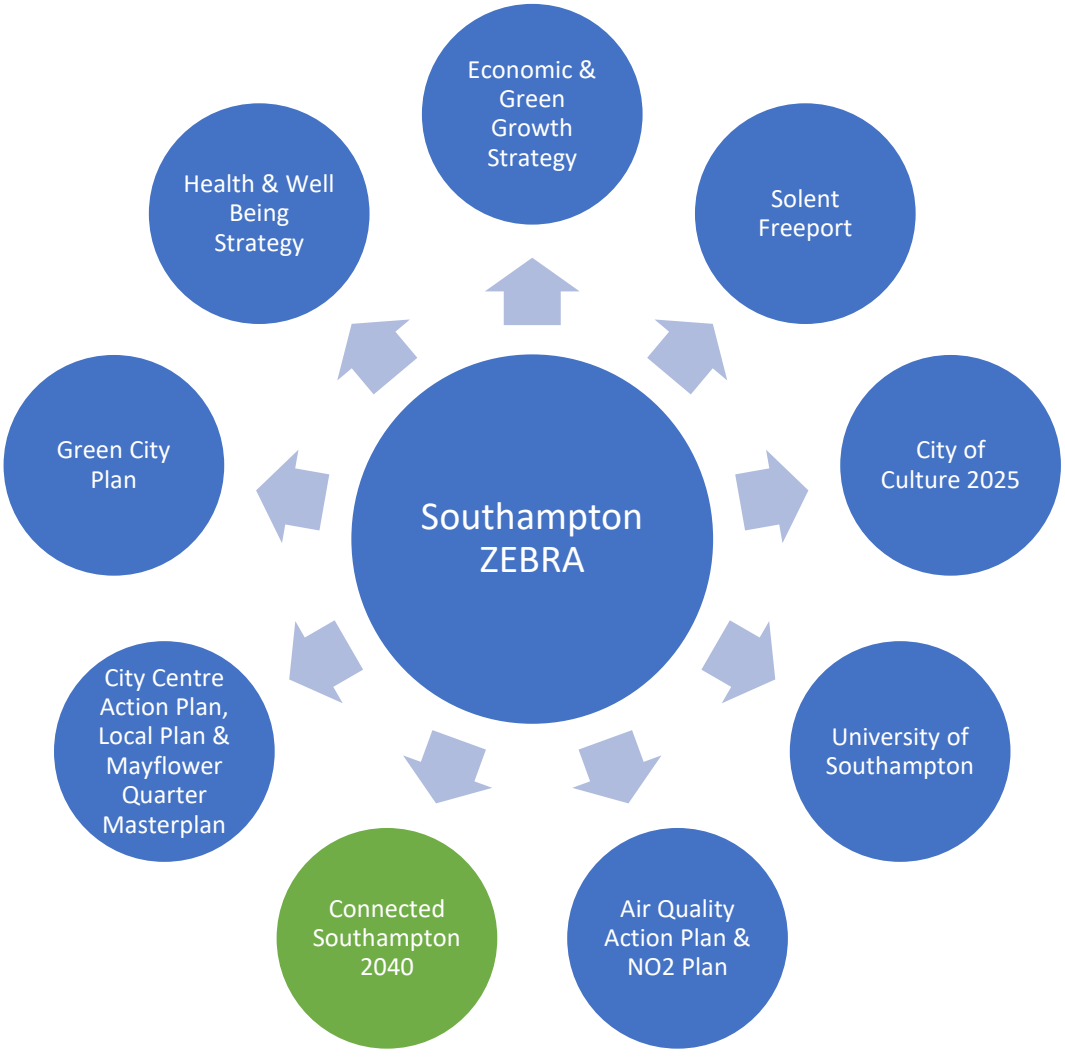
		ZEBRA Objectives						
		Commitment to decarbonisation and reduce transport's contribution to CO^2 emissions	Support roll out of 4,000 Zero Emission Buses	Support manufacturers in development of zero-emission bus technology	Support partnership working between LTAs and bus ops	Understand challenges		
DfT	Levelling Up Economy						Connectivity	Regional
DfT	Reduce Environmental Impacts						Decarbonisation	Regional
DfT	Improve Transport for User						Value for Money	Regional
		Sustainable economic growth	Local levelling Up	Becoming a Greener City	Ambition for Transport	Increase bus patronage		

	Local Objectives			
Strong Alignment	Good Alignment	Neutral	No Alignment	

Table 2.11 – Southampton ZEBRA Policy Matrix

ZEBRA impacts the policies by:

- Introducing 32 zero emission buses in Southampton, which will the first in the city allowing 14% of the network to be zero emission but carrying 20% of the passengers. This would form part of the 4,000 zero emission bus target and provide the ability for learning to be gained for all operators in Southampton regarding introducing zero emission buses;
- This, alongside the other SCC and University of Southampton projects that are introducing zero emissions vehicle to their fleets will contribute towards the wider decarbonisation of transport in Southampton;
- ZEBRA will help to create the Zero Emission vision in the LTP and Greener City vision for the Corporate Plan, it will also provide zero emission access to the Solent Freeport locations at Southampton Airport and the Port allowing staff to access work by green modes
- Zero emission buses will continue to improve transport for the user in Soutahmpton



2.6 Southampton's Ambition and the Case for Change

This section sets out the ambition for zero-emission buses in Southampton and the case for why the change is required.

It provides strategic context, identifies the drives for change including the need for change, the air quality problem in Southampton and Eastleigh, other drivers and how it fits with the strategic transport ambitions of Southampton and the recently published Southampton Bus Service Improvement Plan (BSIP).

2.6.1 Strategic context

The Southampton ZEBRA bid is focused around four strategic drivers for change that support the Council's ambition to be a City of Opportunity[7] as set out in the Corporate Plan 2021-25. the overarching ZEBRA bid objectives, and wider DfT strategic priorities.

The ZEBRA bid objectives are:

- To support Government's commitment to decarbonisation and to reduce the transport sector's contribution to CO^2 emissions;
- To support the roll out of 4,000 Zero Emission Buses;
- To support bus manufacturers in development of zero-emission bus technology;
- To support partnership working between LTAs, bus operators, and other local stakeholders
- To understand better the challenges of introducing zero-emission buses and supporting infrastructure to inform future government support for zero-emission buses.

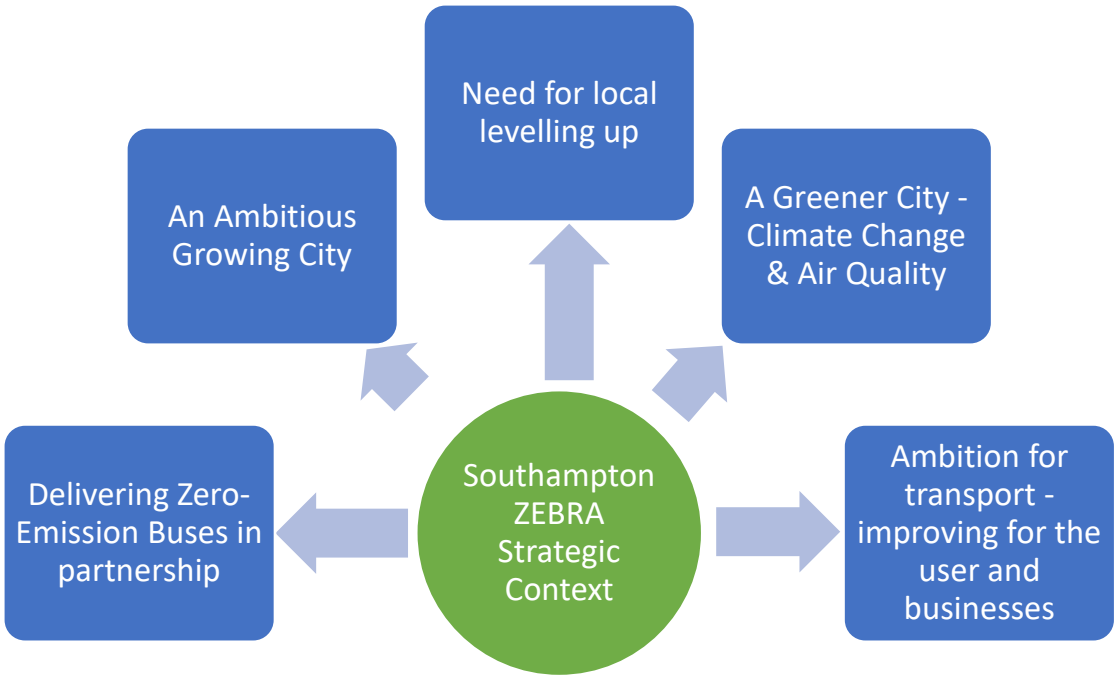
The DfT strategic priorities are:

- Grow and Level Up the Economy
- Reduce Environmental Impacts
- Improve Transport for the User

The strategic drivers for change in Southampton Corporate Plan are:

1. An ambitious growing city where need to support new jobs and opportunities that enable the journey to net carbon zero by 2050, City of Culture 2025 bid, and Freeport Status. This includes building on the city's excellent transport links to continue to grow the economy, develops to meet demands of a modern world, and remains a great place to live & work;
2. A need for local levelling up that connects deprived communities with those new jobs and opportunities, but also improving Southampton's productivity against South East average;
3. Becoming a greener city that can accommodate changes in the environment and leads the way in using technology to reduce air pollution as part buses play in getting to net carbon zero; and
4. The ambition for transport, particularly buses, improving it for the user, the need for modal shift and supporting local businesses.

[7] Southampton Corporate Plan 2021-25



From this strategic context there are drivers for change and why we want to intervene with the Southampton ZEBRA project. These are:

- An **Ambitious Growing City** that needs high quality public transport so that economic growth is sustainable, zero emission buses form part of the approach;
- Need for **levelling up and tackling deprivation** by having high quality public transport that is reliable, and can be used by everyone to get to where they need to go, and that the disproportionate impacts of transport such as pollution on health inequalities are reduced;
- **Reducing the environmental impact of transport** with the transition to a zero carbon transport system. This is needed to reduce the impacts of air pollution on residents in Southampton and to make the city resilient to climate change. ZEBRA supports the work that the Council and University are doing to decarbonise their own fleets, and supports the bus operators in moving to zero emission buses by helping with the high set up costs for zero emission vehicles; and
- **Improving Transport for the User** with high specification vehicles that are accessible for all, allow for a fairer fare system through capped fares, that meet the latest PSVAR standards, and the ambitions of the emerging Southampton Enhanced Partnership.

2.6.2 An Ambitious Growing City

Sustainable Economic Growth

Southampton has some bold ambitions for the future for sustainable economic growth.

These are set out below.[8]

[8] Connected Southampton 2040 Transport Strategy

Southampton's Future

Between 2015 and 2036 £3bn is expected to be invested in development in Southampton creating 24,000 new jobs with 7,000 being created by 2026.

This will see a potential increase in population of 30,000 more people living in Southampton.

The growing population will require places to live, meaning over 19,500 new homes are required to be built in Southampton, and another 23,000 in the surrounding area.

The Port of Southampton is planning to double its throughput by 2035 and could be handling 3.46m people on cruises, over 3m containers, 1.8m vehicle exports, and 2.6m tonnes of bulk cargo.

This growth could see an additional 74,000 people trips being made – 11% more than now. To keep traffic levels at the same as today almost 40,000 of the additional trips will need to be made by public transport – primarily bus.

To deliver this there is a need for high quality, clean and safe transport links. As set out in our LTP Connected Southampton 2040.

Most of the housing and employment growth in Southampton will be in the City Centre as set out in the City Centre Action Plan (2015) and draft Mayflower Quarter Masterplan (2021). Through to 2026 5,450 new homes are planned along with employment development providing 4,700 new jobs.[9] This development is worth £3bn, and £1.9bn of the development has already occurred including at West Quay South, Bow Square, Mountpark Southampton (former Ford factory at Swaythling), Moxy Hotel, developments around the Central Parks, and MAST Arts Complex completed in the past three years.

Further sites will continue to intensify land use and grow population in the City Centre. The Bargate ward is already the fastest growing ward in the city (with population 20% since 2011), and by 2024, its population is expected to increase by 20% again. Several major development sites have been identified as 'Very Important Projects' by SCC the locations of which are shown in Figure 3.14, and are promoted as vital to the economic growth aspirations of Southampton and the wider City Region.

Over the next five years major residential and mixed use developments are in the pipeline, the primary ones being:

- **Bargate Quarter** – residential (519) and retail (2,500m²) mixed used in heart of City Centre reinvigorating the historic City Walls and connecting West Quay with East Street quarters (starting 2022);
- **Itchen Riverside**– residential and employment clusters with focus on marine and maritime sector as well as St Mary's Stadium (already started with 800+ homes through Chapel Riverside – 457 homes and Meridian Waterside – 350 homes - developments), Northam Gasholders (400-500 homes), and the River Itchen Flood Alleviation Scheme (RIFAS) will protect over 1,000 homes;
- **LeisureWorld** – mixed residential (600 homes), office (10,000m² and leisure (10,000m²) offer densifying site and acting as part of Mayflower Quarter along West Quay Road;
- **Maritime Gateway** – mixed used residential (600 homes), office (10,000m²) and retail (2,000m²) offer on former Toys R Us site opposite Southampton Central Station; and

[9] City Centre Action Plan, SCC, 2015 & Core Strategy, SCC, 2015

- **Nelson Gate and Mayflower Quarter -** Nelson Gate is north of station (344 homes) and south of Southampton Central Station are major mixed office, residential, retail and leisure plans that will create a new Central Business District adjacent to Southampton Central station.

Figure 2.14 VIP development sites in Southampton

This will change the focus and mix of the City Centre with further retail, employment, education, cultural and residential facilities.

Future growth in Eastleigh - A third of the housing growth by 2036 within the Borough is expected to be within a proposed Strategic Growth Option (SGO) area at North Bishopstoke-Fair Oak. 3,300 new homes are to be delivered up to 2036 (and proposals for a further 2,000 beyond 2036). Sites for a further 7,000 new homes either have planning permission or are proposed for new housing within the emerging Eastleigh Local Plan. These sites form an arc to the north and east of Southampton. Working clockwise these sites are:

- Stoneham Park (Eastleigh urban extension),
- West of Horton Heath,
- Boorley Green,
- To the east of Hedge End at Woodhouse Lane, and north of Botley, and
- Bursledon west of Hamble Lane and in Hamble[10].

This growth along with strong employment growth within Southampton could increase in-commuting into Southampton.

Employment allocations are clustered in Eastleigh Town Centre and around Southampton Airport and 30,000m² of employment floorspace is proposed for the SGO. While a level of self-containment of additional trips is expected to be achieved at some of the largest developments, it is forecast that current high volumes of travel between Eastleigh and Southampton, and vice versa, will intensify as a result of these developments. For example, it is anticipated that 12% of residents in the new SGO will work in Southampton and 18% in

[10] Draft Eastleigh Local Plan, EBC, 2019

Eastleigh. This will see further trips being made along the congested A335, A334 and A3024 corridors crossing the M27. Bus connections from Fair Oak are already lengthy and increases in traffic on Bishopstoke Road into Eastleigh will further compound these times and further undermine the attractiveness of bus services.

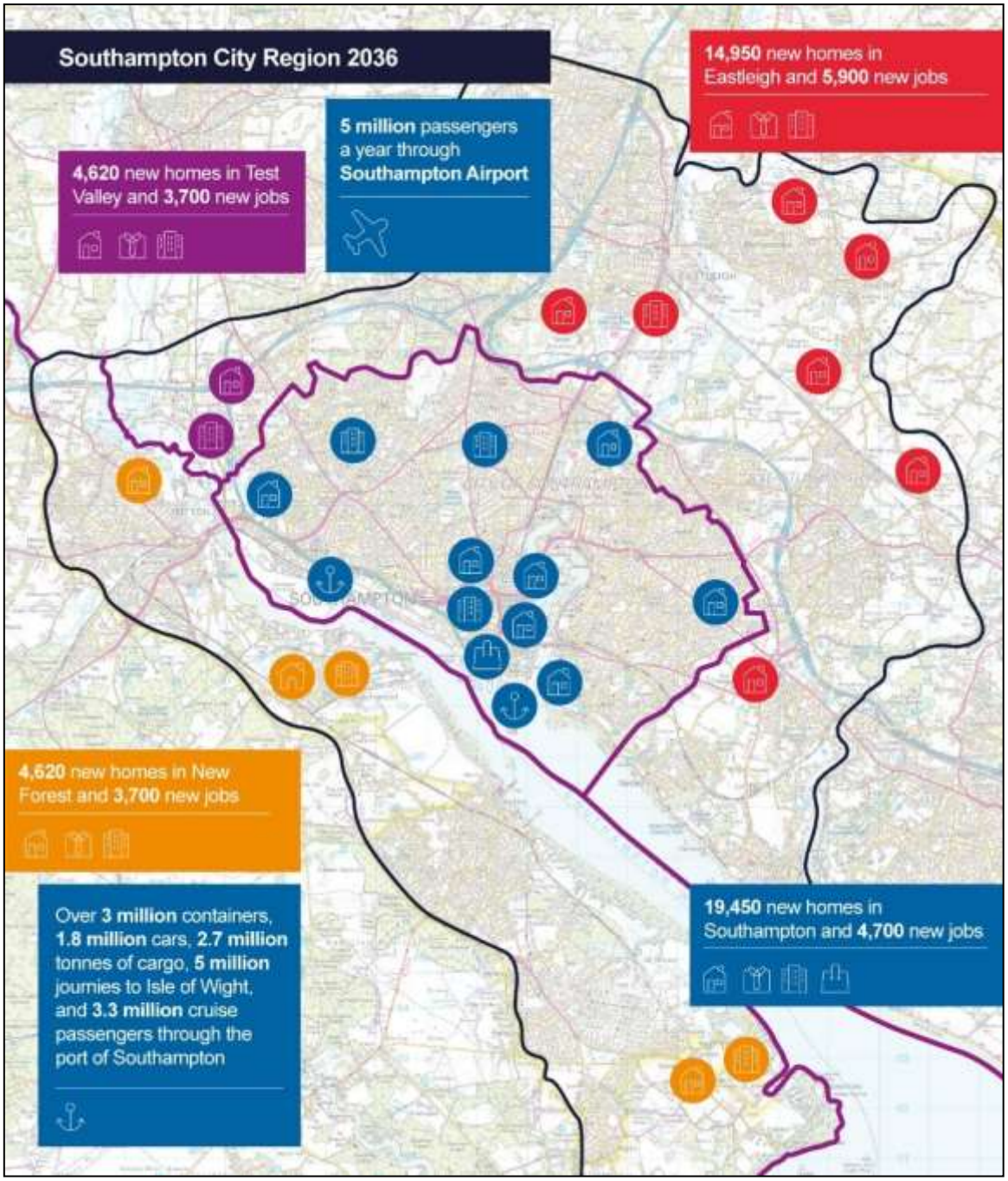


Figure 2.15 Southampton City Region Developments

The City Region's **two International Gateways** have masterplans for growth, and both form part of the Solent Freeport proposals:

- ABP as the owners of the Port of Southampton are planning for significant growth in both cargo and cruise passenger traffic to 2035. Over this timeframe, the level of container traffic is expected to increase by 57% to between 3.1m and 3.7m TEUs (twenty equivalent units) ro-ro automotive traffic and dry bulk volumes are expected to double, and general cargo increase by 88,000 tonnes compared to in 2015. To

enable this growth the Port is investing £500m in new quayside, container movement and vehicle handling facilities.

- Cruise passenger levels are also expected to increase to 3.5m with additional cruise calls across the week and the new Horizon Cruise Terminal opening in Summer 2021[11]. Intensification of use facilities is planned at Solent Gateway (formerly Marchwood Military Port) in the longer term.
- Southampton Airport is also planning to grow from 1.9m passengers in 2017 to 5m by 2037 and is planning for expansion of terminal, runway and parking facilities in the next 5-10 years[12].

This forecast growth at the international gateways are expected to see increased Heavy Goods Vehicle (HGV) traffic movements between the M3-M27 and the Port, and in vehicles travelling to and from the Airport via A335 and M27.

The University of Southampton is one of the UK's top research universities and a member of the Russell Group. Over the coming decade the University is planning to invest approximately £300m in its estate to improve the quality of the teaching spaces and student experience. This is particularly key in the recovery from the Covid pandemic. The University has strong links with the National Oceanography Centre (NOC) in the Port's Eastern Docks and University Hospital Southampton. The UniLink network is focused on the University with all services using the modern Highfield Interchange.

University Hospital Southampton (UHS) NHS Trust employs over 11,000 people in a variety of roles and services. UHS are investing heavily in research, cancer treatment, additional capacity and an innovative Health Campus which recently started construction. UHS is served by the U6 and U9 providing connections between the University and Hospital campuses.

An Ambitious City Summary

The Southampton ZEBRA project helps support this by

- Providing 32 new zero-emission vehicles on existing routes to University of Southampton, City Centre, Central Station, University Hospital, Port of Southampton and Southampton Airport
- This allows people zero-emission access to these important employment hubs and encourages modal shift with the latest modern vehicles

2.6.3 Levelling Up & Deprivation

Southampton is one of the most deprived cities in the South East – with pockets of deprivation in it. 11% of the city's population live in the top decile of the most deprived areas of England.

People living in these areas, which are either close to the City Centre or are located on the edge, have lower levels of car ownership. These areas also have higher levels of bus travel to work and reliance on buses for other journeys. Car ownership across Southampton is lower than average, with 30% of households in the city not having access to a car – this rises to 51% in Bevois ward close to the City Centre. Areas around the University in Swaythling have above average levels of no car owning households. These are shown in Tables 2.12 and 2.13 and on Figure 2.16.

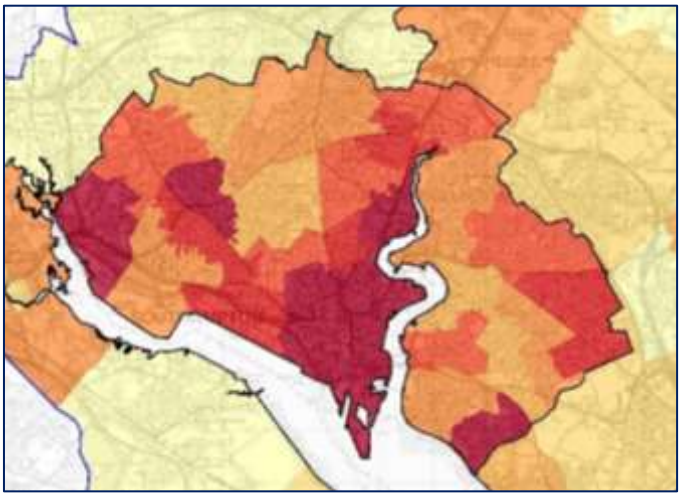
[11] ABP Port of Southampton Draft Masterplan 2035, 2016

[12] 'A Vision for Sustainable Growth' - Southampton Airport Masterplan to 2037, September 2019

IMD 2020 Southampton	Households Not Owning a Car	Method of Travel to Work			
		Walk	Cycle	Bus	Car
10% most deprived	42%	15%	4%	14%	54%
10% least deprived	16%	16%	7%	5%	54%

Table 2.12 – Method of travel to work and car ownership, Southampton, 2011 Census

Car Ownership Levels in Southampton



Households with No Car/Van Ownership in Southampton by MSOA (2011 Census)

Ward	No Cars in Household	1 Car or Van	2+ Cars or Vans	Travel to Work by Bus
Bargate	43.6%	43.1%	13.2%	7.4%
Bassett	21.6%	43.5%	34.8%	6.9%
Bevois	44.5%	39.9%	15.5%	9.7%
Bitterne	33.5%	43.1%	23.4%	12.0%
Bitterne Park	19.5%	47.4%	33.1%	7.9%
Coxford	24.2%	47.6%	28.2%	9.4%
Freemantle	29.7%	48.8%	21.5%	7.3%
Harefield	25.9%	44.2%	29.9%	9.6%
Millbrook	29.3%	45.0%	25.6%	9.6%
Peartree	23.5%	44.7%	31.8%	10.2%
Portswood	32.0%	43.7%	24.3%	9.4%
Redbridge	32.3%	44.2%	23.5%	10.4%
Shirley	26.6%	45.3%	28.1%	6.6%
Sholing	18.8%	45.7%	35.5%	9.7%
Swaythling	32.6%	43.3%	24.1%	11.5%
Woolston	29.5%	45.2%	25.4%	13.2%

Table 2.13 Car Ownership Levels by Ward and MSOA in Southampton (2011 Census)

Table 2.9 shows where the levels of car ownership are lowest in Southampton, these are also the areas with the higher levels of travel to work by bus. The areas in Bevois, Portswood and Swaythling wards with lower levels of car ownership have higher than average levels of bus use. The U1 for example links both the Wessex Lane halls of residence with the University, but also a large residential area in Mansbridge with the University and City Centre.

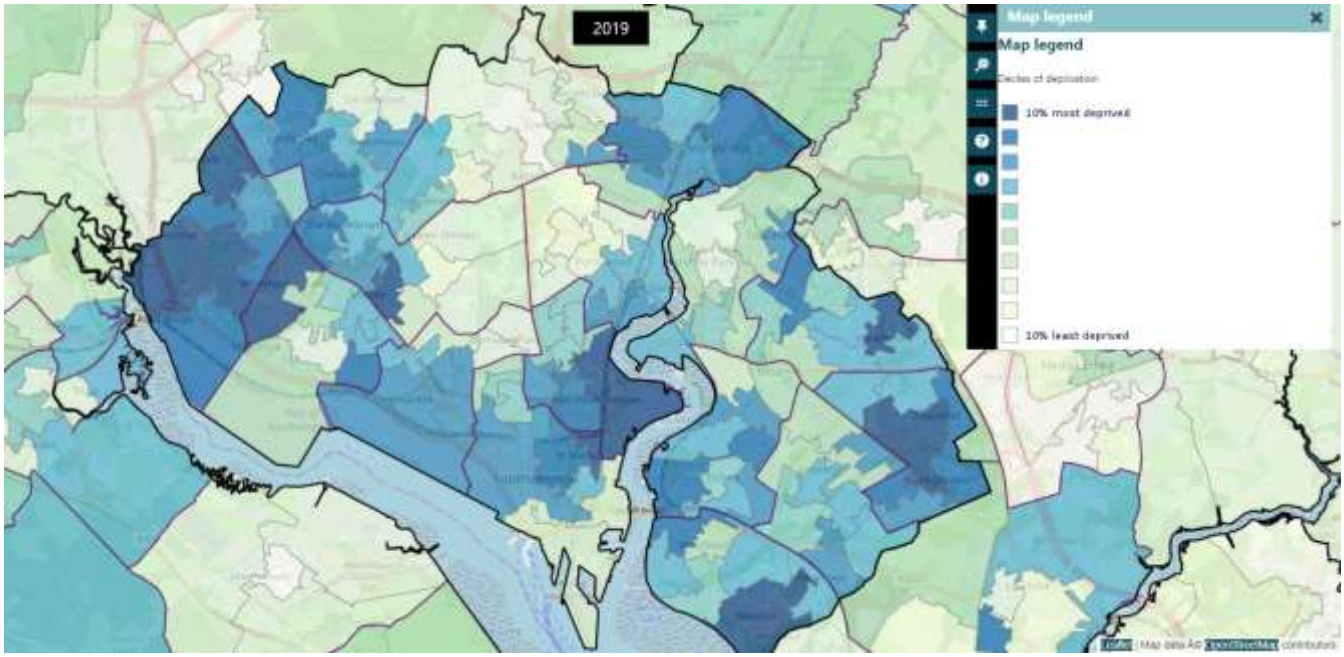


Figure 2.16 – Levels of Deprivation in Southampton (IMD 2019)

The Southampton Joints Needs Assessment (2019) notes that whilst Southampton has achieved significant economic growth in the last few years, in line with being in the affluent south, the city's characteristics relating to poverty and deprivation present challenges more in common with other urban areas across the country with high levels of deprivation.

The Index of Multiple Deprivation (IMD 2019), shown in Figure 2.16, illustrates how Southampton continues to be a relatively deprived city. Based on average deprivation rank of its neighbourhood LSOAs, Southampton is now ranked 55th (where 1 is most deprived) out of 317 local authorities; more deprived than comparator cities of Bristol (82nd), Leeds (92nd) and Sheffield (93rd). Southampton has 19 LSOAs in the 10% most deprived in England meaning around 12% of Southampton's population live in these areas.

The well documented relationship between deprivation and health (e.g. Marmot 2010) and poor health can lead to low income with health affecting how people can take up paid employment. Poor health in childhood may also affect educational outcomes, limiting job opportunities and potential earnings. The wider environment, including emissions from traffic, can be a wider determinant in poor health outcomes.

Across Southampton there are some stark health inequalities between the most and least deprived neighbourhoods. Healthy life expectancy varies across the city, with males living on average 6.6yrs less in the most deprived areas compared to the least, while females live 3.1yrs less on average. Those in the most deprived are 2.85x higher to die at any age from any cause than the least deprived areas.

For example, there is a high prevalence of COPD and lung disease in deprived areas which can be affected by poor air quality. Emissions from traffic using fossil fuels passing or queuing in these locations, even outside of a designated AQMA, will have an impact on people's quality of life and potential to develop these life shortening conditions. Areas of Swaythling, Portswood and Bargate wards served by UniLink services are such areas. They are also areas with a high proportion of the population with multiple long-term conditions.

Improving the environment will have a contributory impact on improving conditions and quality at all stages of life. Transport, as well as providing the accessibility and connections to services, education and employment, is part of the environmental improvement. Reducing fossil fuel based emissions from transport will improve local air quality, but also makes transport safer and cleaner to use. This accumulation of benefits will improve people's quality of life and aim to reduce the inequalities in Southampton.

Through our TCF and the Solent FTZ programmes we are proposing to implement bus priority, better bus stops, widening local travel options, new cycle routes and creating spaces for people in local areas and in the City Centre. All the buses in the ZEBRA project will run on, fully or in part, TCF corridors (to Chandlers Ford and Portswood-Eastleigh). These will benefit from the priority and facilities so that people in these deprived or lower car owning areas have viable and attractive alternatives. For example, the Portswood corridor provides direct connections for people in Swaythling to the University, local shops in Portswood, health care at University Hospital, and to the City Centre. Better journey times on these routes means that buses are attractive, and provide a more efficient for operation on batteries.

The buses will be fitted with Tap On Tap Off readers which will allow for capped fares ensuring that users are charged the best value fare for their journeys.

The proposal will support the UK's bus manufacturing industry with support for jobs in Eastleigh with training opportunities, and in Northern Ireland at the proposed bus manufacturers.

All of this supports the Government's strategic priority to 'Grow and Level Up the Economy'.

Levelling Up & Deprivation Summary

The Southampton ZEBRA project will support two approaches to reducing inequalities and level up. The existing UniLink services travel through the areas with low car ownership and higher bus use in Bargate, Bevois and Portswood wards. These are also some of the most deprived areas in Southampton with poor health outcomes. Clean zero-emission buses will reduce transport's contribution to fossil fuel induced poor air quality, and coupled with wider transport programmes to improve journey times, improve active travel and reduce congestion, will assist in the reduction of the deprivation gap in Southampton and improve resident's quality of life.

2.6.4 Reducing Environmental Impact of Transport

Air Quality in Southampton

Approximately 100 people annually in Southampton are expected to die prematurely from poor air quality.

The Southampton ZEBRA bid provides a real opportunity to make a significant change in addressing poor air quality in Southampton, to make residents healthier, and reduce premature deaths.

Air quality remains a key health risk in Southampton. Estimates suggest that 5.8% of deaths in Southampton in 2017 were attributable to long term exposure to particulate pollution alone. It is important to reduce air pollution in Southampton quickly because:

- A large proportion of Southampton residents are children and young people (60,000 children and young people, 3,000 births per year), who are the most vulnerable, for longer, to the health impacts of pollution;
- Southampton has a higher than average rate of preventable respiratory and cardiovascular early deaths, high rate of chronic obstructive pulmonary disease, and comparable asthmas prevalence compared to England average;
- Deprivation is increasing, and Southampton has some of the most deprived areas in southern England;
- The area of NO^2 exceedance is alongside one of the most deprived areas of Southampton with a high density of resident children.

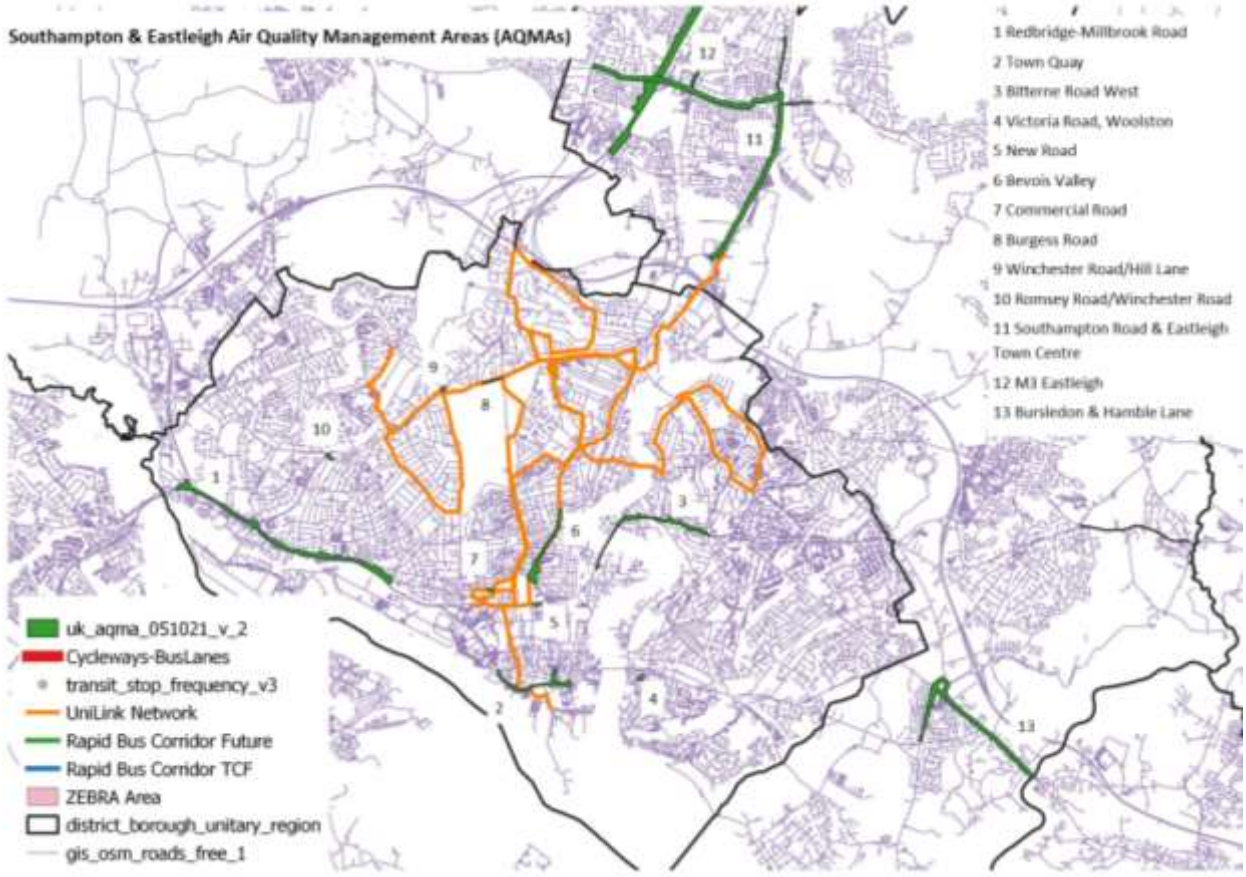


Figure 2.17 – Air Quality Management Areas in Southampton

There are 10 Air Quality Management Areas (AQMAs) with first implemented in 2008, in Southampton for exceedance in the annual mean nitrogen dioxides (NO^2) limit. The largest is the A33 Redbridge Road-Millbrook Road West (1) with other significant areas of Southampton covered include A3024 Bitterne Road West (3) and A335 Bevois Valley Road (6). Approximately 1,350 residential households, with approximately 1,700 residents, are within these ten AQMAs.

Figure 2.17 shows the location of the AQMAs in Southampton and Eastleigh and the interaction with the ZEBRA network. Five of the 10 AQMAs are on UniLink routes – Town Quay (2), Bevois Valley Road (6), Commercial Road (7), Burgess Road (8), Winchester Road/Hill Lane (9). Buses will run through the Southampton Road/Eastleigh Town Centre (11) AQMA in Eastleigh between the depot and Southampton. As the population increases in the City Centre, with the proposed growth explained in 2.6.2, better air quality will benefit these residents when they move in.

The Redbridge Road-Millbrook Road West AQMA coincides with the most heavily trafficked road which provides access to the City Centre and the Port. Road transport remains the greatest contributor to poor air quality and non-compliance in Southampton. All 10 AQMAs are established because of heavy traffic flows and queuing at junctions. Buses alone have been estimated to contribute between 3.5-8.5% of NO2 concentrations at monitored sites, rising to as high as 42% on two monitored corridors with high bus activity. The highest concentration monitored in the city in 2020 was at a location on an otherwise quiet roads lined by bus stops, largely believed to be a result of buses idling when waiting.

From a transport evidence base the reasons for high levels of air quality in the AQMAs can be due to:

- Congestion on A33 around M271 Redbridge Roundabout in peak periods, alleviated due to Highways England RIS1 project, served by 12 buses per hour,

- A limited number of crossings across the River Itchen from eastern Southampton,
- Shirley Road is served by 60+ buses per hour is prone to slower speeds across the day,
- Junction pinch points on cross-city routes cause localised congestion and air quality hotspots, and
- Congestion is in part a result of high levels of car usage, but on average 30% of Southampton households don't have access to a car – higher than the England average (26%).

More recently, Southampton was one of the first five cities required by central government to assess the need for a charging Clean Air Zone due to exceedances of the EU Ambient Air Quality Directive. While a charging Clean Air Zone was not found to be necessary, a series of non-charging measures were suggested and are now committed under a ministerial direction.

Buses were targeted for improvement in the Local NO2 Plan as the business case was able to demonstrate that improvements could be effective in quickly improving air quality and relatively easily achieved. Bus measures include the requirement to ensure that the bus fleet meets a minimum emission standard of Euro VI minimum. The clean bus retrofit programme was implemented as an early measure to The Local NO2 Plan and was successful in retrofitting over 140 buses to Euro VI compliance.

As a result of the recent infraction ruling from the EU Court of Justice and uncertainties around a recovery from the pandemic, SCC is under pressure from central government to provide assurances that the EU Ambient Air Quality Directive will be achieved in the shortest possible time. Electrification of buses in the fleet presents a significant opportunity to for improving local air quality by effectively removing tailpipe emissions.

Car ownership is uneven across Southampton, with central Southampton (Bargate and Bevois wards) having the highest levels of no car households. However, estates on the periphery have areas with low car ownership – Redbridge has 33%, but suburban Bassett has 19%.

The locations with lower levels of car ownership are those most affected by air pollution. For example the Redbridge Road-Millbrook Road and Bitterne Road West AQMAs are adjacent to the most deprived areas of Southampton. As set out in section 2.6.3, Southampton's deprived areas have higher percentages of adults with limiting long-term illness, COPD recorded prevalence, and heart disease.

Source apportionment for the Southampton Clean Air Zone Business Case was carried out at four locations in Southampton (A33, A3057, A3024 and A3025) showed that roads provided the most significant contribution to NOx concentrations (between 59-76% of all). The road contribution can be broken down further to show contribution from each of the main vehicle types. Diesel cars account for the highest proportion (average 41%) followed by HGVs. Bus travel accounts for 1.3% traffic on Southampton's roads[13], yet accounts for between 5 and 30% of NOx[14]. This is shown in Figures 2.18 and 2.19.

[13] SCC Traffic Counts 2019

[14] Southampton NO2 Plan - Clean Air Zone - Full Business Case (southampton.gov.uk)

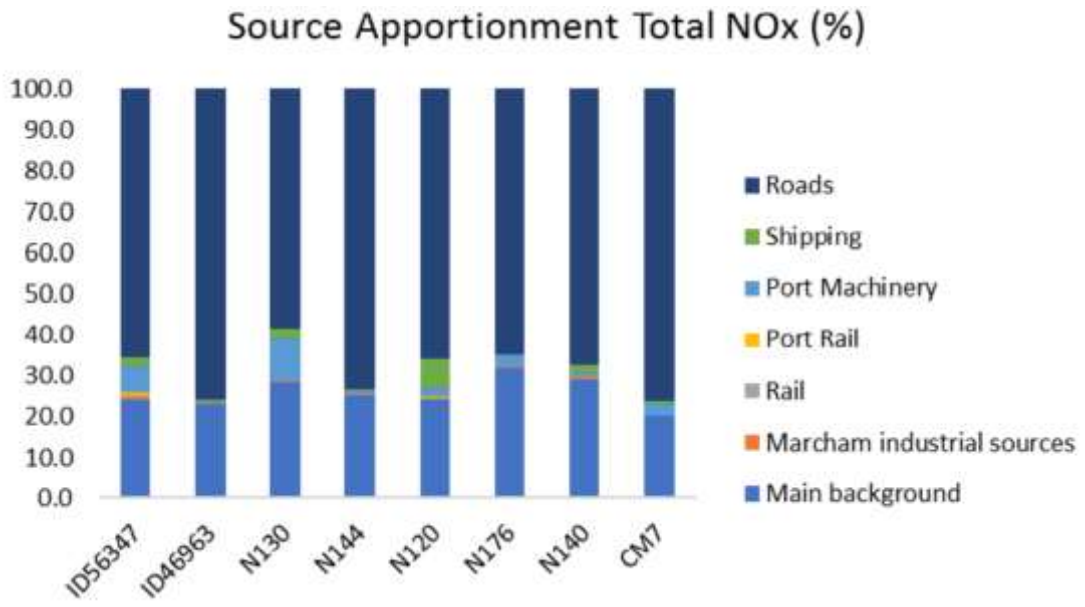


Figure 2.18 Source Apportionment Total NOx, Southampton 2015 Base

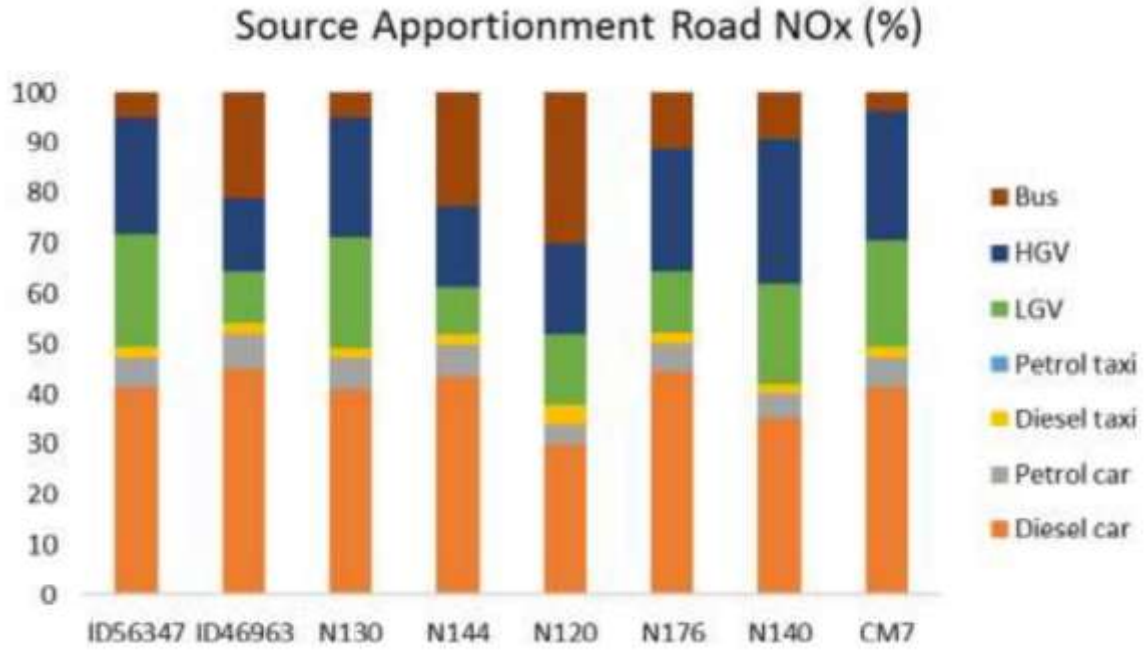


Figure 2.19 Source Apportionment Road Emissions, Southampton 2015 Base

As part of the Clean Air Zone work all buses in Southampton were either upgraded to Euro VI or engines were retrofitted with technology to reduce tailpipe emissions to Euro VI standards. This mean that as a result of the retrofitting programme emission from buses in 2020 reduce to 1-5%.

The ~200 Euro VI buses in Southampton have been estimated (using conservative assumptions) as emitting 9,910 kg of NO^2 a year. Upgrading 32 of these buses to electric would result in savings of about 1,530 kg of NO^2 a year because of effectively removing tailpipe emissions from these vehicles. This would benefit the AQMAs in the City Centre, such as Town Quay and Commercial Road, as the population increases in the future.

Air Quality in Eastleigh

Eastleigh Borough Council (EBC) is committed to reducing the exposure of people in the Borough to air pollution and has a long history of monitoring and delivering initiatives to

tackle air quality issues. There are currently four AQMAs in Eastleigh Borough, all of which have been declared due to the levels of nitrogen dioxide (NO_2) exceeding the annual objective of 40µgm^3. One of these, Eastleigh AQMA No.1 (A335 Southampton Road), covers an area directly affected by this bid as shown in Figure 2.8**Error! Reference source n ot found.**. **Error! Reference source not found.**.8 also marks the location of the Barton Road depot, from which buses travel through the AQMA along Bishopstoke Road and Southampton Road to Southampton. **Error! Reference source not found.** shows annual a verage measurements of NO_2 which include ongoing exceedances in recent years and a slowing rate of improvement, taking into account that unusual circumstances in 2020 will have affected the measurement in this year. This highlights the need for further intervention in this area, as detailed by the Council's Air Quality Action Plan (AQAP) which contains actions aimed at reducing pollutant levels for below the objective.

Road transport is the most significant contributor to NO_2 levels in Eastleigh Borough and is therefore the target of the majority of measures in the AQAP. Delivery of Southampton's clean bus retrofit programme has already benefitted the area by ensuring buses travelling through Eastleigh to the depot are EURO VI compliant, included in the AQAP as measure 'TR4.3 – Monitor progress of Clean Bus Technology Fund and implications for EBC'. However a source apportionment study carried out in February 2021 found that diesel EURO VI buses still contribute 2.4% of roadside NOx in this corridor and removal of bus tailpipe emissions will further contribute to compliance with air quality objectives in this key AQMA.

The project aligns with EBC's aspirations around electric vehicles, shown by measures in the AQAP including:

- ENV3 – Promote the use of electric vehicles
- TR5.1 – Promote the Low Emission Taxi Incentive scheme
- HOU1.1 – Update planning guidance to require EV charging in new developments
- EC1.4 – Upgrade EBC's internal fleet to low emission vehicles
- CFH3 / BIFOHH2 / HEWEB2 / BHH8 – Consider potential locations and funding sources to install electric vehicle charging points in various local areas
- CFH4 / HEWEB1 / BHH5 – Investigate expanding Co-Wheels electric vehicle locations to various local areas

Electric buses and other aspects of the Bus Back Strategy are also likely to mitigate the expected increase in private vehicle use because of COVID19 and public transport reluctance, further improving local air quality.

SCC recognise that any improvements to air quality can only serve to improve public health. The Council led Green City Charter aspires for continual improvement in local air quality to reduce the discrepancy in the public health burden pollution creates between Southampton and other areas.

Climate Change

The DfT's Transport Decarbonisation Plan aims to phase out petrol and diesel vehicles by 2040, and the National Bus Strategy sets out ambition for a green bus revolution to support achieving net zero by 2050. The funding for moving the bus fleet to zero emission by 2-4- will provide environmental benefits by decarbonising buses but also improvements in noise and vibration.

Locally, Southampton and Hampshire Councils have declared Climate Emergencies. SCC declared a climate emergency in 2019 and set out its actions in the Greener City Plan. A way of addressing the carbon footprint of the city is to decarbonise the transport network. The Council is already converting it fleet to electric, with much of the smaller vehicles already transitioned, and are now looking at the larger vehicles like trade vans and refuse vehicles. Hampshire County Council also declared a climate emergency in 2019, with a target to be carbon neutral by 2050.

Figure 2.20 shows estimates of per-person carbon footprint for Lower Super Output Areas (LOSAs) in Southampton. This is drawn from a wide range of data to show where carbon footprints come from and how they can be reduced. The UniLink network is added in red and shows that the services can help people to reduce their carbon footprint. Areas in Shirley and Bassett would benefit the most from making switch to bus and reducing their carbon footprint with the zero emission bus. This would also reduce carbon footprints where currently it is good now.

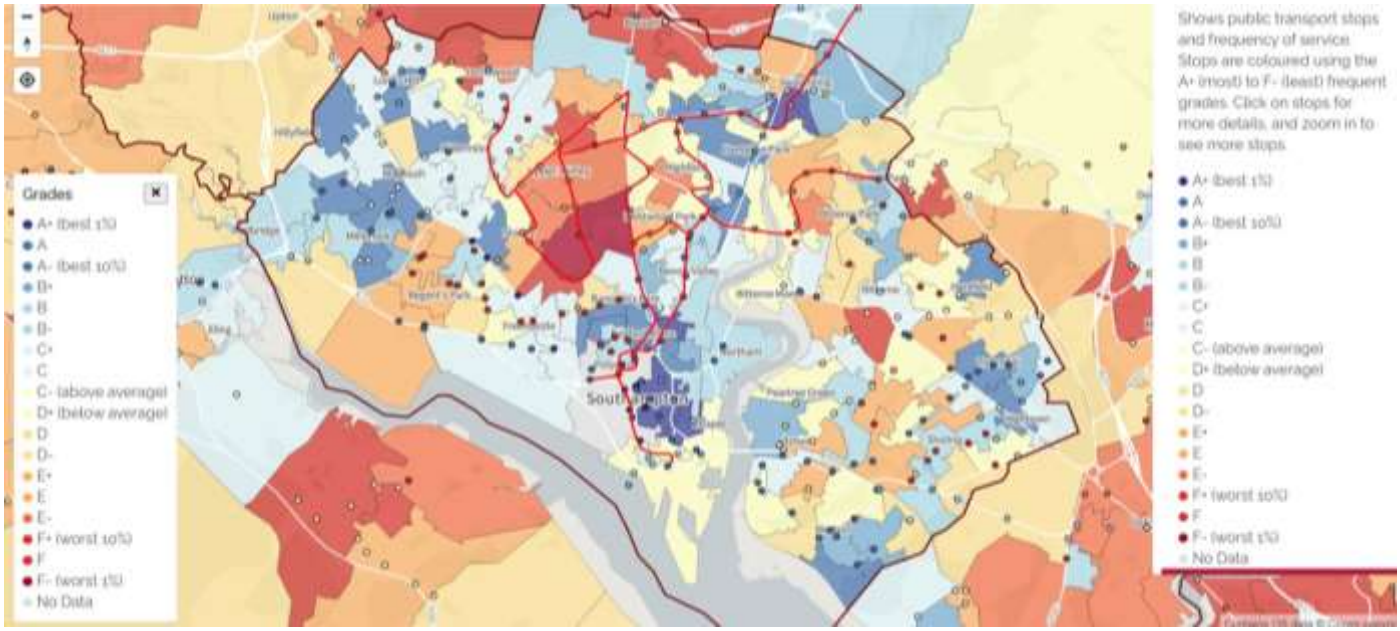


Figure 2.20 – Household Carbon Emission Estimates in Southampton with public transport routes

This directly applies and aligns with the Government's strategic priority to reduce the environmental impact of transport, and the ZEBRA objectives to introduce 4,000 zero emission buses, and support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO^2 emissions.

Reducing Environmental Impact of Transport Summary

The Southampton ZEBRA project will support the reduction in the environmental impact of transport in Southampton by

- Providing 32 zero emission buses that operate in six of Southampton's and one of Eastleigh's Air Quality Management Areas
- Reduce carbon emissions from transport in Southampton by x tonnes
- Improve air quality by reducing the NO^2 emissions

2.6.5 Improving Transport for the User

Improving the transport system for the user is a strategic priority for DfT.

Southampton has good bus usage, with over 20m bus passenger journeys made annually before Covid. This has grown by 10% since 2010. There is still potential for further growth in markets. Usage in terms of journeys per head is lower than Reading, Nottingham and Bristol which have similar socio-economic characteristics.

However, as we emerge from the pandemic bus use in 2021 was 50% down compared to 2019 and further growth is required. Continuing to make bus travel attractive and innovative is a key part of the Southampton BSIP vision.

There has been a history of investment in bus vehicles in Southampton meaning that the bus fleet in has an average age of 2 1/2yrs with fares among the lowest in the country. Continued investment by the operators and innovation with multi-modal smartcards (SolentGo), USB & WiFi, low floor, Euro VI compliant vehicles – all completed by 2020, and investment in the bus stops infrastructure has contributed to bus patronage in Southampton bucking national trends.

There has so far been no commercial investment in zero emission buses, all buses are low emission and bus operators have progressed to have their diesel fleet at Euro 6 standard by 2020.

User satisfaction ratings (Transport Focus Surveys 2019 for GSC and First Hampshire) show that Southampton performs well for some elements being above the England average. However, the results of these surveys show that satisfaction with punctuality and the value for money nature of bus travel is low. While Southampton is above the England average this indicates that there is still requirement to improve the levels of satisfaction. This is shown in Table 2.14.

	England	Bluestar	First
Overall	89%	89%	89%
Journey Times	85%	89%	85%
Punctuality	74%	80%	78%
Value for Money	66%	72%	54%
Customer Service	76%	83%	80%
Cleanliness	79%	89%	87%
Space	87%	89%	89%

Table 2.14 Bus User Satisfaction GSC & First Hampshire (Southampton & Portsmouth)

Research for the Southampton BSIP indicates that almost two-thirds of the respondents[15] would use the bus more if buses in Southampton were electric or other zero emission vehicles.

A focus on the UniLink network, which is commercially operated via the contract with the University of Southampton, means that the ZEBRA investment will ensure around 20% of users on Southampton's bus network will be travelling on electric buses from 2023. Initially 14% of Southampton's buses will be electric but investment in GSC's depot will mean that further electric buses could be implemented. This will significantly raise the profile of bus travel and improve passenger experience on bus travel as Southampton emerges from the pandemic. This will encourage further passenger growth from both students and public.

Southampton is pursuing an Enhanced Bus Partnership, which stems from the adopted BSIP with a goal of having a zero emission bus fleet by 2030. The ZEBRA project will provide the learning and experience to allow the bus operators to understand the value of investing in zero emission vehicles as part of any future rolling programme of investment. Zero emission buses fit into wider plans for decarbonising transport in Southampton, the Greener City Plan is looking to make SCC's own fleet zero emission by 2030. Entering the EP in early 2022 will mean that, along with local investment, maximise the potential access to upcoming Government grants. This will ensure that the growth in the wider Southampton City Region will be sustainable and zero carbon. Figure 2.21 shows this transition.

[15] SCC BSIP Survey responds level 1,851

Figure 2.21 – Timeline for transition to zero emission buses in Southampton

Routes will provide access to Southampton's hospital – University Hospital Southampton and Royal South Hants. Providing clean transport access for staff, patients and visitors.

There is a focus on the route serving both of Southampton's Universities – Southampton and Solent. Travel for students from the University of Southampton on the buses is included in their halls fees. Travel is allowed for the public on these services as well. This will provide cleaner and high quality buses for students, staff and visitors to the Universities, maximising the chances that students will continue to use the bus as their graduate and move into world of work. The services pass eight schools, and as children are more prone to asthma and other breathing difficulties exacerbated by air pollution. Introducing zero emission buses on these routes will be important in tackling this.

The buses will serve some of Southampton's biggest employers – Port, Hospital, City Centre, University & Airport – allowing for access to these sites by zero emission. This will complement investment by these employers in their own fleet. The Port of Southampton have invested in shoreside electric vehicles and the new Horizon Cruise Terminal provides UK's first shore-to-ship charging to reduce emissions from ships when in port.

It should be noted that the existing Euro VI UniLink buses will be cascaded elsewhere in the GSC family of companies giving benefits beyond Southampton.

New zero emission buses provide significant benefits to people using them over the existing diesel fleet. On average they emit 34% less CO^2, the vehicles are quieter for on board travel, and will be supplied to highest specifications that meet operator and PSVAR standards to help with accessibility:

- Wheelchair ramps and space for 2 wheelchairs,
- Tap On Tap Off readers for contactless capped fares,
- USB Chargers and WiFi,
- High quality interiors with colours schemes to help dementia,
- 'Next stop' audio and visual announcements, and
- Double door entry and exit for faster loading and unloading to minimise dwell time at bus stops.

It should be noted that the cost of new zero emission buses can be significantly higher than standard ICE vehicles. Market engagement for this project found that zero emission buses can be 110% higher than ICE vehicles. This increases more with other items such as battery replacement, and any opportunity charging. Costs for chargers and the electrical connection infrastructure are additional. Therefore, commercial investment in new zero emission buses by operators, even when accompanied by investment in roadside infrastructure (bus priority, bus stops, and real time information), is not financially viable.

Learning by the wider Go-Ahead Group at Salisbury and Waterloo indicates that third party capital investment is crucial in getting these projects successfully concluded. Battery performance and size capacity have also grown in the period since these schemes, so that

batteries are able to operate on services in a city size of Southampton effectively on one overnight charge.

The ZEBRA project will operate alongside the Southampton TCF Programme (2.6.10) and the Solent Future Transport Zone (FTZ). All of which are aiming for a step-change in public transport and active travel in Southampton. As part of the Solent FTZ programme a Mobility as a Service (MaaS) product is due to launch in Summer 2022 and will be able to be used on the buses. Solent MaaS, known as Breeze, will initially include buses and escooters, with rail, car club, ferries and bikeshare being added to over 2022. This is one of the first MaaS projects in the UK, and the first outside of an ITA. This will provide an added benefit in encouraging more people to use the bus with best value fares and easy integration with other modes.

The buses will be entering service on the Portswood TCF and City Centre corridors where investment in bus priority, interchanges, bus stops and local mobility options will help to improve bus journey times and integration with other modes.

This directly applies and aligns with the Government's strategic priority to improve transport for the user, and the ZEBRA objectives to support partnership working between Local Transport Authorities, bus operators, and other local stakeholders as set out in the NBS, and provide a better understand of the challenges of introducing zero emission buses and supporting infrastructure to inform future government support for ZEBs

Improving Transport for the User Summary

The Southampton ZEBRA project will improve transport for the user in Southampton by:

- Providing high specification zero emission buses that are open for everyone to use
- Provide zero emission access to key employment, education and health care destinations in Southampton providing clean access for staff, patients, students and visitors
- Meet the aspirations of the Southampton BSIP with start to zero emission buses – 20% of Southampton's bus passengers will be travelling on a zero emission bus in 2023.

2.6.7 Other drivers for change

The University of Southampton has a longstanding commitment to environmental performance, carbon reduction and sustainability. The current Sustainability Strategy was introduced in 2020 and commits the University to reaching zero carbon operation by 2030, with specific goals linked to Scope 3 emissions and carbon associated with transport activity. Strategy documents are available on the University Sustainability website.

The University operates an Environmental Management System accredited to ISO14001:2015, and is in the process of establishing an Energy Management System under ISO50001, to plan and deliver continual improvement in environmental and energy performance.

The University Travel Plan provides further context for transport activities across University campuses, with specific objectives for the growth and improvement of Uni-link services and the migration of vehicles associated with the University to electric operation. This has delivered measured reductions in both staff and student car use and has supported the development of the Uni-link network via the contract. The Travel Plan is updated on an annual basis, although the current update has been delayed by the coronavirus pandemic and is expected to take place in mid-2022.

Both the Sustainability Strategy and the Travel Plan utilise academic expertise and research links to deliver against targets. If this application is successful, academics within the Transportation Group at the University will play an integral part in the monitoring of service delivery and vehicle performance, with specific student projects created as a result.

The University of Southampton have active research projects assessing the impacts of electrification which would be applied to the monitoring & evaluation of the project, utilising expertise from their Transport Research Group (TRG) and Faculty Centre of Excellence on Reengineering for Electric Mobility. Associated collaborative projects are already underway at the University to study decarbonising transport, battery storage, air quality and environmental impact, which would benefit greatly from data generated by this project as a demonstration of real-world application of electric vehicle operations. The project would also open opportunities for additional undergraduate and postgraduate research. These links to academic activity could in turn inform improvements to technology, systems and applications, increasing confidence in the vehicles and charging infrastructure and supporting wider adoption of electric vehicles.

Go South Coast have a strong sustainability ethos and already operate electric buses in Salisbury for the city's Park & Ride scheme. In 2018 they adopted a Green Energy Policy to providing public transport services that meet passengers' needs now and in the future. Public transport plays a key role in reducing the UK's carbon footprint by providing an alternative to the use of private cars and reducing the environmental impact of transport. This includes an ambition to use low-carbon products such as electric buses and working with stakeholders to tackle climate change.

As part of the project, Go South Coast will enable further education and training including for engineers to transfer skills from mechanical to electrical as well as several apprenticeships focussed on electric bus technology.

2.6.8 Strategic fit with LTA ambitions

The Southampton ZEBRA projects has strong strategic alignment with the Council's Corporate Plan, Local Transport Plan, Greener City Plan and Bus Service Improvement Plan. The relationship is shown in Figure 2.22.

The Southampton Corporate Plan 2021-25 aims to make Southampton a leading city for green economy in the way the technology can be used to reduce air pollution. This includes delivering on journey to net carbon zero by 2050. Part of this will be delivering electric vehicle charging across the city, particularly in estates, and introduction of new zero-emission buses.

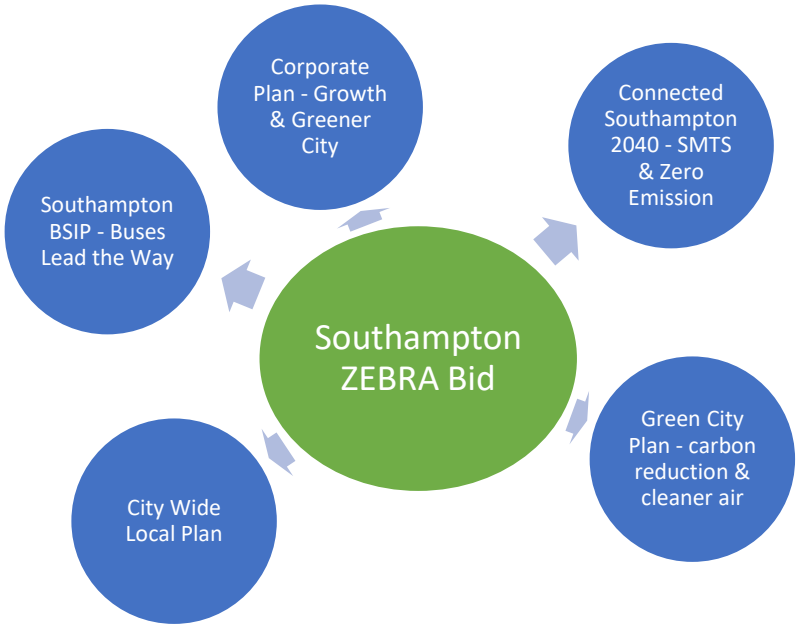


Figure 2.22 Relationship between ZEBRA bid and LTA Ambitions

Connected Southampton 2040 (LTP4) is the city's current long-term transport strategy that sets the ambition and direction of travel for transport over the next 20 years. Over that period Southampton will be transforming with 24,000 new jobs created leading to a requirement for 19,500 new homes. To support this an efficient and innovative transport system is required to keep the city moving. As well as the economic growth, Southampton faces challenges around social inequalities, ageing population, geography, and pollution.

Connected Southampton sets out these ambitions to support reducing carbon, improving air quality and generate modal shift to sustainable travel:

- Ambition is for 10% of journeys in Southampton to be by bike, and increase bus mode share by 11% by 2027,
- Southampton Mass Transit System (SMTS) is envisaged as a step change in public transport provision across Southampton bring all elements of public transport together, including bus, to form a coherent integrated customer focused system. Seeking to provide priority where possible and a 'metro' level of service that is low, and then zero, emission by 2030,
- Walking & Cycling - the ten-year Cycling Strategy sets out the Southampton Cycle Network (SCN) to looks for a step-change in cycling infrastructure and modal shift,
- The Southampton Transforming Cities programme that looks to kick start the SMTS Rapid Bus Corridors, including Portswood serving the University,
- Southampton already has a Quality Bus Partnership in operation since 2012 with the operators and this has driven partnership investment in fleet, lower emission vehicles, WiFi etc. Southampton is committed to progressing with an Enhanced Partnership with operators for draft in April 2022.

The ambition for public transport is to develop the SMTS using the Enhanced Partnership and TCF as the starting point. Having a zero emission network forms part of the ambition for the network. The first elements of the STMS are being delivered through TCF and objective is to see a 5% decrease in bus journey times on the Portswood corridor. It is estimated that annually a bus emits 79t of CO^2, across the UniLink fleet this is 2,500t – equating to approximately 20% of the University's CO^2 footprint. The new zero emission buses will provide an immediate reduction in local CO^2 emissions.

The Council and University are both signatories of the city's Green City Charter which sets a target of 2030 for members to achieve a net zero carbon footprint.

- Local air quality remains a point of public health and compliance concern in Southampton. SCC has 10 Air Quality Management Areas where levels have exceeded air quality standards.
- SCC is currently undertaking a full-scale review of its Air Quality Action Plan for the city. The Plan will set out how compliance with air quality objectives and limits will be maintained – it will also restate the council's commitment towards continual improvement in local air quality and public health. The Plan will follow no from the end of the current Local NO2 Plan (non-charging Clean Air Zone) and incorporate any new requirements from central government.
- Electrification of buses in Southampton has a large potential to improve local air quality in key areas, while also making journeys more appealing.

SCC is embarking on the decarbonisation the transport network with its own fleet and supporting public uptake of EVs:

- 49 electric vans in operation, with over 27 charge points in 7 depots and others in pipeline,
- 50 public charging points in SCC car parks,
- 2 rapid chargers for taxis and more to come,
- Inputting into the 1000 car parking spaces project to ensure EV infrastructure is considered, and
- Submitting an OZEV bid on two potential on-street charging sites for residents without off-street parking.

To support decarbonisation and active travel the Southampton Cycle Network has been developed to create a high quality safe and coherent cycle network. SCC has the aspiration to increase cycling's mode share by 10%. The first phases of the SCN have been delivered through TCF, ATF and CAZ projects and seen a 20% increase in cycling on one route. The TCF and ATF programmes is seeking to deliver over 11 miles of new cycle routes along with four new Active Travel Zones close to AQMAs by 2023.

2.6.9 Summary of Southampton's BSIP Proposals

Southampton has completed its first Bus Service Improvement Plan (BSIP) submitted in October 2021. This was developed in partnership with all the local bus operators and stakeholders with a shared vision:

That buses are an attractive choice where the bus network is built on reliability, carbon-neutral, integration, value for money, inclusivity & partnership to keep Southampton moving, to meet its needs now and in future

The BSIP has nine ambitions

1. A network that is accessible for all, integrated and frequent,
2. Buses are an attractive alternative – fast, attractive & reliable,
3. Bus travel is affordable and achieves multi-operator access
4. Buses will be easy to understand and use
5. Buses are integrated with other modes and into the City fabric
6. The City and District Centres are hubs within the network and buses support their sustainable growth
7. Modern buses lead the way for the decarbonisation of transport
8. Passenger input & security
9. This is the first step – the development of the integrated Southampton Mass Transit System

Over the short-term in the next two years, subject to funding, looking at

- Complete the Southampton TCF Programme of Rapid Bus Corridors to Totton & Waterside and Portswood-Eastleigh (see 2.6.10), Local Mobility Hubs, cycle infrastructure, interchanges at Southampton Central Station and Woolston, Active Travel Zones in St Denys' and Woolston, City Centre schemes including bus priority and new bus hub at Albion Place – which most ZEBs in this project will call at and then see further ones as the roll out of ZEBs is progressed;
- Aim to have bus priority in all Southampton's traffic signals installed by 2024;
- Pursue this ZEBRA bid to introduce the first all-electric zero carbon buses in Southampton as part of developing evidence base (costs, range, passenger numbers, local emissions, local electricity grid capacity, infrastructure, perceptions, delivery etc) for further investment and roll out of ZEBs in Southampton (and wider area) to aim for a fully zero-emission Southampton fleet by 2030;
- Completing roll out of Tap On-Tap Off card readers on all buses to provide a flat capped fare on all buses in Southampton and into the wider City Region;
- A commitment to maintain 100% compliance that all buses operating in Southampton are of at least Euro VI standard (either retrofitted or as-built) – over past three years Clean Bus Technology Funding has upgraded all of Southampton's bus fleet to be at least Euro VI equivalent;
- Support the launch of Solent wide Mobility as a Service (MaaS) product aligned to Solent Go multi-modal multi-operator ticket and various new products for it through Solent Transport;
- A comprehensive marketing and promotion campaign for the bus to encourage people to use the bus more;
- Developing ticketing offers and products for young people, young carers, those Not in Education, Employment or Training (NEETs), or Jobseekers;
- Subject to funding implement findings studies in the journey time reliability across the network, supported services, multi-modal opportunities for Shirley-Romsey corridor, and
- Upgrades to bus stops, accessibility, security, real-time information, and Legible Bus maps and bus stop flags.

The ZEBRA project will deliver on one of the BSIP ambitions for buses to lead the way in decarbonisation, enabling confidence and further evidence for bus operators and partners on the deliverability and real-world application of all-electric buses. The buses would be fitted with TOTO readers, next stop information, USB chargers, bus priority, WiFi and be accessible. Being all-electric will mean that they will enable the commitment to maintain Euro VI or better vehicles in Southampton.

From the BSIP the partners are now developing the Enhanced Partnership agreement in line with DfT timescales.

2.6.10 Southampton TCF Programme

The funded £57m Southampton City Region TCF Programme will support the ZEBRA proposals by implementing the first Rapid Bus Corridors in Southampton and Hampshire. These aim to provide bus priority, new mobility hubs, better bus stops, and enforcement on corridors from the City Centre to Totton, Chandlers Ford, Eastleigh and Woolston.

The programme is being jointly delivered by Southampton City Council and Hampshire County Council.

On the corridors TCF intends to provide sections of bus priority, traffic signal priority, bus stop upgrades (including real-time information, shelters, lighting, CCTV etc), local travel mobility hubs and shared mobility. In the City Centre the programme looks to improve the interchange and gateway arrival experience at Southampton Central Station, onwards wayfinding and walking and cycling routes from the station to the City Centre to St Mary's Stadium, a sustainable transport led approach to redefine a major junction at Civic Centre

Place to make it more people friendly, bus priority measures at junctions and on New Road, new bus hub at Albion Place and Above Bar Street.

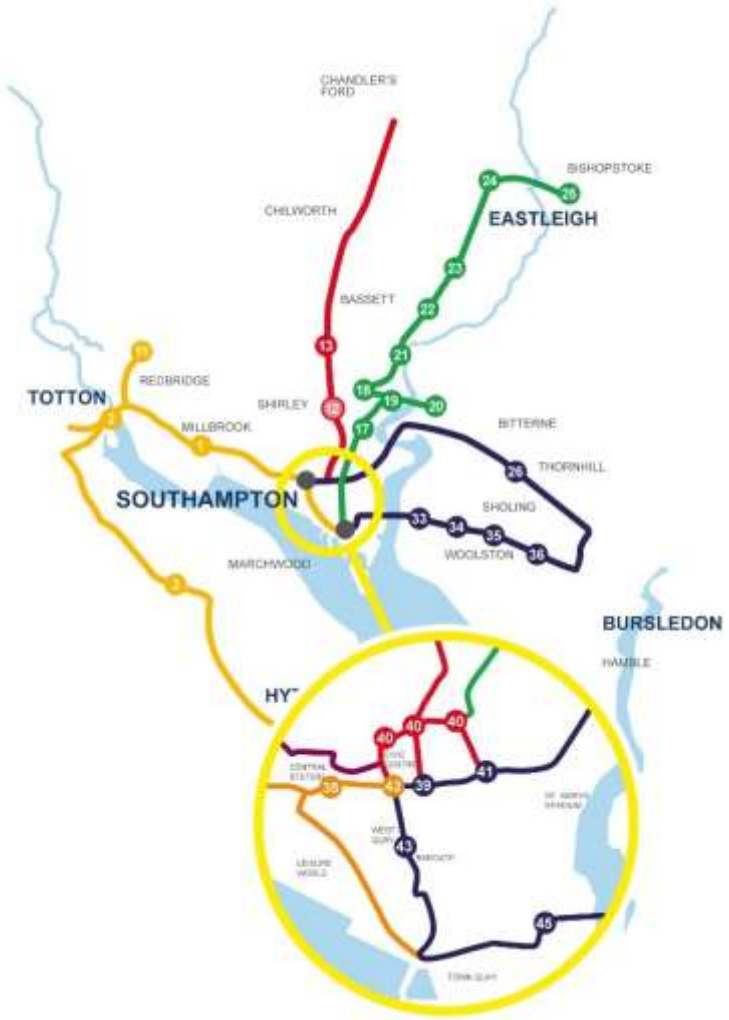


Figure 2.23 Southampton TCF Programme

TCF Scheme	Activity	Service	Delivery
13 Burgess Road/Bassett Avenue	Traffic Signal Priority & Crossings	U2, U9	2022
18 Portswood Local Mobility Hub	Interchange with other modes, Super Stop	U1, U6	2022/23
19 St Denys Rapid Bus Corridor	Traffic Signal Priority, bus stops & Crossings	U9	2022
22 Wessex Lane & Swaythling Station	Bus stop enhancements, interchange with other modes	U1	2022
25 Portswood Road Bus Priority	Traffic Signal Priority, Priority, Bus Stops, interchange with other modes	U1, U6	2022
38 Central Station Interchange	Interchange with other modes	U1	2022/23
39 Saints Mile (Central Station to St Mary's Stadium)	Priority Lanes, Traffic Signal Priority, Public Realm, Super Stops, Crossings, Interchange with other modes	U1, U6	2022/23

40 Northern Ring Road	Traffic Signal Priority, Priority Lanes/Access & crossings	U1, U2, U6	2022
43 Albion Place Bus Hub	Interchange with other buses	U1	2022/23

Table 2.16 – Southampton TCF Schemes Benefiting ZEBRA

Table 2.16 shows the schemes that will provide benefit to ZEBRA funded UniLink services. The ZEBRA buses would start to operate in the last year of TCF works and will benefit from improved journey times and reliability on the corridors to Chandlers Ford (red), Eastleigh (green) and in the City Centre.

TCF sets the groundwork for future changes to the City Centre that benefits buses. These include an incremental development of a bus priority 'loop' that buses can use in either direction around an expanded pedestrian core area, new public spaces at Bargate Square, Hanover Square, Guildhall Square, cycle and pedestrian routes.

Over the coming financial years, the Council will be investing over £10m in major road resurfacing programme, there will be a focus on main bus routes such as The Avenue, Portswood Road and Bevois Valley Road which are served by UniLink services. This further complements the noise reduction and improved ride comfort.

Examples of the TCF schemes at Southampton Central Station and Civic Centre Place (on the Saints Mile) are shown in Figure 2.24. These will all benefit the UniLink services to help make bus journeys in Southampton more attractive, reliable and quicker improving transport for the user.

Figure 2.24 Southampton Central Interchange and Civic Centre Place TCF Proposals

2.6.11 Solent Future Transport Zone

Future Transport Zones are a trial programme funded by the DfT to help make journeys easier, smarter and greener.

The Solent Future Transport Zone (FTZ) project will provide real-world testing of trials for innovative ways to transport people and goods. Awarded £29m in 2020 the programme runs to 2024 and involves research, data analysis and understanding by Solent Transport (partnership of Hampshire County Council, Isle of Wight Council, Portsmouth City Council and Southampton City Council) and the Universities of Portsmouth and Southampton.

Part of the programme is looking at new products for the existing SolentGo multi-operator multi-modal ticket and the development of a Mobility as a Service (MaaS) system. SolentGo is being enhanced with a range of products that will be available on the UniLink services including 'Solent 5' carnet tickets.

The Solent MaaS – known as breeze – will be one of the first in England outside of an ITA. This will allow users to plan, book and pay for journeys across all public transport modes including cycling, walking, driving, car clubs, e-scooters and more. This will including the UniLink services and allow for integrated seamless travel. It will work alongside the introduction of capped fares and Tap On Tap Off readers being implemented as part of TCF.

A significant amount development work has been carried out with a soft launch planned for early 2022, before launching in Spring 2022 with bus operators and Voi the escooter provider in the Solent. Further modes will be added through 2022 including rail, car clubs and future Solent e-bike hire scheme.

2.7 Aim & Objectives

This section (in conjunction with the analysis above) summarises the scheme's aims and objectives and how they map to the ZEBRA programme's objectives and the DfT's wider priorities.

2.7.1 Scheme Aim & Objectives

The overarching aim for the Southampton ZEBRA project is to provide electric buses for the UniLink service in Southampton.

Seven objectives have been identified, these are:

1. Reduce local carbon emissions from transport and improve Southampton's air quality;
2. Decarbonising Southampton's transport system as it moves towards a zero-carbon future
3. Increasing confidence in all-electric buses and charging infrastructure to support wider adoption of zero emission buses in Southampton and Hampshire;
4. Partnership working with suppliers, bus operators, and local stakeholders to support the development of zero emission buses in Southampton;
5. Strengthen the working relationships between the local authority, University and bus operators for the long-term benefit of Southampton;
6. Understand the challenges of introducing zero-emission buses in Southampton to support their wider role out in the city, Solent area and country; and
7. Encourage more people to travel by bus.

2.7.2 Meeting Local Air Quality Objectives

The Southampton ZEBRA project is likely to have significant benefits for local air quality by removing emissions from buses travelling through six of Southampton's AQMAs in 2022. This will reduce the impact of transport on those AQMAs and the people who are exposed to pollutants. Diesel buses are a significant contributor to poor levels of air quality.

Both Southampton City and Eastleigh Borough Councils have adopted Air Quality Action Plans (AQAP) in place to deal with air pollution in both authority areas. Southampton has also adopted a Greener City Plan 2030 (see Section 2.5.3).

Policy	How ZEBRA meets Objective
Connecting Southampton 2040 (LTP4)	
Southampton Mass Transit System	Rapid Bus corridors (Chandlers Ford and Portswood) with zero-emission buses operating on them
Zero Emission City	First 32 ZEBs operating in the City paving the way for future investment in ZEBs by all operators to achieve 2030
Bus Service Improvement Plan	
All buses in Southampton to be zero emission by 2030	First 32 ZEBs operating in the City paving the way for future investment in ZEBs by all operators to achieve 2030
Air Quality Action Plans (Southampton & Eastleigh)	
Modernise the bus fleet	Provide first ZEBs operating in the City that act as catalyst for further investment Partnership working with bus operator and University as a large employer
Work in partnership to improvement public transport services to reduce emissions	
Greener City Plan	
100% of bus routes will be serviced by clean air zone compliant vehicles by end of 2020	Continues compliance with the clean air zone objectives and enhances with zero emission. Euro VI will be redistributed to other routes in Southampton.
Work with partners to deliver the infrastructure needed to support a zero emission public transport system across the city by 2030	Working with GSC and the University to deliver 32 zero emission buses and the charging infrastructure at Eastleigh depot that can be expanded as further buses are converted to zero emission

Table 2.17 – Alignment with local policy objectives

2.7.3 Scheme Objectives & DfT Objectives

The seven Southampton specific objectives have been generated for the project and these are set out in Table 2.18 with how they map to the DfT's ZEBRA objectives.

Government ZEBRA Objectives	Southampton ZEBRA Objectives
To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO^2 emissions	Reduce local carbon emissions from transport and improve Southampton's air quality
To support the roll-out of the 4,000 Zero Emission Buses from National Bus Strategy commitment	Decarbonising Southampton's transport system as move towards a zero-carbon future
Support bus manufacturers in the development of zero emission bus technology	Increasing confidence in the vehicles and charging infrastructure to support wider adoption of zero-emission buses in Southampton & Hampshire

Support partnership working between Local Transport Authorities, bus operators, and other local stakeholders as set out in the NBS	Partnership working with suppliers, bus operators, and local stakeholders to support the development of zero emission buses in Southampton
	Strengthen the working relationships between the local authority, University and bus operators for long term benefit of passengers and Southampton
Understand better the challenges of introducing zero emission buses and supporting infrastructure to inform future government support for ZEBs	Understand the challenge of introducing zero-emission buses and their infrastructure in Southampton to support their wider roll out in city, Solent and country
	Encourage more people to travel by bus

Table 2.18 Alignment of local and national ZEBRA objectives

2.7.4 Achieving the Objectives

Table 2.18 shows the metrics for how the Southampton ZEBRA project links the local objectives to the objectives of the ZEBRA programme and wider DfT priorities will meet the local objectives and DfT objectives. This includes identifying how the outcome of the scheme meets that objective.

DfT ZEBRA Objectives	Southampton ZEBRA Objectives	How Achieved (Metrics)
To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO^2 emissions	Reduce local carbon emissions from transport and improve Southampton's air quality	By replacing the UniLink fleet of diesel buses with 32 brand new zero-emission buses that go through 6 AQMAs with expected reductions in CO^2
To support the roll-out of the 4,000 Zero Emission Buses from National Bus Strategy commitment	Decarbonising Southampton's transport system as move towards a zero-carbon future	By replacing the UniLink fleet of diesel buses with 32 brand new zero-emission buses contributing to the Government's commitment for 4,000 new ZEBs in 2022/23.
Support bus manufacturers in the development of zero emission bus technology	Increasing confidence in the vehicles and charging infrastructure to support wider adoption of electric buses in Southampton & Hampshire	Improving the bus offer in Southampton, making bus attractive, and generating interest and publicity around zero-emission buses. Buses are proposed to be a new version with larger battery capacity and double door which will provide ability to provide a full 18hr

		day operation on one charge. Supports further development by the bus manufacturer of larger capacity batteries with reduced degradation.
Support partnership working between Local Transport Authorities, bus operators, and other local stakeholders as set out in the NBS	Partnership working with suppliers, bus operators, and local stakeholders to support the development of zero emission buses in Southampton. Strengthen the working relationships between the local authority, University and bus operators for long term benefit of passengers and Southampton Encourage more people to travel by bus	Develops a partnership not just between a LTA and bus operator, but with other third parties – in this case the University as contractor and for evaluation. Providing real world evidence and case studies, analysed by the University, to inform improvements in technology, systems and applications Working with Go South Coast, University of Southampton, bus manufacturers, and infrastructure suppliers to understand procurement, supply, design and manufacturing issues and how this overall supply chain impacts on embedded carbon of zero emission buses. Develops the partnership principles envisaged in the BSIP and emerging EP. Using the University to assess the useful life and impact of zero emission buses on carbon and patronage. Provides evidence base for further investment decisions by bus operators and LTA in ZEBs in future
Understand better the challenges of introducing zero emission buses and supporting infrastructure to inform future government support for ZEBs	Understand the challenge of introducing zero-emission buses in Southampton to support their wider roll out in city, Solent and country	Southampton can provide learning about introducing electric buses in a busy urban environment with high specification and long operating days across a distinct network.

		How a wider partnership approach is being used between LTA, bus operator and University to develop, implement and monitor the project. Demonstrating the challenges with electrical connections. Using a monitoring and evaluation plan and sharing information with Solent Transport and other UK authorities and operators. Provide insight into charging demand between academic term time and non-academic term time and what the 'spark' effect is on patronage levels Provide evidence for further investment in ZEBs in Southampton for other operators

Table 2.18 – Relationship between ZEBRA and Local Objectives

2.7.5 Support to Wider DfT Priorities

The Southampton ZEBRA project will also support wider DfT priorities. Table 2.19 shows how the wider DfT priorities on Growing and Levelling Up the Economy, Reduce Environmental Impacts/Air Quality and Improve Transport for User will be achieved by the Southampton ZEBRA project.

Wider DfT Priority	How Southampton Achieves This
Grow and Level Up the Economy	Supports the £3+bn of private investment in Southampton that will deliver over 19,500 homes, jobs, and support a growing Port. ZEBRA buses will provide clean access from a range of communities in Southampton, including some most deprived in the city, to new opportunities including Solent Freeport (in both Port and Airport), University Hospital, both Universities and in the City Centre.
Reduce Environmental Impacts/Air Quality	Provides a real opportunity to make a significant change in addressing poor air quality in Southampton, to make residents healthier, and reduce some of the 100 premature deaths due to poor air quality. ZEBs will run through 6 of Southampton's

	AQMAs reducing emissions. They will also be quieter reducing bus noise.
Improve transport for the user	Provide an enhanced bus user experience, with more reliable journey times, integrated with other modes, better ticketing and journey choice options, making use of better value bus fares so the bus is an attractive and viable travel option for all.

Table 2.19 Relationship to wider DfT Objections

2.7.6 Monitoring Process

Monitoring is an important part of the process of developing the project, to track where the project is in its lifecycle, to take action and to learn, and share learning, from issues and successes.

Three elements of data are considered to be vital to the monitoring and evaluation of this project.

- Bus operations
- Transport, air quality and carbon impacts
- Scheme

We will plan to collect the monitoring data set out below, to be shared with the Department on a quarterly basis and collated by the programme-level evaluator.

We will collect majority of data at quarterly during, six month and 12 month post and then annually after for certain key indicators such as patronage, battery performance, charging regime, and modal split.

Bus Operations	Transport Impacts	Project Monitoring
Zero Emission Vehicles - Number purchased - Number in operation - Replaced ICE buses - Charging Methodology - Chargers installed - Capacity of chargers - Battery performance - Time taken to charge	Transport - People mode share - Average speed of cars and buses	Spend against budget
Bus Patronage - Average daily patronage - Revenue - Mileage covered - Operational costs	Carbon Impacts - Emissions against ICE - Well-to-wheel emissions - Battery state	Progress against programme
	Air Quality information from affected AQMAs	

Table 2.20 Monitoring & Evaluation Outline Framework

Linked to the ZEBRA Bid, the University has already committed to a MSc project focussed on our transition to an electric fleet, with the expectation of further specific research projects should our bid be successful. The MSc project will examine the life-cycle costs and benefits of electric buses compared to the diesel services they will replace. This will include consideration of capital costs, operating and maintenance costs, demand impacts and environmental effects. Particular attention will be paid to whether electric buses have a

'sparks effect' in terms of increasing demand and the determination of the optimal replacement strategy, including the cascading down of the diesel fleet

A fuller monitoring and evaluation plan is set out in the Management Case section 6.9.

2.8 Options appraisal

This section will go through the option identification and appraisal process that was utilised to arrive at the preferred option for the Southampton ZEBRA project.

2.8.1 Project Summary

The Southampton ZEBRA project will seek to deliver the following:

- 32 new all-electric double-deck buses on the 4 UniLink bus services that link the University of Southampton with City Centre, Port, Airport, Hospital and residential areas using funding from ZEBRA, Go South Coast, Southampton City Council and University of Southampton,
- 16 Electric vehicle charging infrastructure at Go South Coast's Eastleigh depot.
- Positive perceptions around bus travel, supporting Southampton's Bus Service Improvement Plan and Corporate Plan objectives
- Supporting the University of Southampton's objectives for net-zero
- Improve air quality

Figure 2.25 show a map of the routes that the new zero emission buses will operate on, Air Quality Management Areas, along with the location of the Eastleigh depot.

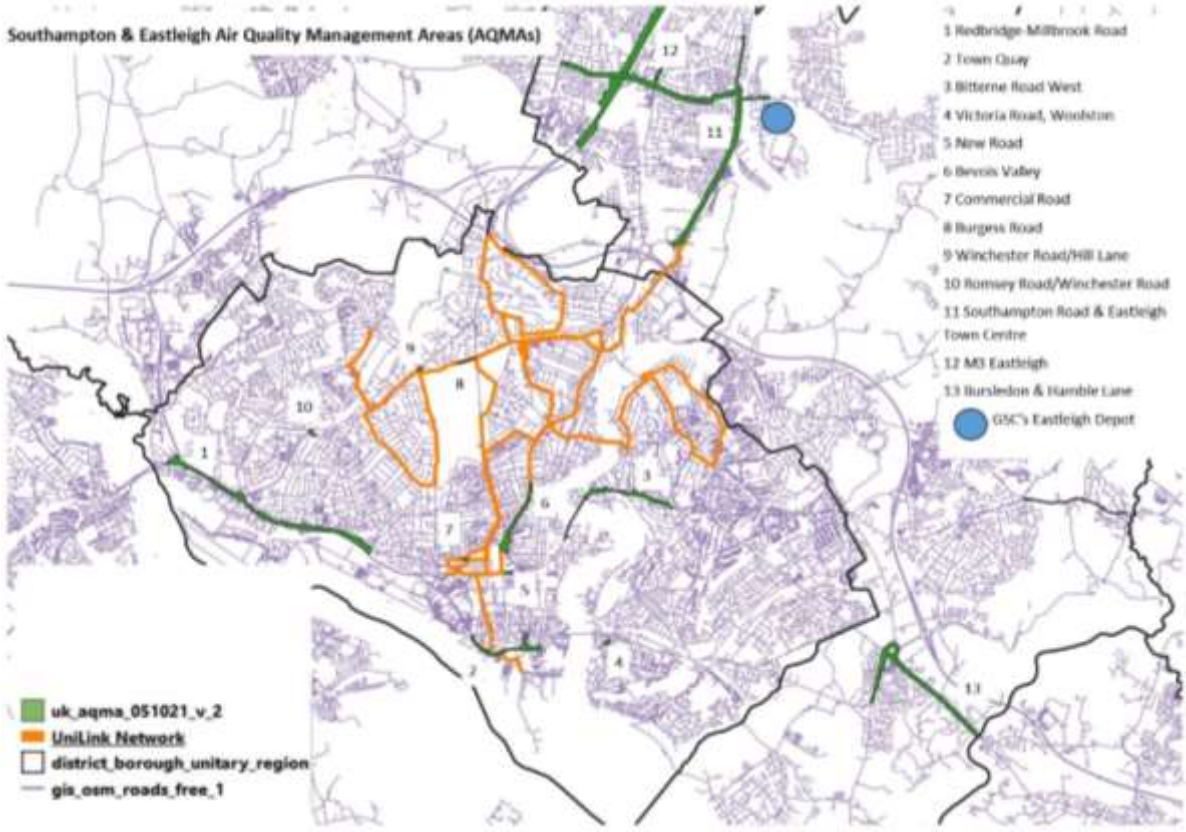


Figure 2.25 Southampton ZEBRA Project Area

2.8.2 Options Assessment

The following sections explain why the Southampton project has chosen the number of buses, the geography, the technology and the infrastructure.

To develop the Southampton ZEBRA proposal an options assessment process was done to identify the area, the technology type, number of buses, and partnerships. The process identified an initial long-list of potential projects that was then taken through an EAST style assessment to arrive at a shorter list that was appraised using a multi-criteria assessment to arrive at the preferred option. The process is shown in Figure 2.26.

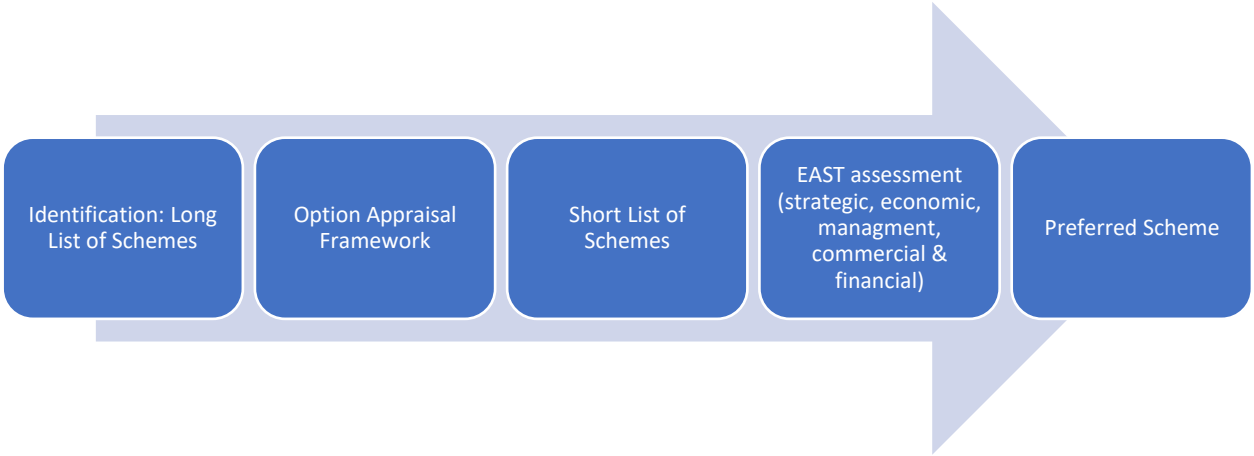


Figure 2.26 – Option Appraisal Process

An initial identification of potential project areas was carried out by SCC and the local bus operators were invited to comment on potential geographies, technologies and infrastructure types. This generated a long list of 11 geographies, 5 technologies, and 5 infrastructure options. Geography covered distinct self-contained bus networks, a corridors approach, and different spatial geographies based on Southampton with a range of areas of Hampshire included.

The Long List of Schemes is shown in Table 2.21.

Geography	Technology	Infrastructure
UniLink Network Corridor basis – e.g. Shirley-Bitterne Southampton Southampton & Eastleigh Southampton & Waterside Southampton City Region Quay Connect All Southampton Buses (inc long distance) Joint Solent Bid (with Hampshire & Portsmouth) First Network GSC Network Do Nothing	Hybrid – diesel-electric All Electric Battery Hydrogen Alternative Fuel (e.g. cooking oil) Diesel – 'better than Euro VI' Do Nothing	In Depot Charging Hydrogen stations In Depot Charging & On Street Opportunity On Street Opportunity only Overhead Wires Do Nothing

Table 2.21 – Long List of ZEBRA Schemes

Before arriving at a preferred project scope for the Southampton ZEBRA, option sifting of the long-list was undertaken using a series of multi-criteria sifting tools.

The multi-criterial tools looked at the geography, technology and infrastructure requirements and used principles based on the EAST framework but adjusted for this project. This would

broadly cover the strategic case as well as the other cases in the DfT's standard five-case appraisal framework.

- Strategic Fit – compulsory alignment with local and national ZEBRA objectives;
- Value for Money – potential value for money category (vfm);
- Impact on Environment – noise, air quality, greenhouse gases;
- Deliverability – credible delivery plan, willingness of partners – bus operators, LTA, neighbouring LTAs, other partner organisations (University, Hospital, Port etc), risk; and
- Technology – is it available and reliable.

This sifting process was carried out in a three-stage approach:

1. Initial screening to ensure Strategic Fit;
2. Removing potential showstoppers to maximise environmental benefit, value for money and affordability; and
3. Sifting geographies, and technology and infrastructure separately to arrive a final list and area.

This three-stage approach is summarised in following sections, with a full record of the sifting process presented in the Options Appraisal Framework is in Appendix 2.1.

2.8.3 Stage 1 Strategic Fit

Due to the high-level nature of the exercise, the assessment against the strategic fit is focused on whether the option can effectivity address the identified problems and contribution to the objectives (i.e. expect material impacts). Findings from the assessment were simply recorded using Yes or No after review against the core local and national ZEBRA objectives outlined in Table 2.22. This has been done for the technology and infrastructure long-list.

Local ZEBRA Objectives		National ZEBRA Objectives	
Reduce local carbon emissions	Decarbonising Southampton's transport system	Decarbonise and reduce transport sector's CO^2 emissions	Support roll out of 4,000 ZEBs in England
Support wider adoption of ZEBs in Southampton and Hampshire	Develop and strengthen partnership working	Support bus manufacturers in developing ZEB technology	Support partnership working
Understanding challenges around the introduction of ZEBs in Southampton	Encouraging more people to travel by bus	Understand challenges of introducing ZEBs	

Table 2.22 – Strategic Fit Objectives

If a scheme did not meet the local and national objectives – not a 'strategic fit' – it would be automatically sifted out to ensure that anything brought forward to the next stage has a strategic case.

At this stage the following were not taken forward:

- Do Nothing – not considered an option that met the overall objectives, and
- Diesel Vehicles – doesn't meet the objectives around zero-emission.

2.8.4 Stage 2 Showstoppers & Defining the Package

When appraising the case for each of the schemes under the Economic, Financial, Management & Commercial aspects, there was scope for details on how one scheme may score compared to another. This was in order to identify potential showstoppers or prioritise ones that bring a stronger case. The criteria used and typical factors considered when scoring against each criterion are presented in Table 2.23.

Value for Money	Environmental	Deliverability	Technology
Capital Cost Potential VfM category	Noise Air quality Greenhouse gases	Credible delivery plan Willingness of partners	Availability Reliability

Table 2.23 – Stage 2 Sifting Criteria

Each scheme was scored using a five-point grading system, with 0 being neutral and 1 to 2 (-1 to -2) representing increasing positive (or negative) impacts. When assessing the options, consideration was given to the level of work already completed to date or technology assurance to date. Reasons for score given to individual schemes were recorded.

Stage 2 of the sifting process were carried out based on finalised scores.

If a scheme scored -2 or less on any of the three criteria (VfM, environment and deliverability), in Stage 2 it was sifted out. This approach was selected as a score of -2 was deemed to represent significant risk to delivery or operation so the scheme could be a 'showstopper'.

The Stage 2 sifting looked at the various options in terms of vehicle procurement in the UK bus market for Go South Coast are:-

1. DM - Continue to Purchase Euro VI buses;
    - This would maintain the status quo and mean that efforts to decarbonise the fleet would not be met;
    - This approach would not meet the aims of reducing pollutants by the road transport industry, and as one of the latterly purchased diesel buses as the industry begins to transfer to carbon neutral modes, could lead to the vehicles being a stranded asset
2. DS1 - Purchase Diesel Electric Hybrid buses;
    - These vehicle would limit the contribution of the sector to reducing emissions. As a group, Go-Ahead has seen varying performance from diesel hybrids and reliability issues mean this approach is not favoured;
3. DS2 and 3 Purchase Fully Electric Buses;
    - We have trialled electric buses in Salisbury to assess overall performance in real world scenarios along with customer feedback which is overall favourable to fully electric buses;
    - Electric Buses exist on the market which can meet the needs of the operational circumstance required as well as having learnt lessons from the Salisbury project;
    - The network proposed lends itself to electric operation being a largely complete network in a contained town network style environment
4. DS4 and 5 Purchase Hydrogen or other fuelled Buses

- Currently hydrogen buses on the market are unlikely to meet the operational requirements of operation – they are also considerably more expensive than electric provision worsening the business case;
- The lead in time from discussions with hydrogen suppliers do not lend themselves to the ZEBRA funding timescales;
- It is currently uncertain whether any hydrogen for this site would be grey or green hydrogen – we are keen to use only green hydrogen;
- Hydrogen better lends itself to longer distance inter-urban operation which does not come into scope under this project.

The outcomes of the second phase of the are shown in Appendix 2.1 and summarised in Table 2.24.

Technology	DN	DS1	DS2	DS3	DS4	DS5	DM
Option Description	No Intervention - no investment in ZEBs	Hybrid (diesel-electric)	All Electric Battery	All Electric Charge	Hydrogen	Alternative Fuel	Diesel
Score	-13	-5	14	8	-2	-5	-8

Table 2.24 – Outcome of Stage 2 Technology

From the Stage 2 sift the Southampton ZEBRA project will pursue **DS2** all-electric battery double deck buses.

By using all-electric this approach meets the policy objectives for the Council in Connected Southampton 2040 of being a zero emission city for 2030 and for the University to be net-zero. Zero emission helps to address issues around air quality, carbon emissions, increasing buses' mode share by making them more attractive, and generating a 'buzz' around shift towards zero emission vehicles.

Go-Ahead Group's Commitment to Net Zero

Since 2016, the wider Go-Ahead Group (of which GSC is a constituent company) has achieved a reduction in absolute carbon emissions by 22%. Our strategy outlines how we will continue to adapt to the effects of climate change. This includes decarbonising our transport fleet, reducing the negative impact of air quality from our operations, cutting our water usage and reducing waste

The Go-Ahead Group's overarching target is to become a net zero carbon business by 2045. As milestones on the way to this target, Go-Ahead plans to achieve a decarbonised bus fleet by 2035 and to eliminate all remaining diesel trains from its networks by 2035, helping to meet our 75% emissions reduction target by 2035.

The UK's bus sector has made very significant progress in introducing low emission, efficient technologies over the last decade. Currently a journey by diesel car, even a Euro 6 one, emits 10 times per passenger NOx (383mg NOx/km) of a comparable journey by Euro VI bus (40mg NOx/km) 15. The NOx emissions from a Euro VI bus passenger are even lower than a Euro 4 petrol car passenger (43mg NOx/km). The opportunity is now to build on this track record and apply learning to the new technology to enable cleaner growth in the area.

2.8.5 Stage 3 Route Optioneering

Following the completion of the Stage 2 sifting to identify the preferred option for vehicle type and charging mechanism, a further sifting exercise was carried out to identify the preferred operating geography.

This process reduced the number of potential schemes from 11 geographies to the preferred geography option focused on the UniLink network and fleet.

- Do Nothing
- DS1 UniLink Network
- DS2 Corridor basis – e.g. Shirley-Bitterne
- DS3 Southampton
- DS4 Southampton & Eastleigh
- DS5 Southampton & Waterside
- DS6 Southampton City Region
- DS7 Quay Connect
- DS8 All Southampton Buses (inc long distance)
- DS9 Joint Solent Bid (with Hampshire & Portsmouth)
- DS10 First Network
- DS11 GSC Network

Again an initial sift was carried out to identify whether the geographical area met with the national and local strategic objectives. This sift identified that 3 of the geographical areas did not meet the strategic objectives. These were:

- Do Nothing
- DS7 Quay Connect service only
- DS9 Joint Solent bid (Southampton & Portsmouth)

The second sift looked at how the geographies would contribute to the objectives around

- Reducing Impact on Environment,
- Deliverability,
- Levelling Up – providing access to deprived neighbourhoods, and access to services; and
- Potential Value for Money.

Again, each geography was scored using a five-point grading system, with 0 being neutral and 1 to 2 (-1 to -2) representing increasing positive (or negative) impacts. When assessing the options, consideration was given to the level of work already completed to date or technology assurance to date. Reasons for score given to individual schemes were recorded.

The Option Appraisal Framework records this in Appendix 2.1 and the outcomes of the route optioneering phase of the are shown in Table 2.20.

Geography	DN	DS1	DS2	DS3	DS4	DS5	DS6	DS8	DS10	DS11
Option Description	No Intervention - no investment in ZEBs	UniLink Network	Multi-Operator on one corridor	All Operators Southampton City	Southampton & Eastleigh	Southampton & Waterside	Southampton City Region	All Southampton Buses	First' s Network	GSC' s Network
Score	-18	15	7	11	12	12	12	8	7	11

Table 2.25 – Outcome of Stage 2 Technology

From this is the **DS1** UniLink network was chosen.

UniLink is a contract operated by Go South Coast for the University of Southampton to provide bus services that are open to everyone – students, residents and visitors to Southampton.

Service	Route	Frequency/hr	AQMA	Levelling Up & Deprivation
U1	National Oceanography Centre-City Centre-Central Station-Portswood-University-Airport	6-7	Town Quay	Provides access to Solent Freeport (Port & Airport), links top 10% deprived LSOAs in Bargate & Bevois to City Centre, University and Airport
U2	Mayflower Halls-City Centre-The Avenue-University-Bassett	6	Commercial Road, Burgess Road	Links to top 10% deprived LSOAs in Bargate & Bevois to City Centre & University
U6	City Centre-Bevois Valley-Portswood-Swaythling-University-Hospital	3	New Road, Bevois Valley, Burgess Road, Winchester Road	Links to top 10% deprived LSOAs in Bargate & Bevois to City Centre, University & Hospital
U9	Townhill Park-St Denys-University-Upper Shirley-Hospital	4/day	Burgess Road, Winchester Road	Provides a cross-city connection linking Townhill Park to University and Hospital – potential for future growth in service

Table 2.26 – the UniLink network

The four routes of the UniLink network, summarised in Table 2.26 and shown in Figure 2.27 connect the main campus of the University at Highfield in the north of Southampton with all other University sites – halls of residences, sport facilities, University Hospital Southampton, City Centre, and the National Oceanography Centre in the Eastern Docks. There are strong connections between the University and Hospital for teaching, research and innovation, and the National Oceanography Centre is world-leading research for marine environment. The services also link to Southampton Central Station, Town Quay for Hythe and Isle of Wight ferries, and provide the only public bus service to Southampton Airport.

Figure 2.27 UniLink Network Map

2.9 Preferred Option

The preferred option is to progress with an all-electric battery zero emission proposal on the contained UniLink network.

- 32 new all-electric double-deck buses on the 4 UniLink bus services that link the University of Southampton with City Centre, Port, Airport, Hospital and residential areas using funding from ZEBRA, Go South Coast, Southampton City Council and University of Southampton, and

- 16 Electric vehicle charging infrastructure at Go South Coast's Eastleigh depot.

2.9.1 Why this Option

This bid focuses on all-electric vehicles operating on the UniLink network which are core commercially operated services. If the ZEBRA bid is successful 14% of Southampton's fleet will be zero emission carrying 20% of patronage by 2023.

The current UniLink fleet comprises of 32 Euro VI double deck buses specifically branded. This provides a self-contained fleet that operates a distinct brand with an ethos that can be aligned to the University's commitments for net-zero carbon.

The current operation for the UniLink services has a Peak Vehicle Requirement of 30 buses with 2 spares to deli very the service on the routes provided. The proposal will be for a like for like replacement of the current UniLink branded vehicles.

Significant analysis by the bus manufacturer, Wrightbus, has modelled all routes and running boards to ensure that the buses procured through this process can undertake the work needed. This has concluded that they are fit for purpose as well as having enough battery capacity to undertake the work and recharge in time for the next day. This is provided in Appendix 4.4.

Clean Diesel Euro VI buses replaced by this bid will be cascaded within the sister "Bluestar" fleet in Southampton with older vehicles leaving operational service.

This ZEBRA project would be a whole fleet replacement like for like with vehicles having the same features for next stop display and audio, wheelchair spaces, Tap On-Tap Off readers (funded via Southampton TCF), USB charging, WiFi, and low-floor accessibility.

Figure 2.28 Existing UniLink Euro VI Buses

This will replace the existing Euro VI buses that operate on the services introduced 2016-18. These will be recycled within the Bluestar fleet to ensure that the benefits of Euro VI are retained within Southampton. Those replaced by the former UniLink fleet would be cascaded to elsewhere in the GSC area of operations that do not have air quality issues.

This solution has been identified as it meets the local and DfT objectives in the following ways:

- Reduce Local carbon emissions – all-electric buses are identified as the most suitable as they provide zero emission and support the decarbonisation of the bus fleet. All the services on the UniLink network travel through an AQMAs – 6 in Southampton, plus 1 in Eastleigh when travelling to the depot. This will have benefits for reducing NO2 and CO2 emissions to zero with wider health benefits to the 900 households in the affected AQMAs. The 32 buses are sufficient for existing network and allows for future growth, such as any extension of services or frequencies set out in the Southampton BSIP;
- Encouraging more people to travel by bus by improving travel choices – the network provides access to the University and City Centre, as well as Airport, Port and Hospital for a portion of Southampton that doesn't have direct connections to these destinations. This links some of the most deprived communities in Southampton to key economic destinations. Making the bus more attractive to a wider range of people will increase patronage and support modal shift from cars;
- Air quality impacts, economic impacts, and improved transport for all are maximised by this choice of scheme; and
- Decarbonising the transport system and support roll-out of 4,000 ZEBs nationally – provides 32 all-electric zero emission buses that will provide evidence and confidence to continue decarbonisation of Southampton's bus fleet. All-electric buses as they are the most suitable for those routes providing ability for all-day running without need for charging. The total number of buses is the current UniLink fleet and allows for future growth without affecting the overall PVR for the network

2.9.2 Why Vehicles

The approach has been to provide all-electric battery vehicles as our zero-emission bus solution.

As part of developing the Business Case, GSC has been liaising with major British and European Manufacturers. This includes ADL/BYD, Switch, Volvo and Wright Bus. The preferred supplier has been selected on the basis they better need the business needs of the Unilink service and also has the largest battery and therefore range. Evidence of discussions with bus manufacturers is included at Appendix 4.9 and 4.19.

Bus manufacturers have been supplied with Bus car line data – indicating when each bus leaves the depot and returns as well as the running board whilst out on duty. GSC has additionally appointed an independent energy consultant, Evenergi, to assess manufacturer data, car data lines and running boards as well as typographical and charge data to assess how buses will perform in real world scenario. As a result, and with looking toward the half-life of the vehicle different battery specifications have been assessed with the result that the decision has been made to use [redacted] batteries which give a longer range and improves the ability of buses to get back to the depot at the end of service.

[redacted]

[redacted] GSC currently have 3 of their product operating in Salisbury, whilst the vehicles have proven quite

reliable (for the route they do), service backup has been poor and this creates risk when factored up.

[redacted]

Independent assessment of the drive train data, battery data, charging regime as well as topography and car lines operated by buses we analysed the performance of the initial [redacted] battery product. This shows that after a few years operating at 80% battery state of health (usually around years 5-7) 10% of buses could not complete a full day of operation. Even with opportunity charging and a modified schedule the [redacted] battery could not complete a day. However, the larger [redacted] battery would compete and operational day. This is the reason the larger battery has been decided as the vehicle can undertake the full run of existing diesel buses following extensive third party modelling. This is shown in Table 2.22.

	Unilink modified schedule			
	[redacted]		[redacted]	
Battery Size	[redacted]	[redacted]	[redacted]	[redacted]
Average SoC	[redacted]	[redacted]	[redacted]	[redacted]
ZEB run suitability	[redacted]	[redacted]	[redacted]	[redacted]

Table 2.27 UniLink Battery Capacity Analysis

32 vehicles will provide a straight bus for bus replacement for the existing UniLink bus fleet. [redacted] The modelling carried out has indicated that this is sufficient for the operation.

Therefore, whilst these buses are a higher specification in terms of battery capacity they have been selected for operational efficiency and to operate the services required. If these buses were not used in favour of a smaller battery this would result in fewer buses able to survive the operational day. If this was the case these buses would need to leave service mid to late afternoon in favour of older diesel buses – this would be sub optimal in terms of fleet and schedule efficiency, use of resource, air quality, consistence of product and service and operational cost maintaining a high number of diesel spares.

The vehicles have a high vehicle specification to meet the aspirations of the Southampton BSIP to improve the transport network for the user and encourage more people to travel by bus.

- Double doors for easy and quick loading/unloading at bus stops as the UniLink services are high passenger volume particularly during university term times and this keeps dwell time at bus stops at a minimum enabling efficient bus operation;
- Have tap on-tap off (TOTO) readers for contactless capped fares which has been introduced in Southampton since autumn 2021;
- USB charging points at all seats, WiFi, next stop audio and visual announcements as standard to maintain high quality features already in place in Southampton; and
- Fully accessible with wheelchair ramp, audio loops, dementia friendly internal colour schemes and CCTV to make them accessible and secure.

Having a high specification from the start of operation reduces costs to retrofit TOTO, USB, and next stop announcements at a future date. The additional doors to aid quicker and efficient loading/unloading support an efficient bus operation. It has been chosen to go for high specification buses will continue to attract passengers to use buses enabling a greater modal shift increasing carbon savings of both zero emission vehicles and shift away from private vehicles. These additional features have increased the initial purchase cost but reduce need have further investment from GSC or others later.

With the smaller batteries the all-electric bus may be withdrawn from service early and replaced with a diesel bus reducing the total carbon savings from running all-electric buses all day. This would not meet the objectives to decarbonise Southampton's transport network and the JAQU Clean Air Ministerial Direction to improve air quality in Southampton.

Electric was chosen over other alternatives such as hydrogen as the compact nature of the network with average annual mileage of 40,000 and the specification of the buses is best suited to do this.

This is a new vehicle offer from Wrightbus and the development of this supports the development of the UK bus market, supporting jobs in Southampton and Northern Ireland where vehicle is manufactured.

The vehicles chosen will provide:

- A new approach to getting around Southampton for the transport user with high quality zero emission buses;
- Provide zero emissions buses operating across the whole operating day reducing risk that diesel buses are used; and
- Provide high specification vehicles that meet the aspirations of BSIP – TOTO for capped fares, USB and next stop displays & announcements.

Further detail on the market engagement carried out to date is set out in Section 4.4 and detailed vehicle specification in Section 4.5.

A [redacted].

2.9.3 Why the technology type?

All electric vehicles were chosen as they provided the most readily available technology to start operation in Autumn 2022 – the start of the new academic year.

The Options Assessments identified that other technologies such as diesel would not meet the objectives around improving air quality, reducing carbon emissions and improving transport for the user. The difference for all-electric would be on reducing the carbon emissions and air pollution to zero while providing a high specification product that attracts people to travel by bus.

[redacted].

[redacted] is included in Appendices 4.17 and 4.18.

Learning from the Salisbury Reds all electric Park & Ride project that GSC have operated since 2018 has help to provide expertise and training within GSC.

2.9.4 Why Routes?

The UniLink network has been chosen as these were identified as those ata which investment could be targeted to best achieve the strategic objectives of SCC, the University, the DfT and wider ZEBRA objectives.

It provides a self-contained network with its own brand identity in Southampton. UniLink services are available to the public as well as students and staff of the University of Southampton. They currently carry around 5,000,000 passengers per annum and provide connections for people travelling to Southampton's main economic drivers – City Centre, University, Hospital, Airport and Port. Upgrading UniLink fleet to zero emission will mean that 14% of Southampton's bus fleet will be zero emission, carrying around 20% of the overall patronage.

All the UniLink services travel through areas of deprivation and six of Southampton's AQMAs and improvements in air quality will benefit residents living here. Other services would have impacts on air quality but not on deprivation. Table 2.23 shows the percentage of buses in each AQMA that will be zero emission as a result of this bid.

AQMA	Buses per hour			
	Electric ZEBRA	Diesel Euro VI	Total Buses	% Electric
A33 Redbridge Road	0	18	18	0
Town Quay	7	13	20	35%
Bevois Valley	6	7	13	46%
Commercial Road	6	0	6	100%
New Road	0	17	17	0%
Bitterne Road West	0	17	17	0%
Winchester Road/Hill Lane	4	0	4	100%
Winchester Road/Romsey Rd	0	31	31	0%
Burgess Road	1	0	1	100%

Table 2.28 Percentage of Electric Buses in AQMAs

This would also support stronger working relationships between the City Council, bus operator and the University. The University also provides the ability for independent academic review of the project.

In addition to operational and environmental benefits, focusing on the Uni-link network will generate significant research opportunities for faculties at the University of Southampton, utilising the knowledge of the academic community to advance our understanding of the real world performance of electric vehicles and infrastructure. In this way we would hope to contribute towards a wider adoption of electric vehicles in public transport, improvements to technology and increased passenger satisfaction- employing specialist expertise available to the University as an innovative addition to the benefits of this submission. We recognise the resource issues associated with battery technology which will need to be addressed as electric vehicle use increases and will continue to apply to research in this area to inform the transition to fully sustainable transport options.

2.9.5 Why the infrastructure/ charging method/schedule?

With all-electric bus option chosen this has led to a need for changes to GSC's Eastleigh to accommodate electric buses. This will enable a more efficient use of the depot providing savings and benefits to GSC in terms of operational requirements. GSC have used their expertise from operating the Salisbury Red Park & Ride all-electric fleet to help inform the infrastructure, charging method and scheduling requirements.

This element will include the 16 in-depot chargers and the DNO electrical connections.

- [redacted] smart SWARCO [redacted] Chargers with dual outlet – that enables each charger charges two buses making a more efficient use of the depot;
- The expected product lifespan is a minimum of ten years and while all EV charging equipment supplied and installed by Swarco is fully tested for reliability and safety, a service contract will be entered into to help ensure that equipment is maintained in full working order; and
- Charge time of between [redacted].

Chosen as the two separate hardware components, the charger lends itself to bus depot installations where the parking of buses in proximity leaves minimal room for a charger. The incorporation of a Charge Management System (CMS) means that the supply can charge a higher number of vehicles. The Salisbury experience has helped to shape this element so that as much of the existing supply can be used before the upgrade of the electrical supply.

Based on the modelling carried out on daytime running and battery consumption for the project the charging schedule has been developed. [redacted] the charging infrastructure needs to be able to fully charge a vehicle between return and operation the next day. This includes any requirement for the bus to be cleaned, repaired or serviced.

Service	First Bus	Last Bus	Route Length	Charging Window
U1 (6-7/hr)	[redacted]	[redacted]	[redacted]	[redacted]
U2 (6/hr)	[redacted]	[redacted]	[redacted]	[redacted]
U6 (4/hr)	[redacted]	[redacted]	[redacted]	[redacted]
U9 (4 services/day)	[redacted]	[redacted]	[redacted]	[redacted]

Table 2.29 – UniLink First & Last Bus and Charging Window

Based on this independent real world assessment the SWARCO DC chargers were chosen. [redacted]

[redacted]

[redacted] project team have worked with SSE and SWARCO to design a layout that can be delivered within the depot area identified and accommodate the buses subject to the bid.

2.9.6 Electrical Connection

Scottish & Southern Electric (SSE) are the Direction Network Operator (DNO) for the Eastleigh depot. SSE have been involved in the project to carry out assessments on the electricity supply to the Eastleigh Depot. Embedding of SSE early in the project team means that assessments and identification of early risks can be dealt with before award so that the project can start on time and deliver the electrical connections for when the buses are due to enter service in Autumn 2022.

SSE are also involved in an assessment with the University of Southampton, who as part of their own decarbonisation strategy are seeking to move away from gas heating on their campuses.

[redacted].

Energisation of the new supply is dependent on the outcome of the Modification Application to National Grid and the completion of any works that may be required as an outcome of that process. GSC, at their own cost has made this application as soon as the issue was known but due to statutory timescales this information will not be available for the submission o the SOBC. Accordingly the project team have included a risk based costing and will update the DfT once the application outcome is known.

[redacted]

[redacted]

A risk based cost has been provided, see Section 5.2.4, but a final cost is not confirmed until an application is made to National Grid.

All the electricity supplied to the depot by SSE and is generated by fully renewable sources. This means the well-to-wheel electricity for the Southampton ZEBRA project is zero-carbon further enhancing the project as part of full decarbonisation of the transport network.

A letter of support from SSE is included in Appendix 4.7.

2.10 Changes since the EOI

There have been changes between the EOI stage and the preparation of this Business Case. The number of buses and geography remain the same.

Following further market engagement the total value of the bid for vehicles and infrastructure has increased from £16.329m to £22.588m – an increase of £6.259m. This will be an additional £3.567m of ZEBRA grant ask, and £2.7m of local match funding from bus operators, the Council and the University.

This is shown in Table 2.30.

	EoI Costs (£ms)				FBC Costs (£ms)			
Element	**Total**	**DfT Ask**	**GSC**	**Third Party**	**Total**	**DfT Ask**	**GSC**	**Third Party**
Buses	14.944	5.208	[redacted]	[redacted]	18.297	6.588	[redacted]	[redacted]
Infrastructure	1.385	1.031		[redacted]	4.291	3.217	[redacted]	[redacted]
Total Project Cost	**16.329**	**6.239**	**10.082**		**22.588**	**9.806**	**12.784**	

Table 2.30 – Changes since EoI

This has resulted from:

- An increase in the cost of the new zero-emission vehicle from £[redacted] estimated in the EoI stage to £[redacted]. The original estimated was based on initial enquiries by GSC based on double deck purchases for GSC's Bluestar operations to wider Go-Ahead Group specifications and prices. The updated increase cost followed formal quotations from the bus manufacturers following a tendering process carried out by GSC. The final specification from the preferred manufacturer (Wrightbus) has determined an increase in cost. Wrightbus quote is the best value based on range and ability to undertake the duties required – the prices have increased due to revised manufacturer pricing, the use of group pricing and a requirement for larger battery packs. Outline of the market engagement to date is set out in Section 4.4, and quotations in Appendix 4.12;
- The total cost of the vehicles is £[redacted] compared to [redacted] at EoI stage
- Detailed assessment by SSE and the DNO into the off-site electrical connections to GSC's Eastleigh depot identified that further infrastructure work is required, and that there is a local network constraint to supply. This requires additional funding as it will help to increase the local electricity supply and pump prime any further investment in electric buses in GSC's fleet that operate from Eastleigh. The connection request is subject to an application to the National Grid, due to existing constraints which cannot be qualified unless a connection application is made. The total cost of the on-site infrastructure has increased to £[redacted]. This work is required to be done to provide the necessary power supply to the GSC's Eastleigh depot for the 16 chargers. The specification and quotations is set out in Appendix 4.11;
- Modelling has identified that due to the long operating day for some buses (notable those on the U1 service) between [redacted], vehicles run a risk of returning to depot with less than [redacted] battery charge
- Vehicle specifications have improved following market engagement and detailed independent modelling of battery life and use by Evenergi identified that [redacted] This ensure that the vehicles can do a full day of operation without needing to return to depot;
- Quotation from SSE is only valid until 31st March 2022 (90 days) and risk that this could increase or spare electricity supply is used by other businesses on the Barton Park Industrial Estate where GSC are tenants. This has provided a greater deal of certainty regarding the cost and supply of power but any delay in funding decision may lead to loss of quote, supply and costs;

- The increase in costs has seen an increase in the local match contribution from SCC and the University of Southampton to match this. Local third party match contribution has increased from £[redacted] at EoI Stage to £[redacted].

2.11 Summary

The Strategic Case has set out how the Southampton ZEBRA project has been developed to date, sets out the case for change for why there should be investment in zero emission buses, how the project has been assessed and what the preferred option is. It also sets out the differences between the Expression of Interest and this Full Business Case.

The following can be summarised from the Strategic Case:

- Southampton is a growing city with bold ambitions for the future, however there are pockets of deprivation that are affected by poor health inequalities which can be exacerbated by poor air quality. Investing in buses, including on existing routes, will support levelling up within Southampton by connecting people with where they want to go in a clean way;
- There is an air quality problem in Southampton, the Council has been mandated to reduce NOx emissions in the city in the shortest possible time, investing in zero emission buses forms part of the policy approach set out in the Corporate Plan, LTP, and Greener City Plan;
- The UniLink network connects the City Centre with the University, Port, Airport, main hospitals and some of Southampton's deprived areas, and that 14% of the bus network would be zero emission by 2023, this carried 20% of the patronage;
- This supports the Government's ZEBRA objectives by introducing 32 zero emission buses in Southampton as part of the 4,000 new zero emission buses, which will be the start of the transition to zero emission making a real step change in provision and decarbonisation of transport. It will provide evidence on how to introduce zero emission buses and supporting the UK bus manufacturing industry with introducing a newer model;
- This will continue the close partnership working between the City Council, the local bus operators and the University of Southampton – ensuring that partners work together to a shared vision;
- The project will seek to improve transport for the user with buses are a new model with larger batteries than standard to ensure longevity, they will be of the highest quality with USB charging, WiFi, Tap On Tap Off readers for capped fare, disabled and dementia friendly vehicles with double doors that aid with fast loading and unloading reducing dwell time at stops;
- The new buses will be supported by a package of bus priority measures, bus stop upgrades, real time information provision and integration with other modes through the Southampton TCF programme for Portswood and at Southampton Central Station by 2023, and the launch of the Solent MaaS project (the first outside an ITA) in 2022;
- This is an innovative bid that will make use of the University as an academic assessor and that the learning from the project can be shared across with Government, other local authorities and bus operators.

The Southampton ZEBRA project's objectives and outcomes are met

DfT ZEBRA Objectives	Southampton ZEBRA Objectives	How Achieved (Metrics)
To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO^2 emissions	Reduce local carbon emissions from transport and improve Southampton's air quality	By replacing the UniLink fleet of diesel buses with 32 brand new zero-emission buses that go through 6 AQMAs with expected reduction in CO^2
To support the roll-out of the 4,000 Zero Emission Buses from National Bus Strategy commitment	Decarbonising Southampton's transport system as move towards a zero-carbon future	By replacing the UniLink fleet of diesel buses with 32 brand new zero-emission buses contributing to the Government's commitment for 4,000 new ZEBs in 2022/23.
Support bus manufacturers in the development of zero emission bus technology	Increasing confidence in the vehicles and charging infrastructure to support wider adoption of electric buses in Southampton & Hampshire	Improving the bus offer in Southampton, making bus attractive, and generating interest and publicity around zero-emission buses
Support partnership working between Local Transport Authorities, bus operators, and other local stakeholders as set out in the NBS	Partnership working with suppliers, bus operators, and local stakeholders to support the development of zero emission buses in Southampton.	Providing real world evidence and case studies, analysed by the University, to inform improvements in technology, systems and applications Working with Go South Coast, University of Southampton, and bus manufacturers to understand procurement, supply, design and manufacturing issues and how this overall supply chain impacts on embedded carbon of zero emission buses. Using the University to assess the useful life of zero emission buses. Provides evidence base for further investment decisions by bus operators and LTA in ZEBs in future

Understand better the challenges of introducing zero emission buses and supporting infrastructure to inform future government support for ZEBs	Understand the challenge of introducing zero-emission buses in Southampton to support their wider roll out in city, Solent and country	Using a monitoring and evaluation plan and sharing information with Solent Transport and other UK authorities and operators. Provide insight into charging demand between academic term time and non-academic term time and what the 'spark' effect is on patronage levels Provide evidence for further investment in ZEBs in Southampton
	Strengthen the working relationships between the local authority, University and bus operators for long term benefit of passengers and Southampton Encourage more people to travel by bus	Work closely with Go South Coast (as the operators of UniLink) and the University of Southampton to develop and implement the proposals for zero emission buses, and a methodology for monitoring and evaluating how successful they are

3 Economic Case

3.1 Overview

This chapter sets out the economic case for the investment, considers the full impacts of the proposal to determine the value for money and sets out the impacts, costs and benefits to the environment, society, businesses and government of introducing the zero emission buses on the UniLink network in Southampton. This includes the relevant outputs of the Greener Bus Model (GBM) and description of assumptions.

This section sets out:

- The scheme costs (3.3):
- The outputs of the Greener Bus Model and a series of sensitivity tests (3.4);
- Consideration of wider non-monetised benefits that would support the project beyond on the core benefit-cost ratio (3.5); and
- Consideration of the uncertainties and risks associated with the project and economic assessment (3.6 & 3.7).

3.2 Project Summary

The scheme comprises a deliverable proposal for investment to replace the entire UniLink bus fleet in Southampton. The Southampton ZEBRA proposal we deliver the following:

- 32 all-electric double deck double door zero-emission Wrightbus Streetbus BEV buses to operate on the UniLink bus network in Southampton. These would replace the existing 32 Euro VI double decker buses that are currently used;
- 16 dual aspect electric bus charge points and associated management system at Go South Coast's bus depot in Eastleigh; and
- Provision of electrical infrastructure suitable to connect the depot and chargers to the National Grid, with this being provided by Scottish & Southern Electric (SSE).

Further to this the partners are committed to deliver the following with funding not provided by ZEBRA: and

- Battery replacement for the 32 ZEBRA funded buses in year 17 (GSC funded),

The UniLink network, is a contracted bus service let by the University of Southampton consisting of 4 bus routes (3 high frequency and 1 low). It is currently operated by Go South Coast and provides a service that is open to all (public and students).

The Unilink network operates within the dense urban centre of Southampton, providing connections between origin and destination points; from the University to City Centre, Central Station, the General Hospital, National Oceanography Centre, Portswood District Centre, and the Airport.

All UniLink routes operate through Air Quality Management Areas (AQMAs) such as Town Quay, Bevois Valley and Winchester Road.

Buses form an important role for getting people around with some of the city's most deprived communities located close to the UniLink bus routes. People living in these communities are often those who are most adversely affected by poor air quality increasing their health inequalities. This and the dense urban location, suggests that environmental and population health beneficiary impacts would likely be greater than default, national average based GBM assumptions.

The proposal would mean that 14% of buses in Southampton would be zero-emission carrying 20% of the overall patronage. Learning and evidence from this would enable further business case and investment by all operators to fully zero-emission Southampton's bus fleet by 2030.

The project would support the delivery of the Government's target for 4,000 new zero-emission buses and decarbonisation of the bus fleet by 2030. The decarbonisation of Southampton's bus fleet is an ambition and part of the vision for the Southampton Bus Service Improvement Plan (BSIP) and emerging Enhanced Partnership Plan to continue to grow the number of people using buses in the city. It supports the Greener City Plan and the Connected Southampton 2040 (Local Transport Plan) aspirations and objectives.

Based on DfT Traffic Speed statistics Southampton is the 9th slowest city outside of London. Vehicle speeds on A roads in 2019 averaged 17.6mph compared to a South East average of 28.3mph. This means that the vehicles will be spending longer than average in locations of high urban density, in particular within areas of relative greater deprivation, thus having a greater than typical emissions impact per bus kilometre travelled.

Pre-Covid, bus use in Southampton has an upwards long term trend (excluding Covid), up 9% in 2019/20 compared to 2009/10. Southampton was the 7th highest in England for bus journeys made per head of population – with 80.5 in 2019/20, particularly strong for a non-Integrated Transport Area (ITA) or where there is a single municipal bus operator. This suggests there is the potential for further growth within Southampton and not investing within the bus fleet, risks patronage growth stagnation and associated disbenefits.

3.3 Scheme Costs

The total scheme costs for the Southampton ZEBRA scheme, including a 3% risk contingency is £22.6m. Table 3.1 shows a break down by component and funding sources.

Source	Vehicles cost (£)	Infrastructure cost (£)	Total CAPEX (£)
Funding from Southampton City Council	[redacted]	[redacted]	[redacted]
Funding from the University of Southampton	[redacted]	[redacted]	[redacted]
Investment from Go South Coast	[redacted]	[redacted]	[redacted]
ZEBRA	£6,588,696	£3,217,024	£9,805,720
Total	£18,299,078	£4,289,365	£22,588,443

Table 3.1 Southampton ZEBRA Scheme Costs

Total DfT Ask is **£9.805m** (£6.6m ZEBS, £3.2m Infrastructure). This represents approximately 43% of the total capital costs. With 47% of the costs being met by the local partners, the majority of which is from the operator, it reflects limited risk to Government's investment. It also reflects the confidence that the operator and local partners have that the scheme represents value for money.

The monetised impacts as taken from the Green Bus Model (GBM, Core Scenario, 'File 1') are in Table 3.2.

Impacts	Type	Sub-Type	£, 2021, PV
Carbon Impact			[redacted]
NOx Impact			[redacted]
PM Impact			[redacted]
Indirect Tax Impact (Vehicles)			[redacted]
Indirect Tax Impact (Fuel/Electric Duty)			[redacted]
Indirect Tax Impact (Fuel/Electric VAT)			[redacted]
BSOG	Private		[redacted]
Vehicle Maintenance Cost	Private		[redacted]
Infra Maintenance Cost	Private		[redacted]
Operating Cost	Private	Resource	[redacted]

Operating Cost			[redacted]
Operating Cost			-
Vehicle CapEx			[redacted]
DM Fleet Replacement CapEx			[redacted]
Infra CapEx			[redacted]

Table 3.2 Monetised Impacts from GBM

The monetised costs as taken from the Green Bus Model (Appendix 3.1 GBM, Core Scenario, 'File 1') are in Table 3.3.

Impacts	Type	Sub-Type	£, 2021, PV
Vehicle CapEx	Grant		[redacted]
Vehicle CapEx	Public		[redacted]
DM Fleet Replacement CapEx	Public		[redacted]
Infra CapEx	Grant		[redacted]
Infra CapEx	Public		[redacted]
Vehicle Maintenance Cost	Public		[redacted]
Infra Maintenance Cost	Public		[redacted]
Operating Cost	Public	Resource	[redacted]
Operating Cost	Public	Duty	[redacted]
Operating Cost	Public	VAT	[redacted]
BSOG	Public		[redacted]

Table 3.3 Monetised Costs from GBM

The end monetised quantifications are in Table 3.4.

Quantification	Value
Present Value of Benefits	[redacted]
Present Value of Costs	[redacted]
Net Present Value	[redacted]
Benefit Cost Ratio	[redacted]
Cost Effectiveness Indicator	[redacted]

Table 3.4 End Monetised Quantifications

Based on the GBM output, the scheme generates a BCR of **0.19**; under DfT guidance this would on BCR terms alone, represent 'poor' value for money. However, there are additional considerations:

- TAG guidance identifies that contingency costs should not be included within the economic appraisal[16], though these costs have been included as per instruction for this assessment. Excluding the contingency cost element would reduce the PVC (present value of costs) and raise the BCR. It is noted though that the applied GBM default level of optimism bias here at 3% is fairly low.
- Government's Joint Air Quality Unit (JAQU) guidance is that damage cost valuations would have a real year on year increase of 2%. For this submission though, the rate has been set to 0% as per instruction from reviewers. Including the 2% growth would be expected to raise the health related benefits if included, raising the PVB and BCR. Adjusting this to 2% as a sensitivity test has been explored, but there appears to be an error within the GBM with respect to the year on year growth factor (there is no real growth beyond the second year when applied).

[16] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1019887/tag-unit-a-1-2.pdf

- There are a number of non-monetised / wider impacts, which are discussed further below. These and scheme-related risks / uncertainties might affect the end VfM.
- Significant infrastructure costs are included within the scheme; however, some of this infrastructure is expected to last beyond the current cycle of buses identified within this proposal. Government has identified that no new diesel cars and vans should be sold in the UK after 2030 and is currently considering when to set an equivalent deadline for buses. The infrastructure would in all likelihood by required within the medium term without the current proposed scheme, and as such, the 'true' impact is to bring some of these costs forwards, as opposed to introducing costs which would not be required over the long term.
- Similarly, a default maintenance value of 5% per annum has been included within the cost calculations, though for cost elements such as the long term grid connections, this is questionable in terms if magnitude and whether it would be attributable to this scheme.
- The core BCR doesn't include aspects such as patronage growth, willingness to pay, associated benefits in relation to soft measures and air quality benefits, all of which would be expected to provide additional benefits. There is also a perception of the bus benefit from upgrading the all-electric that would have wider benefits for Southampton and the University.

3.4 Greener Bus Model

The Department for Transport's Greener Bus Model (GBM) has been used to calculate the BCR.

3.4.1 GBM Inputs

Key assumptions have been summarised in Table 3.5.

Assumption	Value	Source	Rationale
Number of replaced vehicles	32	Unilink (Go Southcoast)	Number of vehicles required on identified routes
Annual average distance per veh.	[redacted]	Unilink (Go Southcoast)	The approximate Annual Unilink mileage [redacted]. Information provided by Go South Coast Planning & Real Time Information Manager.
Age of the current fleet	3 years	Unilink (Go Southcoast)	Average from records of fleet
Lifespan of the proposed fleet	17 years	Default	Discussed with Unilink (Go Southcoast), seems reasonable
Remaining lifespan of the current fleet	14 years	See above	Assumes 17 years minus the age (3) of the current fleet

Infrastructure maintenance costs	[redacted]% of CAPEX	Default	[redacted]% per annum maintenance on new infrastructure would appear to be quite high, especially when considering that the majority of the infrastructure costs relate to long term (25 to 40+ years), 'one-off' connection costs. However, the default value is currently used in absence of robust alternative supporting information being available.
Diesel and electric bus vehicle values	Double diesel [redacted] Double electric [redacted]	Unilink (Go Southcoast)	Values identified by Unilink (Go Southcoast) further to discussions with suppliers. See the Financial Case for more information on this.
Battery replacement costs	[redacted]	Unilink (Go Southcoast)	Values identified by Unilink (Go Southcoast) further to discussions with suppliers
Electricity price	£ P/kWh	GBM default	Current contracted value is [redacted] but this may change (though in the long term energy prices are likely to reduce somewhat from the current 'spike' seen at the end of 2021 / start of 2022).

Table 3.5 Green Bus Model Key Assumptions

3.4.2 Sensitivity Testing

Standard sensitivity tests which have been carried out at this stage are as follows;

- Forecast ZEB vehicle mileage reduced/increased by [redacted],
- BSOG based sensitivity, BSOG remains at [redacted]p (assuming base case assumption is 22p), and
- Low and High Carbon values (in addition to central in base case).
- Forecast ZEB battery cost reduced/increased by [redacted]%.

In addition, the following sensitivity tests have been added;

- Electricity prices at the current contracted value of [redacted].
- Infrastructure costs set to [redacted]% of the core scenario.

End results from the sensitivity tests are in Table 3.6.

Scenario	BCR	CEI	Excel File Ref.
Core	0.19	708.9	1

+10% mileage	0.26	631.9	2
-10% mileage	0.12	802.9	3
Low Non Traded Cost of Carbon	-0.03	708.9	4
High Non Traded Cost of Carbon	0.41	708.9	5
High Non Traded Cost of Carbon & +10% mileage	0.50	631.9	6
DS BSOG [redacted]	0.03	708.9	7
Battery replacement costs +10%	0.18	713.3	8
Battery replacement costs -10%	0.20	704.5	9
Electricity price at [redacted] rate	0.22	689.5	10
Infrastructure costs at 46%	0.46	496.5	11
High Non Traded Cost of Carbon & +10% mileage & 46% infrastructure costs	0.84	438.9	12
Maintenance costs 2.5%	0.33	631.1	13
High Non Traded Cost of Carbon & +10% mileage & 46% infrastructure costs & maintenance costs 2.5%	0.92	406.3	14
High NOx and PM2.5	0.23	684.3	15
High Non Traded Cost of Carbon & +10% mileage & 46% infrastructure costs & maintenance costs 2.5% & High NOx and PM2.5	0.98	382.1	16
Electric vehicle fleet life expectancy 20 years	0.25	592.6	17
High Non Traded Cost of Carbon & +10% mileage & 46% infrastructure costs & maintenance costs 2.5% & High NOx and PM2.5 & life expectancy of electric fleet 20 years.	1.14	304.8	18

Table 3.6 Sensitivity Test End Results

Of the above sensitivity tests, the higher mileage scenarios are considered most likely than lower mileage, given that the currently average mileage assumption is relatively low, with scope to be increased potentially. Even with an additional 10%, the mileage of 52,547 km per annum would be some way below the generic default of 56,531km per annum. It's noted that if the mileage was set at the default value the implied BCR would increase to 0.31, and if the distance was 70,000 the BCR would be 0.51, without any additional considerations.

The higher costs of carbon is also considered to be more likely than the lower scenario, given the outcomes from COP 26 and political movements towards incentivising reductions in carbon emissions. Increasingly urban centres are charging older and in particular diesel vehicles to operate within congested, high polluting areas, further to Government instruction.

The higher NOx and PM2.5 values are also potentially more realistic than the central values, on the basis that the impact pathways upon which the are the basis for the values, exclude a number of impacts in the central scenario which are included within other Government central scenarios, such as that within the Public Health England (PHE) air pollution tool[17].

The PHE tool takes into account those impacts listed below in Table 3.7, noting that there was also emerging information on dementia and low birth rates.

Tables 3.8 and 3.9 show the equivalent DfT lists of impact pathways included. Based on the TAG Databook (version 1.17), for 'Road Transport Urban Big' areas (i.e., Southampton) the NOx central damage cost per tonne of pollutant is £[redacted] and the equivalent high value is £[redacted]. For PM2.5 the central value is £[redacted] and high value is £[redacted]. Much of the

[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/836720/Estimation_of_costs_to_the_NHS_and_social_care_due_to_the_health_impacts_of_air_pollution.pdf

difference in prices is down to the central value's absence of inclusion of asthma in adults, diabetes and lung cancer (in the case of PM), all of which are include in the PHE equivalent tool.

Impact pathway (PM and NO)	PM	NOx
Asthma (children)	X	X
Asthma Adults		X
Chronic Obstructive Pulmonary Disease (COPD)	X	
Coronary Heart Disease (CHD)	X	
Stroke	X	X
Diabetes	X	X
Lung cancer	X	X

Table 3.7 Public Health England impact pathways – illnesses included for PM and NOx

Impact pathway (PM)	Low	Central	High
Chronic mortality	X	X	X
Respiratory hospital admissions	X	X	X
Cardiovascular hospital admissions	X	X	X
Coronary heart disease		X	X
Stroke		X	X
Lung cancer		X	X
Asthma (children)		X	X
COPD (chronic bronchitis)			X
Diabetes			X

Table 3.8 JAQU / DfT impact pathways – illnesses included for PM

Impact pathway (NOx)	Low	Central	High
Chronic mortality	X	X	X
Asthma (children)		X	X
Respiratory hospital admissions			X
Asthma (adults)			X
Diabetes			X
Lung cancer			X

Table 3.9 JAQU / DfT impact pathways – illnesses included for NOx

The 46% infrastructure cost is considered reasonable and more appropriate than the core scenario, on the basis that the proposed infrastructure will in most cases last significantly beyond the lifespan of the new electric buses. A breakdown of the identified component lifespans is indicated in the table below. Given Governments intent to moving away from diesel vehicles, with the date of a current ban on the sale of diesel buses currently being considered, in the medium term there will be a general move towards electric vehicles. Therefore, the infrastructure cost will provide for not only the currently proposed electric vehicles, but also subsequent vehicles. Further, it will provide electric network upgrades which will super wider functionality and charging capacity.

Infrastructure Cost Item	Approximate Lifespan	% Attributable to scheme buses	Asset Cost	Asset * Reduction Factor
In Depot Charging	~15 Years	100%	[redacted]	[redacted]

Off-Site Electrical Connection	40+ Years	25%	[redacted]	[redacted]
On Site Electrical Connection	~25 Years	50%	[redacted]	[redacted]
Total Electrical Connection Cost	n/a	46%	[redacted]	[redacted]

Table 3.10 Infrastructure Cost Components

Given the long lifespan of some of the infrastructure elements and relative lack of wear and tear compared to vehicles for example, it also quite plausible that the generic [redacted]% maintenance cost per annum is an overestimation and therefore, sensitivity tests have been included with a reduced [redacted]%.

The GBM is a useful tool, but it contains a lot of elements which are generic and don't fully account for local circumstances as a bespoke modelling tool would, therefore caution should be taken in taking the core scenario results as definitive. The above sensitivity tests show that the 'true BCR in the case of Southampton could be far greater, potentially above 1.0. This is based purely on adjusting some of the assumed values within the GBM, non-monetised benefits are also an important consideration and are discussed below.

3.5 Non-Monetised Benefits

Generic non-monetised benefits associated with the transition from older diesel (ICE) buses to newer electric buses which are not captured within the GBM may include;

- Increase in bus journey comfort and reliability
- Improved accessibility
- Noise reduction from diesel engines along the routes

3.5.1 Vehicle quality improvements

Direct improvements in passenger comfort and bus reliability in the case of this proposal are limited, due to the current high specification of vehicles employed on the proposed routes for vehicle change. However, the cascading impact of investing in new electric vehicles is anticipated to result in the end discontinuation of Euro III vehicles within the wider Go-Ahead fleet, rather than the Euro VI vehicles currently used on the proposal routes. Older vehicles will not provide the same quality of ride or reliability as the proposed new vehicles, thus there is an additional anticipated benefit across the fleet.

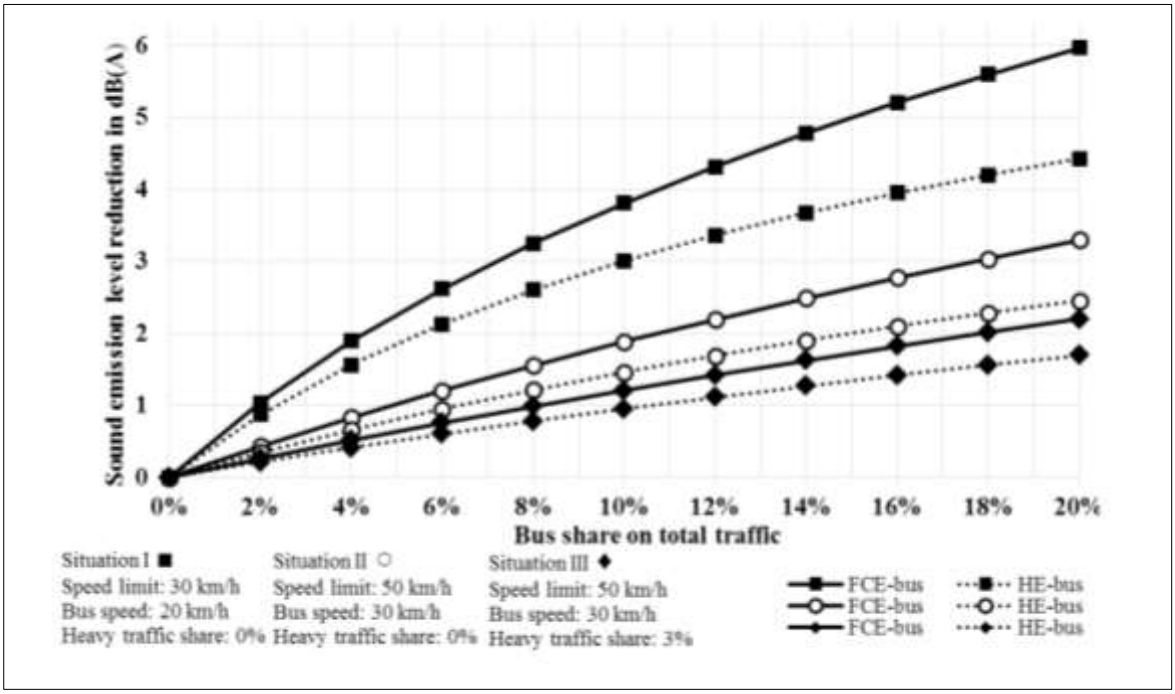
3.5.2 Noise abatement

Noise reduction is an important consideration. DfT does provide default values for reduction in noise per household, but a full noise model could be developed if a typical traffic model based appraisal was used, in absence of a generic form being included within the GBM as it is for carbon impacts. Development of a full noise model is outside of the current scope of works though, therefore, presented here instead are research and DfT values for consideration alongside high level quantifications of potential noise abatement impacts for Southampton.

Presented in Figure 3.1 and 3.2 below are extracts from a research paper, "Transportation Research Procedia 37 (2019) 377–384". The graphics shows scenario comparison for indicative sound reduction benefits of electric and hybrid buses relative to diesel buses.

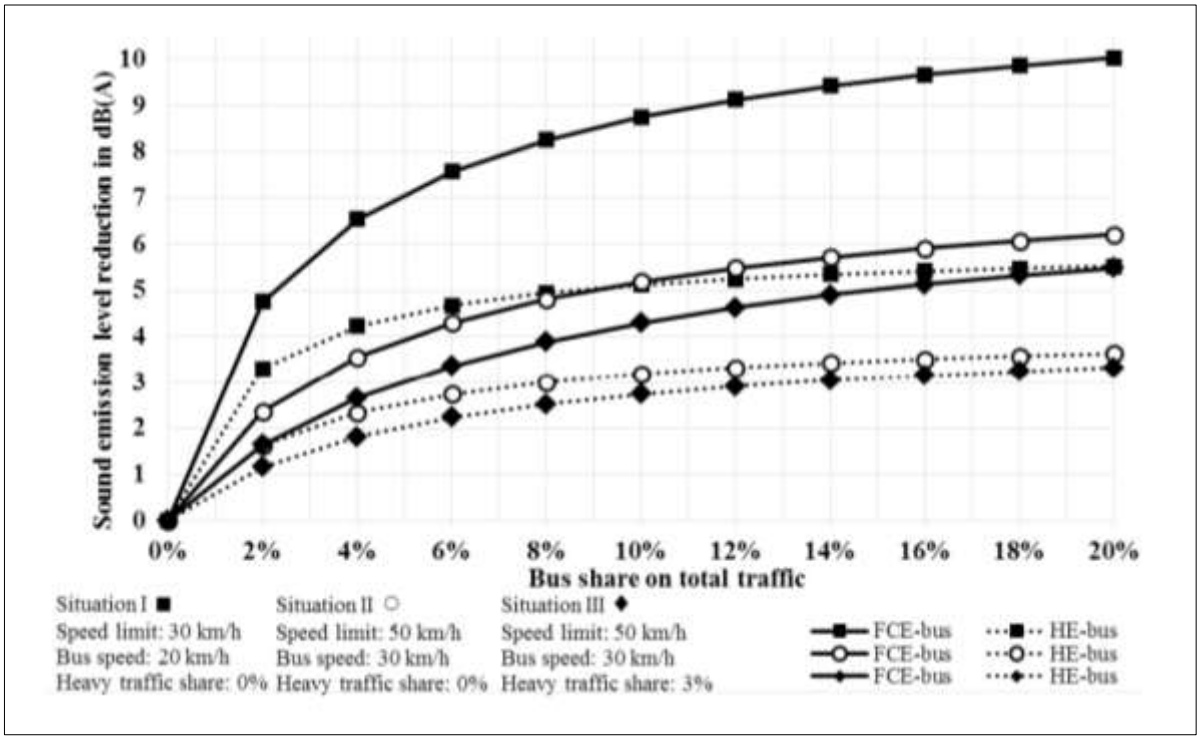
The images show that there is a range of potential noise abatement, depending on traffic speed and composition, and whether noise levels are monitored at bus stops or other roadside locations. The research shows that the scope for considerable noise reduction benefits, up to 10db at bus stops where the bus mode is a high proportion of traffic flow.

Average bus speeds along the scheme routes are approximately 17 km/hr, with bus mode share as a proportion of total traffic flow varying along the route. At bus stops locations where bus comprises 2% of the traffic flow a reduction of 5db might be achieved and at non-stop locations, 1bd. Where the bus mode share increase, to 4% for example, the noise reduction at bus stops may be 6.5db, and at non-stop locations, 2db.



Source: Felix Laib et al. / Transportation Research Prmocedia *37 (2019) 377–384*

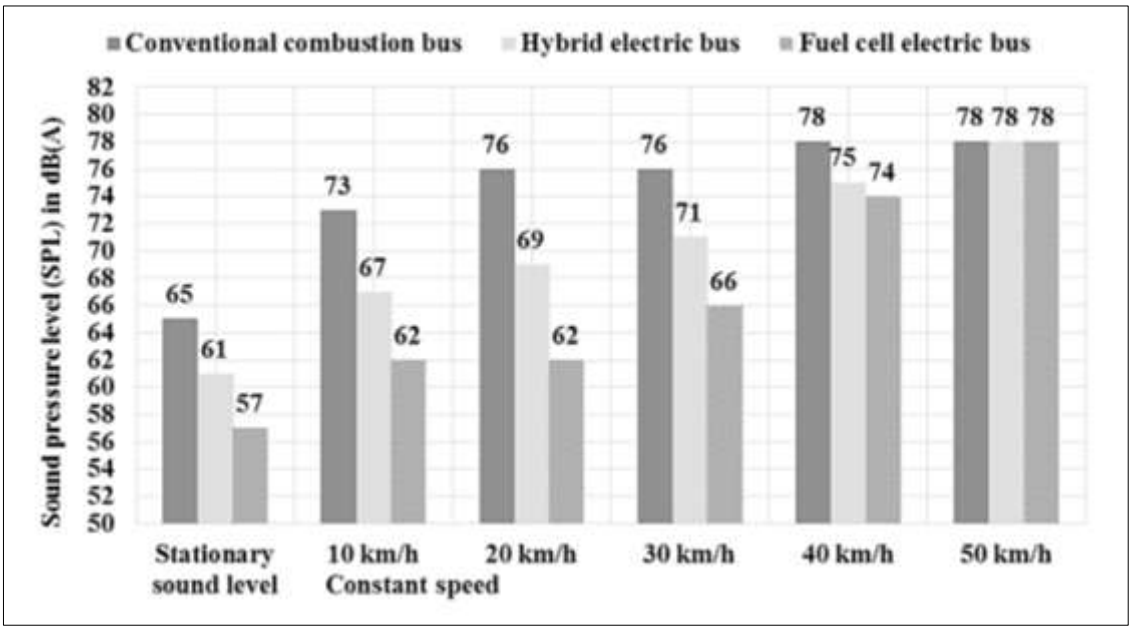
Figure 3.1 Sound emission level reduction when replacing IC (diesel) buses with the studied electric buses as a function of the bus share of total traffic. Calculation for 3 situations using the HE (hybrid) or FCE (electric) buses for constant speed without bus stops.



Source: Felix Laib et al. / Transportation Research Procedia 37 (2019) 377–384

Figure 3.2 Sound emission level reduction when replacing IC (diesel) buses with the studied electric buses as a function of the bus share of total traffic. Calculation for 3 situations using the HE (hybrid) or FCE (electric) buses at bus stops.

Researched sound measurements of isolated buses are presented in Figure 3.2. At low speeds, within congested conditions (such as within the centre of Southampton), diesel buses may operate at around 76db whereas electric buses may operate at around 62db.

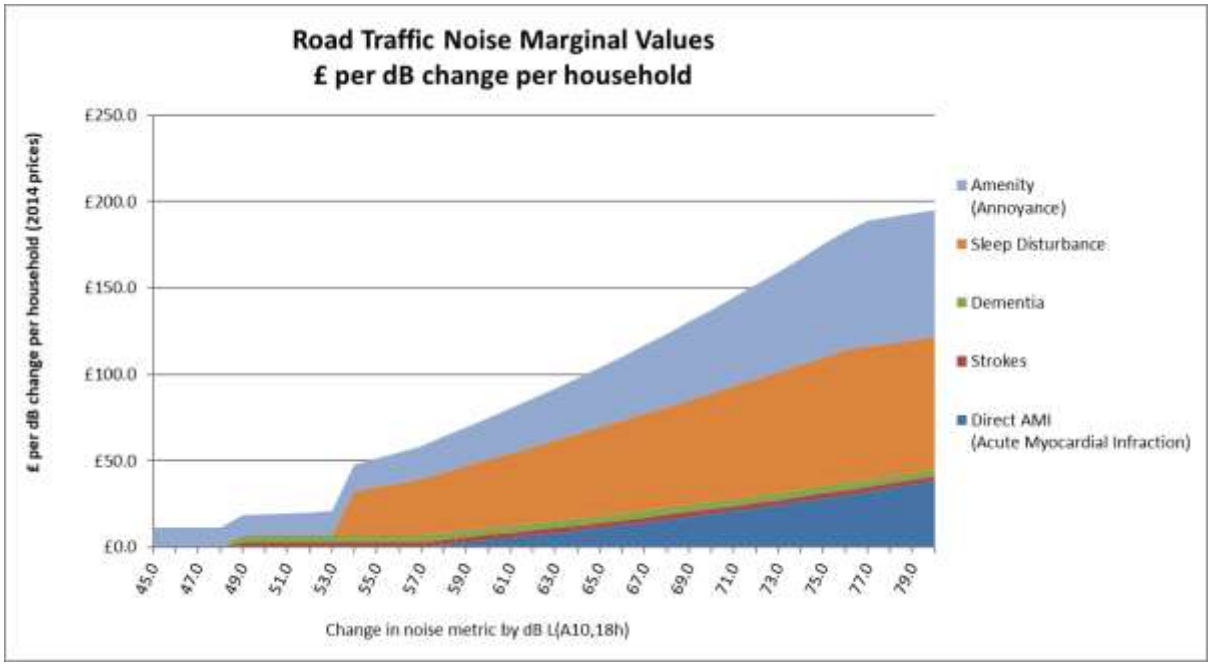


Source: Felix Laib et al. / Transportation Research Procedia 37 (2019) 377–384

Figure 3.2 Stationary and pass-by 7.5-meter sound levels of examined buses

Government sources (https://www.gov.uk/guidance/noise-pollution-economic-analysis) estimate that the annual social cost of urban road noise in England is £7 billion to £10 billion. The same source states that this places it at a similar magnitude to road accidents (£9 billion) and significantly greater than the impact on climate change (£1 to 4 billion). Further, it states "*It is important that the impacts on noise are fully considered in decision making for any policy, programme or project*.".

Government's noise modelling tool assumptions show that the incremental (1db) change in noise metric by decibel, for roads, with an example starting position of 62db going to 63db is £85.90 per household (2014 prices). The marginal cost varies by base noise level, as shown in Figure 3.3 below. TAG guidance presents equivalent data across a range of noise levels, with the current version (November 2021 v1.17) identifying a value of £85.52 (2010 prices) per household per decibel change per annum at 62db.



Source: Department for Environment, Food & Rural Affairs Noise Model

Figure 3.3 DEFRA Noise Model – Noise Marginal Values (£ / db / household)

As identified in the research paper referred to above, the transfer from diesel to electric buses has the potential to reduce nearby noise levels by several decibels, over a long distance and area. Therefore, the total noise benefit over the appraisal timeframe, could have a material impact on the overall BCR and value for money assessment.

Figure 3.4 below shows the Unilink bus service routes within Southampton. Figure 3.5 shows the average daily noise levels on strategic routes (not all local roads) within Southampton, based on data generate by DEFRA. Highlighted in Figure 3.5 are strategic road locations where noise levels range from 55-59.9db (light orange) up to 75+ db. It shows that on the measured local roads, noise levels at roadside are typically 70-74.9db, with decreasing noise levels further away from the roadside.

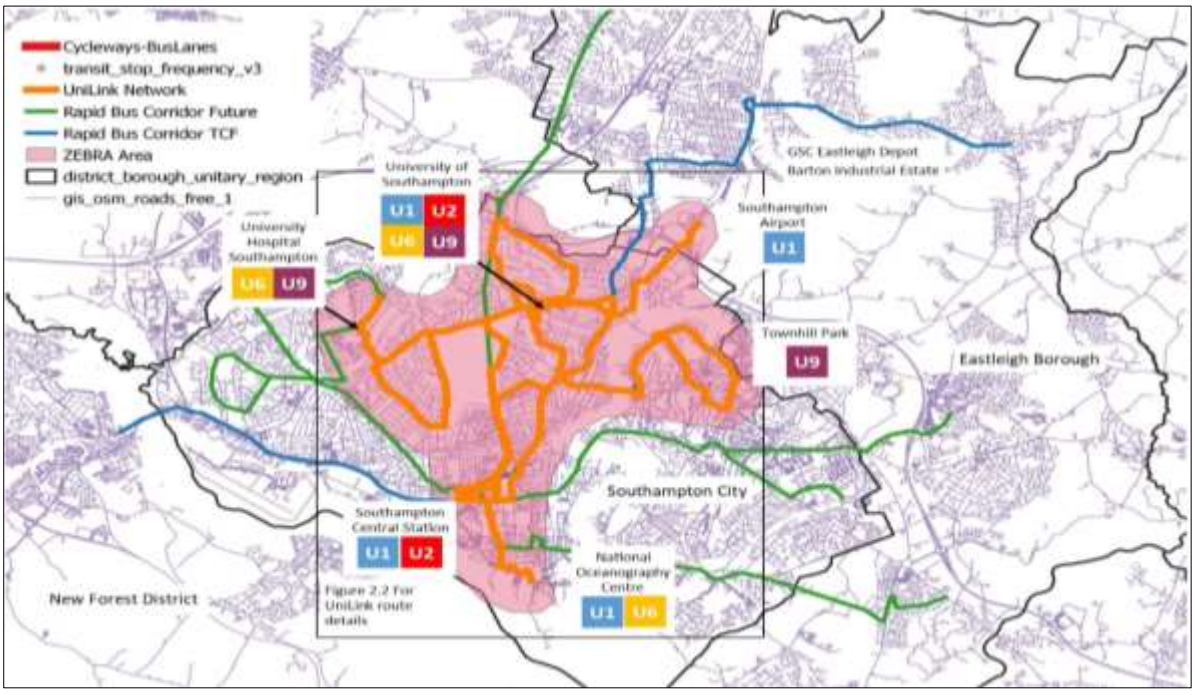


Figure 3.4 Unilink Bus Service Routes, Southampton

Source: http://www.extrium.co.uk/

Figure 3.5 DEFRA Data based Strategic Noise Mapping (CRTN methodology, 2017 data), Southampton

Without a project-specific noise model, estimates of noise abatement impact for the Southampton bus proposal cannot be made, but indicative values can be explored.

Southampton's population is in the region of 254,000 people, assuming the national average household population average of 2.4 people, it would equate to approximately 106,000 households. If 2% of those households experienced a 2.5db reduction as a result of the scheme, the unadjusted price base implied benefit could be in the region of £7.6m (£85 / db change * 2.5db change * 17 years vehicle lifespan * 106,000 households * 2% of total households). The core scenario carbon reduction benefit being approximately £5.3m and the fuel cost savings being £6.4m, this noise abatement benefit for Southampton could be of a similar order.

Whilst the above are very high level, indicative numbers for this noise aspect, it suggests that in absence of any approximation for the potential noise impact (benefit) included within the GBM, the overall monetised benefits and BCR as estimated by the GBM, may be considerably underestimated by this aspect alone. It suggests that the noise abatement benefit of the scheme could generate significant benefits, bringing the NPV closer to zero and BCR closer to 1.

This is a benefit which would likely apply to other submissions also but given the high population density along which the Unilink operates, the relatively slow travel speed, and areas of higher relative deprivation, the benefits to this proposal specifically, are anticipated to be higher than they would be for other submissions.

3.5.3 Levelling Up

A strategic priority for the Government is to Grow and Level Up the UK's economy.

Although Southampton is in the South East it is behind the South East average for productivity and deprivation. Wages in Southampton are £60/week lower than neighbouring boroughs such as Eastleigh, and there is a 18% gap in productivity to the South East average. This makes it more difficult for people to invest in cleaner personal ownership vehicles and therefore they are reliant upon the emission reduction in public transport vehicles, primarily buses.

There are pockets of deprivation in Southampton which are among the top 10% most deprived areas in England. Analysis of the Lower Super Output Areas (LSOAs) in Southampton identify that:

- 18 LSOAs (12%) are in the 10% most deprived LSOAs in England, of these 3 are in the central wards of Bevois and Bargate – served by all the UniLink buses, and
- Further 24 LSOAs (16%) are in the 20% most deprived LSOAs in England and are spread across Southampton– including Swaythling and Townhill Park served by all UniLink services.

This means that 28% of all the LSOAs in Southampton are in the 20% most deprived areas in England.

There is also disparity in quality of life within Southampton itself, healthy life expectancy varies by 6 years for males between the wealthiest and poorest wards.

Higher mortality rates in more deprived areas from heart disease, lung cancer, and chronic lower respiratory diseases account for around a third of the total gap in life expectancy for both sexes[18]. These aspects are directly related to air quality and therefore support the Southampton proposal, given that the routes run through these areas.

The UniLink buses provide access for people from these deprived areas to the Airport, Port, Universities, Hospitals, Port, and City Centre where there are services, jobs and opportunities. This will allow local economic levelling up by connecting the deprived communities with the city's economic drivers. The UniLink network serves the deprived communities in Bargate and Bevois wards directly connecting them to the University, Hospital and City Centre. These connections provide the ability for residents to reach these destinations, particularly as these areas have the highest levels of non-car owning households. Therefore, providing a necessary connection that has the ability to level up these communities against other areas of Southampton.

3.5.4 TfSE Transport Strategy – Transformational Change

The Transport for South East (TfSE)'s 30 year Transport Strategy (2019) sets a vision to 'be a leading global region for net-zero carbon transport networks'. With a view that carbon emissions in South East should be reduced to net zero by 2050 at the latest with improved air quality, reducing the impact and need to travel. As well as improving connectivity between major economic hubs, ports and airports.

The Southampton ZEBRA project aims to support this vision by kickstarting zero-emission buses in Southampton that provide connectivity between the City Centre, University campuses, the Port's Eastern Docks and Southampton Airport.

The investment identified within this proposal therefore has the potential to positively support wider change towards electric bus vehicles, enabling 'transformational change'.

3.5.5 Solent Freeport - Job Accessibility

Centred on the Ports of Southampton and Portsmouth and Southampton Airport, the Freeport is aiming to create 52,000 jobs across UK improving productivity in Solent and additional £3.57bn GVA uplift. The Freeport has links to the Universities with links to maritime, autonomy and green growth. The Freeport sites in the Port and at the Airport will create local job opportunities adjacent to communities in Southampton that are in the most 10% most deprived in England. The Freeport supports levelling up connecting with the industrial heartlands of the Midlands and North with the international gateways.

The ZEBRA proposal supports this with zero-emission bus services between the University and Freeport sites at the Airport and Port. This enable people working in those areas to get

[18] https://www.gov.uk/government/publications/health-profile-for-england-2018/chapter-5-inequalities-in-health

to work, and as the services connect to areas with higher unemployment, such as Bevois ward, provide opportunities for people to access the newly created jobs.

By investing in cleaner buses, it makes these key employment sites more accessible to a wider group of people than those who have access to private vehicle use, by reducing concerns and perceived barriers related to travel pollution and noise. This therefore has the potential to increases employment opportunity and retention rates, as well as increasing the perceived value of travelling by bus in general.

3.5.6 Transport Decarbonisation Plan – Job Creation & Retention

DfT's Decarbonisation Plan sets a date for the phasing out of sale of new non-zero emission buses for 2030 and local bus operators in Southampton are committed to not purchasing new non-zero emission buses from 2022. This is part of the approach in the BSIP to have all buses in Southampton zero-emission by 2030.

This project enables Southampton to start implementing zero-emission buses now to meet net-zero quicker. It will support jobs locally with apprenticeships, training and job security at local bus operators, but also strengthen the UK zero-emission bus supply chain and manufacturers.

3.5.7 Added Value – Investment Risk Barrier Reduction

Southampton is pursuing an Enhanced Bus Partnership, which stems from the adopted BSIP with a goal of having a zero emission bus fleet by 2030. The ZEBRA project will provide the learning and experience to allow the bus operators to understand the value of investing in zero emission vehicles as part of any future rolling programme of investment. Zero emission buses fit into wider plans for decarbonising transport in Southampton, the Greener City Plan is looking to make SCC's own fleet zero emission by 2030. Entering the EP in early 2022 will mean that, along with local investment, maximise the potential access to upcoming Government grants. This will ensure that the growth in the wider Southampton City Region will be sustainable and zero carbon.

3.5.8 Added Value – Supporting Vulnerable Groups

Routes will provide access to Southampton's two hospitals – University Hospital Southampton and Royal South Hants. Providing clean transport access for staff, patients and visitors.

There is a focus on the route serving both of Southampton's Universities – Southampton and Solent. Travel for students from the University of Southampton on the buses is included in their halls fees. Travel is allowed for the public on these services as well. This will provide cleaner and high quality buses for students, staff and visitors to the Universities, maximising the chances that students will continue to use the bus as their graduate and move into world of work. The services pass a number of schools, and as children are more prone to asthma and other breathing difficulties exacerbated by air pollution. Introducing zero emission buses on these routes will be important in tackling this.

The buses will serve some of Southampton's biggest employers – Port, Hospital, City Centre, University & Airport – allowing for access to these sites by zero emission. This will complement investment by these employers in their own fleet. The Port of Southampton have invested in shoreside electric vehicles and the new Horizon Cruise Terminal provides UK's first shore-to-ship charging to reduce emissions from ships when in port.

It should be noted that the existing Euro VI UniLink buses will be cascaded elsewhere in the GSC family of companies giving benefits beyond Southampton, enhancing fuel efficiency, emission reduction and passenger experience, with Euro III to Euro V class vehicles ultimately being replaced.

To ensure that the image of the bus is improved all the buses will have the following as standard to help with accessibility:

- Wheelchair ramps and space for 2 wheelchairs,
- Tap On Tap Off readers for contactless capped fares,
- USB Chargers and WiFi,
- High quality interiors with colours schemes to help dementia,
- Next stop audio and visual announcements, and
- Double door entry and exit for faster loading and unloading to minimise dwell time at bus stops.

The buses will be entering service on the Portswood TCF corridor and in the City Centre where investment in bus priority, interchanges, bus stops and local mobility options will help to improve bus journey times and integration with other modes.

3.5.9 Added Value – Knowledge Sharing & Apprenticeships

The University of Southampton has a longstanding commitment to environmental performance, carbon reduction and sustainability. The current Sustainability Strategy was introduced in 2020 and commits the University to reaching zero carbon operation by 2030, with specific goals linked to Scope 3 emissions and carbon associated with transport activity. Strategy documents are available on the University Sustainability website.

The University Travel Plan provides further context for transport activities across University campuses, with specific objectives for the growth and improvement of Uni-link services and the migration of vehicles associated with the University to electric operation. This has delivered measured reductions in both staff and student car use and has supported the development of the Uni-link network via the contract. The Travel Plan is updated on an annual basis, although the current update has been delayed by the coronavirus pandemic and is expected to take place in mid-2022.

Both the Sustainability Strategy and the Travel Plan utilise academic expertise and research links to deliver against targets. If this application is successful, academics within the Transportation Group at the University will play an integral part in the monitoring of service delivery and vehicle performance, with specific student projects created as a result.

The University of Southampton have active research projects assessing the impacts of electrification which would be applied to the monitoring & evaluation of the project, utilising expertise from their Transport Research Group (TRG) and Faculty Centre of Excellence on Reengineering for Electric Mobility. Associated collaborative projects are already underway at the University to study decarbonising transport, battery storage, air quality and environmental impact, which would benefit greatly from data generated by this project as a demonstration of real-world application of electric vehicle operations. The project would also open opportunities for additional undergraduate and postgraduate research. These links to academic activity could in turn inform improvements to technology, systems and applications, increasing confidence in the vehicles and charging infrastructure and supporting wider adoption of electric vehicles. This therefore could have a significant ‘transformational change’ not only within Southampton, but across the UK.

Go South Coast have a strong sustainability ethos and already operate electric buses in Salisbury for the city’s Park & Ride scheme. In 2018 they adopted a Green Energy Policy to providing public transport services that meet passengers’ needs now and in the future. Public transport plays a key role in reducing the UK’s carbon footprint by providing an alternative to the use of private cars and reducing the environmental impact of transport. This includes an ambition to use low-carbon products such as electric buses and working with stakeholders to tackle climate change.

As part of the project, Go South Coast will enable further education and training including for engineers to transfer skills from mechanical to electrical as well as several apprenticeships focussed on electric bus technology.

3.5.10 Encouraging Active Modes

To support decarbonisation and active travel the Southampton Cycle Network has been developed to create a high quality safe and coherent cycle network. SCC has the aspiration to increase cycling's mode share by 10%. The first phases of the SCN have been delivered through TCF, ATF and CAZ projects and seen a 20% increase in cycling on one route. The TCF and ATF programmes is seeking to deliver over 11 miles of new cycle routes along with four new Active Travel Zones close to AQMAs by 2023.

By reducing pollution and noise from surrounding traffic, it reduces potential barriers to cycling and thus supports Southampton's ambitions for this mode. Increases in travel by active modes will deliver associated health improvement benefits.

3.5.11 Potential Improvements to Performance and Increases in Scheme Benefits

The funded £57m Southampton City Region TCF Programme will support the ZEBRA proposals by implementing the first Rapid Bus Corridors in Southampton and Hampshire. These aim to provide bus priority, new mobility hubs, better bus stops, and enforcement on corridors from the City Centre to Totton, Chandlers Ford, Eastleigh and Woolston.

Over the coming financial years, the Council will be investing over £10m in major road resurfacing programme, there will be a focus on main bus routes such as The Avenue, Portswood Road and Bevois Valley Road which are served by UniLink services. This further complements the noise reduction and improved ride comfort.

By improving bus priority and reducing average travel times for bus, these measures will reduce improve the battery maximum distance travelled per charge and may generate opportunities for increased average distance travelled per bus, increasing associated emissions reduction benefits.

3.5.12 High Specification Vehicles Leading to Reduced Operational Risks

The vehicles have a high vehicle specification to meet the aspirations of the Southampton BSIP to improve the transport network for the user and encourage more people to travel by bus.

- Double doors for easy and quick loading/unloading at bus stops as the UniLink services are high passenger volume particularly during university term times and this keeps dwell time at bus stops at a minimum enabling efficient bus operation;
- Have tap on-tap off (TOTO) readers for contactless capped fares which has been introduced in Southampton since autumn 2021;
- USB charging points at all seats, WiFi, next stop audio and visual announcements as standard to maintain high quality features already in place in Southampton; and
- Fully accessible with wheelchair ramp, audio loops, dementia friendly internal colour schemes and CCTV to make them accessible and secure.

Having a high specification from the start of operation reduces costs to retrofit TOTO, USB, and next stop announcements at a future date. The additional doors to aid quicker and efficient loading/unloading support an efficient bus operation. It has been chosen to go for high specification buses will continue to attract passengers to use buses enabling a greater modal shift increasing carbon savings of both zero emission vehicles and shift away from private vehicles. These additional features have increased the initial purchase cost but reduce need have further investment from GSC or others later.

By investing in high specification vehicles, this suggest that the risk of declining patronage is in this respect less for Southampton than for other proposals which do not propose to invest in such vehicles. This suggests that the contingency allowance for the Southampton proposal might be lowered relative to other submissions.

3.5.13 Potential for Increased Patronage

It is important to note the differences the user has with regards to the electric bus experience particularly as they relate to vehicle comfort (no vibration saved for that caused by the road surface) and that of the reduction in noise and emissions which are a step change better that diesel buses – in the case of emissions – zero tail pipe and noise – significantly lower.

Similar to the 'Sparks' effect observed with the introduction of electric trains, TAG unit 3.2.1 Segmented Value of Bus Interventions refers to generalised journey time reductions for the improvements made to 'soft factors' on buses. The research which was done in 2009 (AECOM) evaluated a number of factors including Real Time Passenger Information, CCTV, Climate Control, Trained Drivers, and new bus shelters. Although electric buses were not measured at the time, it would be logical that the significant increase in journey ambience from electric over diesel would be expected.

Additional research on this aspect is included within "The demand for public transport: The effects of fares, quality of service, income and car ownership. Transport Policy, 13 (4). pp. 295-306. ISSN 0967-070X" from Paulley, N., Balcombe, R., Mackett, R. et al. (2006). This paper suggested that under the heading of rolling stock characteristics that passenger growth of 5% for low floor buses and on trains slam door stock to air conditioned stock was worth around 2.5% of the fare with typical refreshed rolling stock of 1.5% being representative. It is suggested that an upper end figure (5% passenger growth) given the step change in journey experience is not unreasonable.

A case study in Harrogate an estimated figure of an 8% uplift in patronage has been cited by Transdev following the deployment of electric buses within Harrogate. If such an increase was experienced in Southampton, which is comparatively likely given the positive trends in patronage over recent years, it would clearly have a monetary benefit with respect to fare revenue, and could increase overall bus mode share of traffic, reducing congestion. A full double decker bus has the ability to remove the equivalent of 75 cars from the road. The 32 UniLink buses has possibility to remove 2,400 vehicles from the road, which would have additional congestion, safety and environmental impacts.

3.5.14 Further considerations

Additional non-monetised benefits specific to the proposed scheme in Southampton include;

- Rapid change and profile raising will put the bus forward as a transport mode that is attractive and encourage people away from their car for trips in and around Southampton. Moving to being a zero emission city is an integral part of the city's transport strategy for making it better to get around and aligns with the NBS view that 'zero emission buses meet the needs of passengers and communities, and attract people from other forms of transport'.
- Southampton has been proactive in supporting the drive towards cleaner buses and attaining government targets for NO2, with all buses being Euro 6 or equivalent. However, this positive action should not act as a disincentive to invest in electric buses. By supporting this proposal, 14% of buses in Southampton can be made electric and this can act as a much needed catalyst for greater transition to electric buses, escalating the wider fleet transition.
- Between 2015 and 2036 £3bn is expected to be invested in development in Southampton creating 24,000 new jobs with 7,000 being created by 2026. This will see a potential increase in population of 30,000 more people living in Southampton. If only 11% of these additional trips are made by public transport, that would equate to approximately 40,000, the majority of which would be by bus. Without continuing to invest in bus to make it an attractive travel option, travel by bus and business growth would be stifled.

On the above basis, the BCR as estimated within the GBM should be taken with caution, as the output results may be a significant underestimation of the true benefit to cost ratio and value for money for this scheme.

3.6 Considerations of Uncertainties

There are several risks and uncertainties which could affect the value for money both positively and negatively, including those discussed below.

1 - A variance in baseline Bus mileage compared to the model estimate (DfT)

A change in the bus mileage would be associated with either re-routing of the service or increased frequency to meet increased baseline demand over time. RAG Status - **Green**.

On balance there is likely to be more upside risk of an increase than a decrease to average bus mileage, given;

- Southampton is above the England and South East averages for bus mode share for travel to work with 9% of all trips to work in Southampton being made by bus. However, based on 2011 Census and transport modelling (Solent Sub-Regional Transport Model) 2019 strongest flow is between Southampton and Eastleigh – with 24,000 2-way flows daily – only 7% of those journeys are by bus. With 60% of commuting trips less than 3 miles, there is scope for a greater proportion of these journeys to be made by bus and sustainable modes rather than by car.
- People of all ages are increasingly aware of their carbon footprint.
- There are trends towards younger people spending more of their disposable income on 'experiences' and less on fixed assets. Driving licensing among young people peaked in 1992/4, with 48% of 17-20 year olds and 75% of 21-29 year olds holding a driving licence. By 2020 28 per cent of men and women aged 17 – 20 held a full licence. This was down 7 per cent from the previous year and is the lowest percentage figure since 2004[19].
- At an average of [redacted] per bus per annum this is notably below the default GBM value ([redacted]), but is based on observed data from the operator. With greater patronage the frequency might be expanded, or the routes could be lengthened potentially, such that a higher distance per annum could achieved.

If total bus mileage is greater than the core forecast, this would improve the economies of scale, reducing the infrastructure cost per bus mile, and would increase the net emissions related benefits and aspects such as fuel related savings. Conversely, if mileage is less than expected, then less benefits will accrue due to the scheme whilst most of the fixed costs of the scheme will still remain constant – though depending on the degree of change in mileage assumed, there might be some savings on this front, but this would only be expected under a large change.

2 – A relative change in patronage under the with-scheme scenario.

RAG Status - **Green**

The Green Bus Tool does not enable a user input for the change in patronage with the scheme in place relative to baseline conditions. In reality however, the improved rider experience (such as through noise reduction) on the proposed buses would likely have an impact of increased demand, enabling more journeys and increasing patronage related revenue, decreasing overall scheme operating costs.

3 - Battery Life and Battery Replacement Cost

[19] https://www.gov.uk/government/statistics/national-travel-survey-2020/national-travel-survey-2020

RAG Status - **Amber**

It is assumed at this stage of the technology lifecycle for bus batteries that the expected life will meet or exceed the assumed replacement cycles of 8 years. Evidence from other sectors such as electric cars is suggesting battery performance is better than originally forecast providing best practice on battery charging is undertaken. An example is data compiled by the organization Plug In America, the battery pack in a Tesla Model S will lose around five percent of its original capacity over the first 50,000 miles, with the rate of depletion slowing down thereafter. https://www.myev.com/research/ev-101/how-long-should-an-electric-cars-battery-last

Advances in battery technology mean that issues surrounding degradation of performance are being reduced.

The key parameter for any electric vehicle is energy consumption measured in kWh/km, which is significantly connected to the vehicle's weight – thus one of the main areas of focus is to reduce the total weight of the batteries to gain the highest energy density. https://www.sustainable-bus.com/news/bmz-poland-lithium-ion-battery-technology-electric-buses/

It is therefore assumed that the battery replacement cost will be at or below the figure included in the spreadsheet, given that at this stage of the battery technology cycle prices are continuing to fall in both absolute and real terms.

Thus, the assumptions made on both battery life and cost are relatively conservative and the central expectation is that the out turn replacement cost will be lower and the residual value of the battery higher than forecast.

4 – Bus Life Span and Vehicle Reliability

RAG Status - **Amber**

On bus life, there are two elements to this; the battery pack has already been described above, and the second element is the chassis and associated mechanical components (axles, chassis, braking systems and body). 17 years is the average life expectancy for the buses based on DfT guidance. However, given the average distance travelled per vehicle in the case of Southampton, this has been increased slightly to 20 years.

In general, vehicle reliability for electric buses is expected to be higher through than for diesel buses primarily through the removal of the internal combustion engine with an electric motor which has fewer moving parts.

5 – Delay to Depot and Sub Station and BSOG Rate

RAG Status - **Red**

In line with the DfT Guidance – the current fleet parameter for BSOG is set to Basic BSOG rate + LCEB, AVL and Smartcard Uplift. However, if the previously recommended BSOG basic rate was considered more appropriate this would increase the benefit of the scheme.

Conversely though, if the zero emissions BSOG rate was used instead of the core value of 22p, this would decrease the net benefit.

Delays to the depot and substation could impact the transition to electric vehicles, but existing vehicles could be used until the revised start date. Delays might alter the cost profile, though costs incurred at a later year would be subject to a greater discount rate.

5 – A domino effect on bus replacement and incremental emissions reductions

RAG Status - **Amber**

The buses currently operating on the route are Euro 6 equivalent. Therefore, the direct comparison is on the baseline scenario of operations with those vehicles (without the scheme), against the proposed scenario with new electric buses. However, the Euro 6 buses

along the route are anticipated to be redistributed, enabling the removal of more polluting Euro 3-5 buses elsewhere. Therefore, the reduction in net emissions will be greater than only the change from Euro 6 to electric buses along the scheme service routes.

3.7 Considerations of Risks

The key risks surround those which have been sensitivity tested;

- Forecast ZEB vehicle mileage,
- BSOG based sensitivity,
- Variation in the modelled versus actual carbon values,
- Battery replacement costs, and
- National grid / connection costs.

In addition, the main risk for a business case would be around scheme costs.

- Inflation is currently (at the time of writing, January 2022) creeping up, though the costs are forecast to be incurred almost entirely in 2022 and therefore this aspect of the total cost risk is relatively small compared to a scheme with costs over a longer timeframe;
- Cost uncertainties around the Distributed Network Operator (DNO) connection and sufficient spare grid capacity at Eastleigh depot; and
- The suggested level of optimism bias of 3% is quite low for a scheme of this nature, compared to the values identified in TAG guidance. As per the guidance specific to this appraisal however, a contingency of 3% has been applied on top of the base costs (albeit contrary to TAG guidance).

A summary RAG table of the top 8 strategic risks has also been included (as aligned with the Strategic Case). For a broader discussion of identified risks, see the Risk Register (Appendix 4.14).

Risk	Rating (Before)	Mitigation	Rating (After)
Delay in delivery of vehicles	R	Initial quotations and letters of support from manufacturers received which the operator has an ongoing contractual relationship with demonstrating scale of operations. Commercial case sufficiently well prepared. Early supplier engagement, early fixed installation costs. Comprehensive specification and works schedules. Contracts will be placed with clauses to limit against the possibility of late delivery.	G
Uncertainty over the cost, install and construction of charging infrastructure	Y	Initial contract prices have been received from charging suppliers for the delivery of the depot works Contracts will be placed to place any financial burden on the supplier and feasibility works have been undertaken to mitigate this as far as possible Financial Case – This includes contingency in line with 3% recommendations and has been	G

		quantified. This is sufficient to absorb any cost increases.	
Uncertainty over the cost and timescales of electrical connections to supply the chargers	R	All sites have costs estimates prepared by SSE and have been compared to ensure they are competitive, and engagement is ongoing with SWARCO (MOU in place) to ensure they can realise timescales associated with the project. Fixed price quotations are underway for GSC depots due in February 2022. The costs have been validated by SWARCO which GSC proposes to uses for the installations at their depot locations.	Y
Costs of vehicles and/ or infrastructure in excess of those specified in the bid	Y	Previous Experience of costs and comparable schemes, early engagement with manufacturers, sufficient levels of optimism bias, in calculation of costs and financial contingency identified. We will secure fixed price quotes. Fixed quotes have been provided for the infrastructure element from SSE and SWARCO. (Vehicle Costs from Wrights).	Y
Energy Price inflation for charging infrastructure	Y	A range of energy prices with inflation have been embedded into the financial model which impacts the BCR. Please note revenue costs are not part of the funding sought through the ZEBRA bid	G
Delay in funding decision beyond March 2022	Y	In the event this occurs, work with DfT and partners around a revised programme and the supply chain to mobilise within 1 month of funding decision.	Y
Procurement delays associated with contracts for new vehicles and infrastructure	Y	Legal advice and procurement advice has taken place at bid stage with draft tenders available by the operators	G
Uncertainty over the cost, install and construction of charging infrastructure	Y	Financial Case – This includes [redacted]% contingency in line with recommendations. This is sufficient to absorb any cost increases. Contracts will be placed to place any financial burden on the supplier and feasibility works have been undertaken to mitigate this as far as possible	Y
Failure to achieve delivery trajectory impacting on the reputation of the organisation to secure future funds	Y	Programme is realistic upfront, and the Grant Funding Agreements drafted by SCC are contingent on milestones being achieved. Regular monitoring is planned	G

Table 3.10 Cost Risks with & without Mitigation

3.8 Summary - Value for Money

The core appraisal BCR as taken from the GBM is **0.19**. However, this is not considered to reflect the 'true' value of the scheme.

There are aspects within the GM which are contrary to existing Government guidance on transport appraisal, which have the impact of reducing benefits and increasing costs;

- JAQU guidance is that a real year on year growth in damage cost valuations of 2% per annum should be included, but this is set to the default GM selection 0% - assigning this to 2% would increase the damage cost related benefits.
- TAG guidance is that contingency costs should not be included in the economic case, but this instruction for this submission has been to include contingency costs, increasing the net scheme costs.

From a scheme costs perspective, the approach which has been identified to take is to include all infrastructure costs. However, some of these infrastructure cost items will have lifespans significantly beyond the lifespan of the proposed fleet renewal iteration. Government has imposed a ban on the sale of new diesel car and van vehicles from 2030 and is currently consulting with respect to HGVs and buses. Southampton is pursuing an Enhanced Bus Partnership, which stems from the adopted BSIP with a goal of having a zero emission bus fleet by 2030. It is clear that the medium to long term trend will be an industry-wide transition to electric vehicles – what this current funding scheme does is to help bring forwards that industry transition. Therefore, the infrastructure which supports this proposal and lasts beyond the current fleet, will represent a cost saving for future bus services which have otherwise had to install the same infrastructure at a later date. Similarly, some of the grid strengthened and charging spare capacity will support other electricity users. On this basis, it is estimated that only 46% of infrastructure costs are attributable solely to the proposed fleet upgrade. This alone increases the BCR to **0.46** and an NPV of -£5.3m.

There are broader benefits also to be taken into consideration, some of which are generic for the replacement of older diesel powered buses with newer electric vehicles.

Government guidance is that "*impacts on noise are fully considered in decision making for any policy, programme or project*", identifying that the annual social cost of urban road noise in England is £7 billion to £10 billion, compared to an impact on climate change of £1 billion to £4 billion. In this context, noise related costs associated with road traffic may therefore be twice the climate related impact.

Government's carbon emissions cost impact unit values are estimated via a "target-consistent" carbon valuation approach. They are estimated by considering the level of marginal abatement costs required to reach the targets that the UK has adopted at a UK and international level, as such, the scheme's carbon impact estimation reflects the scheme's climate impact.

The carbon related benefit associated with the core scenario of this proposal, as estimated within the GBM, is £5.3m and the NPV in the core scenario is -£9.85m. However, while the GBM includes approximations for carbon cost change and other monetised impacts, there is no approximation for noise impact change. Inclusion of noise abatement benefits could have a significant impact on the NPV. A high level estimate of the monetary benefit associated with transferring from diesel to electric vehicles as within this proposal, suggest it could largely offset the negative NPV amount in the core scenario. Under the infrastructure cost adjustment test, the NPV improves to -£5.3m, making it increasingly likely that a positive NPV and BCR > 1.0 could be achieved with the monetisation of noise abatement benefits.

Softer impacts such as ride quality improvements associated with reduced noise, increase the perceived value of travelling by bus, which can in turn result in a transfer from car,

reducing congestion and environmental impacts associated with car use, as well as increasing bus revenue.

With respect to the Southampton scheme, an increase in demand has the future potential to be used to increase the use of the identified vehicles, which would in turn could increase the average distance travelled per annum per bus, which is a key variable within the GBM's determination of the end BCR. Southampton's submission currently has a lower than average bus distance per annum value for the proposed scheme routes, which suggests potential scope for this to be increased in the future.

Additional considerations are the strategic benefits which investment in Southampton's first electric buses would bring;

- Southampton has sought to comply with Government's instruction with respect to a Clean Air Plan and achieving NO^2 concentrations at Government target levels within the shortest possible time – this proposal will support with that goal.
- Further, Southampton has areas of higher than average deprivation levels, with low car affordability, so the local population is at a relative disadvantage of being able to support Government's aims to reduce transport emissions individually – investing in electric buses in Southampton will therefore support the Government's 'levelling up' agenda.
- The routes are of strategic importance from a business perspective, linking key ports and airports, which can foster high value jobs growth.
- Southampton University plays an important role in transport related research. Without local case studies and partners to work with in respect to the exploration of the impacts of electric buses, it risks hindering the University's beneficial contribution in further developing the knowledge around this field. That could in turn hinder future development and value for money associated with such projects in general.
- The grant ask represents approximately a third of the total costs, with the remainder being contributed by the operator, University and Southampton Council, this high local contribution represents the confidence in the schemes true value.

Sensitivity testing shows a range of potential BCR values, with the upper end indicating a value of **1.14**. If noise abatement benefits, were included with the scenario of offset infrastructure costs, it is likely that without any additional reconsideration of benefits, such as the Government's recommended real growth in health damage impact values, a BCR of over 1.0 could be realistically achieved.

Taking the above into account, as well as the wider Strategic Case discussion, the scheme is therefore considered to be able to achieve at least low value for money and potentially greater.

4 Commercial Case

4.1 Overview

The Commercial Case explains how the Council and bus operator will engage the market to deliver the new fleet of 32 zero emission buses to operate on the UniLink network, and 20 in-depot charging infrastructure.

It will:

- Provide an explanation of the output based specification (4.2);
- Set out the commercial strategy proposed, the project delivery, commercial model and how the project will work, including who will own and procure the assets – both the vehicles and the infrastructure, and flow of payments (4.3);
- Set out the procurement strategy and relationship between SCC as the funder and GSC as the delivery organisation for the three elements (4.4);
- Demonstrate the level of market engagement to date carried out by the partners (4.6);
- Explain the chosen output based specification for the buses, chargers and electrical connection (4.7);
- How risk is being managed through a risk management strategy (4.8);
- The marketing strategy (4.9); and
- How the project is compliant with procurement and subsidy control regulations (4.10).

4.2 Output Based Specification

The Southampton ZEBRA proposal is to start the transition of Southampton's bus fleet to zero emission so that buses can contribute to decarbonisation of transport, and supporting the Government's aim to introducing 4,000 new zero emission buses in England, improve transport for the user and improve air quality in Southampton.

Through the Southampton ZEBRA proposal we will be delivering the following using ZEBRA funding, bus operator funding and third party match funding:

- 32 new double deck zero emission buses (all of which will be electric);
- 16 dual aspect electric bus charge points and associated management system at Go South Coast's Eastleigh bus depot; and
- Provision of electrical infrastructure suitable to connect the depot and chargers to the National Grid, with this being provided by Scottish & Southern Electric (SSE).

Further to this the bus operator is also committed to deliver the following with funding not provided by ZEBRA:

- Battery replacement for the 32 ZEBRA funded buses in year 8 (GSC funded).

The outcomes for the Southampton ZEBRA are given in the Logic Map in Figure 4.1.

The Logic Map in Figure 4.1 identifies how inputs into the Southampton ZEBRA Programme will deliver a range of outputs. It also demonstrates the linkage between the project, the challenges identified in the Strategic Case, and the anticipated medium and long term impacts of the ZEBRA Programme.

In summary the outcomes anticipated are:

- Increased bus patronage arising from high specification buses that provide an improvement for transport users – maintaining and improving the quality of buses in Southampton and making them quieter onboard;
- Widening the choice of clean travel options in Southampton;
- Buses are leading the way in the decarbonisation of transport and help to level up Southampton by reducing health inequalities caused by air pollution as well as

maintaining access to key economic drivers such as the City Centre, University, Airport and Hospital; and

- Providing evidence for bus operators, and the DfT, on the implementation of a zero emission bus fleet, including the challenges in doing so.

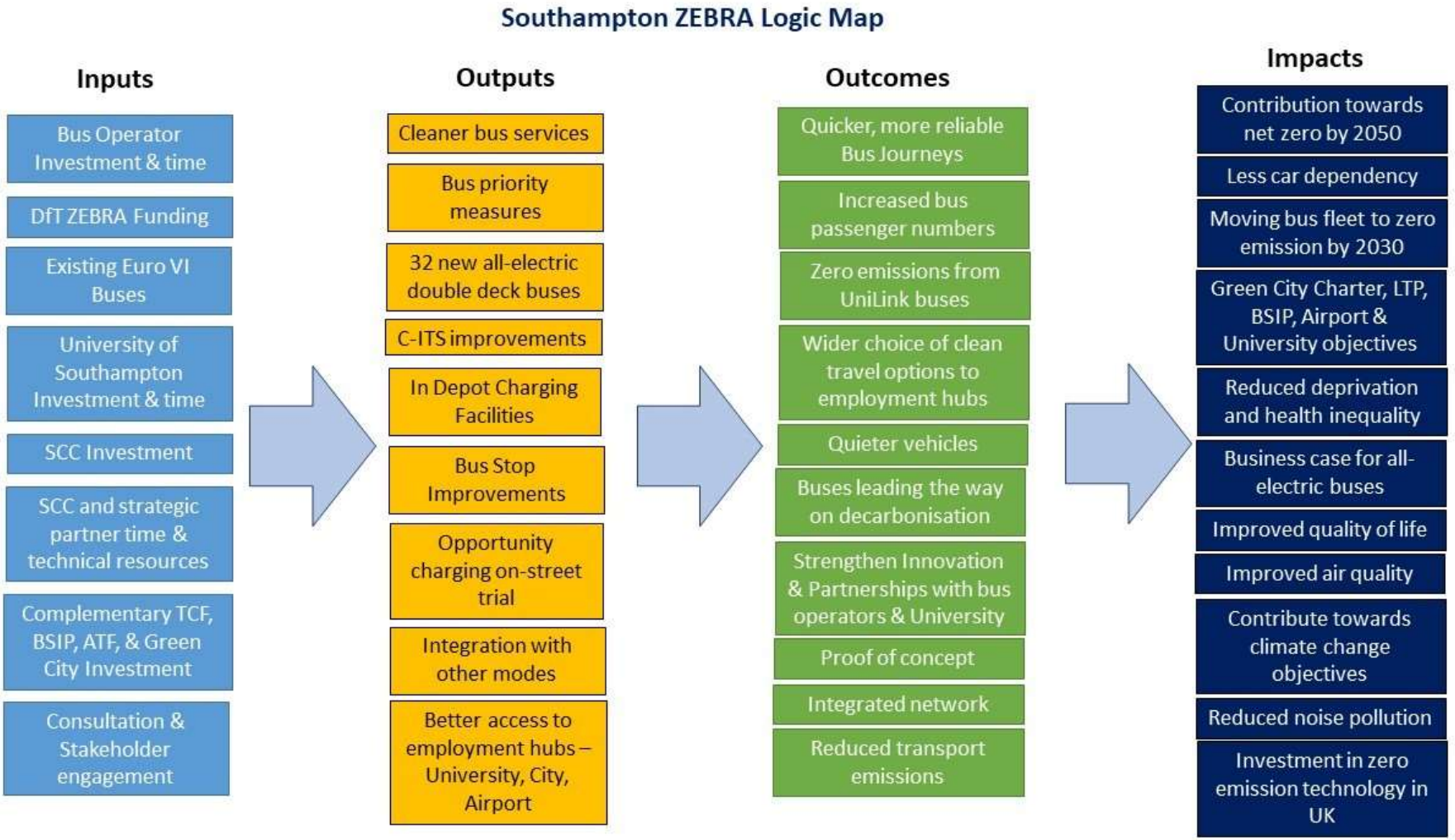


Figure 4.1 Southampton ZEBRA Logic Map

4.3 Commercial Strategy

This section sets out a summary of the commercial model proposed and how the project will work. It provides information on who will procure and own the assets – the buses, infrastructure, and connections. The bus operator will procure and own the buses, chargers and infrastructure.

For the bus operator there are four main elements to their procurement

- Fully electric double decker buses;
- Depot chargers;
- Internal civils works within the depot; and
- Grid connection and upgrade.

4.3.1 Project Delivery

For delivery it has been assumed that a decision on the Standard ZEBRA process will be made in March 2022, and the DfT's requirement that all buses need to be in operation by March 2024.

To date the project has been developed after the DfT's Expression of Interest stage for Standard ZEBRA process in June 2021. At this stage SCC carried out an expression of interest discussion with all the bus operators in Southampton – First, GSC and Xelabus – to ascertain interest in bidding. The only local operator that expressed an interest was GSC and the University in terms of the desire to replace the existing UniLink fleet with electric buses. Reasons given by other operators not wishing to participate including uncertainty over funding, the level of financial support available, impact of Covid on patronage, and not having a suitable network to invest in at the current time.

When developing the project the aim has been to introduce the buses on UniLink during the first weeks of the 2022/23 new academic year. This aim and has been driven by the ambition to introduce the new vehicles at a key point in the academic year when new students arrive in Southampton to start attending university. This means that the new zero emission buses will be in service as quickly as possible providing clear outputs early in the ZEBRA programme with delivery of 32 buses towards the Government's ambition of 4,000 zero emission buses. If the timescales are not achieved there is sufficient buffer within the programme for the DfT deadline of March 2024 to be met.

As SCC is the Accountable Body these arrangements will need to be defined fully for the administration of any grant to the operator. A formal document will be sent out by the Council detailing conditions under which GSC will receive the ZEBRA funding from the Council. This must be consistent with ZEBRA objectives, funding process and the full specification stages. Within the document, GSC's procurement process will need to be set out in detail to be independently reviewed by the Council to ensure best value, consistency with the bid objectives and the emerging Enhanced Partnership.

4.3.2 Commercial Model

Procurement of the directly owned assets (the vehicles, charging infrastructure (in depot and on-street), and the electrical connection) will be carried out by GSC using their own in house corporate procurement process, policies and specification. Due to the significant levels of funding the operator is providing to the project this will need to be in line with their own procurement policies and approvals. This will consider wider Go-Ahead Group (GAG) objectives to ensure flexibility, bulk procurement benefits and fleet-wide management benefits.

Both GSC and the wider GAG have experience of procuring low and zero emission vehicles such as ADL buses in Salisbury and BYD buses for the Waterloo-Victoria service in London. The depot at Waterloo was one of the first in London to be upgraded to accommodate all-

electric buses. The wider GAG are also involved in other ZEBRA bids. The lessons report is shown at Appendix 4.1

As part of the wider Go-Ahead Group, Go South Coast will use the Go-Ahead Sustainable Procurement Policy (SPP). This aims to create a level playing field for all its suppliers, irrespective of size, employees or turnover and will seek to collaborate with small and medium sized enterprises (SMEs) when possible. This includes instances when smaller, local organisations can offer key benefits such as enhanced local knowledge, the provision of local employment or benefits to the local community.

Go Ahead uses the EU definition of SME enterprises; organisations with less than 250 employees and a turnover of less than £44m.

The priority areas we are asking our suppliers to focus on are linked with the Go-Ahead sustainability strategy, which is built around five key UN Sustainable Development Goals. These are the five goals where Go-Ahead believes it can make a positive impact and the key themes are highlighted in Figure 4.1. The GAG Sustainable Procurement Strategy is included at Appendix 4.2.

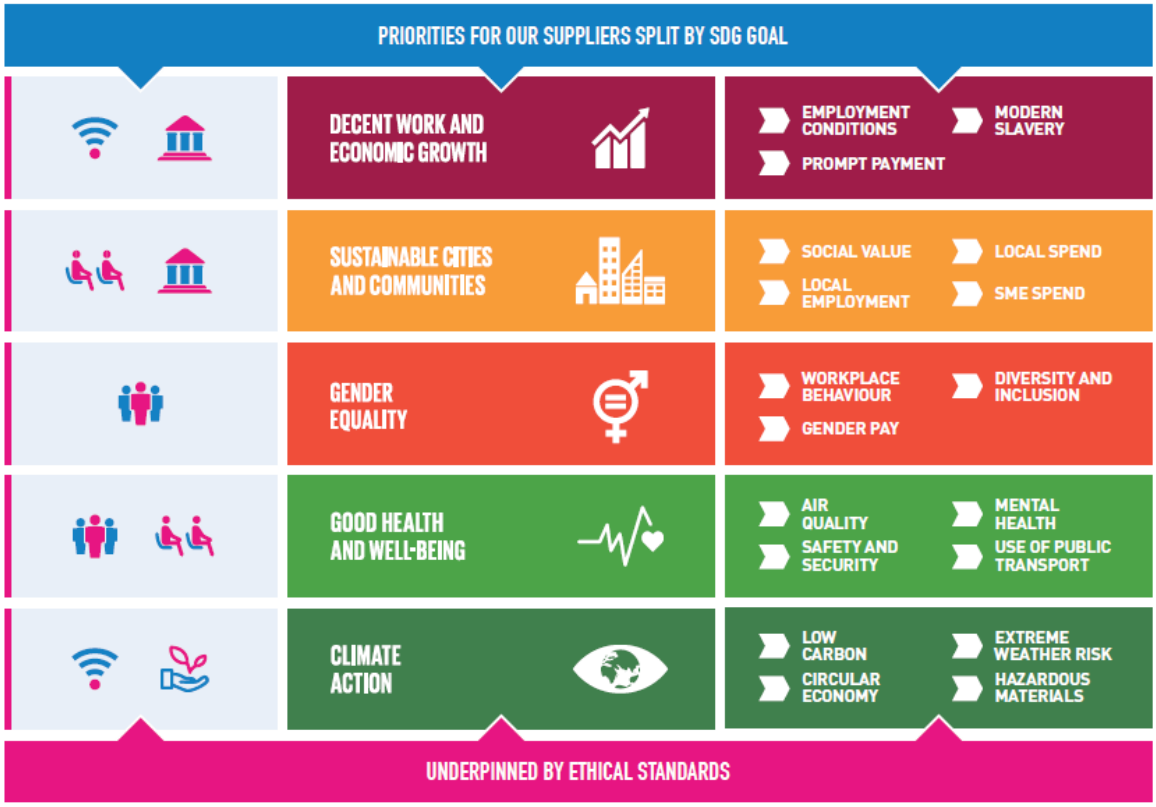


Figure 4.1 - Go Ahead Group Sustainable Supply Chain Charter

The Go-Ahead SPP aims to ensure any procurement through the supply chain ensures that protected characteristics are upheld as well as ensuring local employment within the UK, contribute to low carbon economy promoting inclusivity and diversity and reducing the gender pay gap.

Summary of the Go South Coast/Go Ahead Group ZEBRA Procurement Strategy is set out in Appendix 4.3.

4.3.3 Asset Ownership

[redacted]

The vehicles are specific to the UniLink fleet and at the end of the contract ([redacted]) they would be transferred to the new operator, or would be absorbed into the wider GSC Southampton fleet. This would ensure that the zero emission benefits are retained in Southampton.

4.3.4 Flow of Payments

Southampton City Council (SCC) is the administrator of the grant funding from DfT and SCC's own match funding, this will be via a Local Grant Agreement. SCC will administer the funding to GSC. The University's contribution is via their capital programme and this will be via the existing contractual arrangements for the UniLink service. This will be subject to the University's own financial approvals and procedures.

SCC will seek to administer the grant on a staged release basis on a quarterly basis, which will be in line with the procurement process of the operator and its supplier contracts. This will be at key milestones, including

- When order is placed,
- When first vehicle is delivered, and
- When final vehicle is delivered.

Each grant payment will require detailed evidence relating to the payment made by the operator to the appropriate supplier, together with contractual details including timescales and specifications to ensure compliance with the agreed ZEBRA funding process.

Funding for the project will come from the DfT's ZEBRA fund, and contributions from GSC as local bus operators, SCC Capital Programme, and the University of Southampton's Capital Programmes – all for 2022/23. The division of funding is shown in Table 4.1.

Funding Source	Amount (£m)	Percentage
ZEBRA Grant	£9,805,000	[redacted]
GSC	[redacted]	[redacted]
Southampton City Council	[redacted]	[redacted]
University of Southampton	[redacted]	[redacted]
Total	£22,588,000	

Table 4.1 Funding Source and Proportion

The University of Southampton are contributing to the project as the services are wholly owned by the University and it supports their Corporate intention to be carbon neutral. Southampton City Council are contributing to the project as this supports the Council's air quality and transport objectives, supports development of zero emission buses in Southampton and the evidence base for future zero emission vehicles.

If GSC were to lose the UniLink contract in 2027 the buses, chargers and depot would either be transferred to the new operator, or through agreement with SCC and the University would be transferred to other GSC operations (e.g. Bluestar) in Southampton.

4.4 Procurement strategy

Within this section more detail is set out for the proposed methods and timescales for procuring each element of the ZEBRA scheme, including the buses, charging equipment and the energy infrastructure. This will follow the project plan in Section 6.5.

4.4.1 Procurement Routes

For each element of this plan it is assumed that a decision on the Standard ZEBRA process will be made in March 2022, and that the DfT requirement is that all buses need to be in operation within 2 years of funding award – March 2024.

The following sections set out the plans for the procurement of each element of the ZEBRA scheme.

The objective of the procurement exercise is to find partners to deliver works so as to reduce impact on the operations of the depot and maximise value for money aligning with the budget / cost plan. Where required, market research will be conducted which will identify a potential pool of contractors in addition to those engaged, that have either undertaken similar works previously for GSC and / or are suitable qualified and available to tender.

This is not suitable for bringing in house due to the technical nature of the project (with design, electrification and construction elements).

The overall Capital Spend for the Southampton scheme is being included in the SCC 2022/23 Capital Programme & Budget for agreement at Full Council in February 2022. These plans are well developed and signed off by Section 151 Officer in consultation with the Cabinet Member for Finance & Capital Assets. If not agreed there will be a review of the programme between all parties.

The overall capital spend for GSC has been identified with the Go-Ahead Group Corporate Plan for 2022/2023.

There will be three separate tender projects for the depot to meet the ZEBRA requirements. These are:

- Procurement of New Electric Buses (EBs) – all double deck double door buses;
- Procurement of Electrical Charging Equipment – DC smart chargers to better enable fast electric charge;
- Procurement of power supplies and associated civils works – through co-development with IDNO provider to minimise DNO risk.

The evaluation criteria are proposed as:

- Price: 60%
- Programme: Pass/ Fail
- Approach to Safety: Pass/ Fail
- Methodology: 30%
- Sustainability: 10%

The evaluation will be a joint evaluation process by relevant stakeholders.

4.4.3 Electric Buses

This element sets out how the 32 zero emission all electric double deck buses will be procured. GSC will be the lead on the procurement of the vehicles. During the development of the bid they have been carrying out market engagement (as described in 4.5). Detailed discussions have been carried out with pricing quotes and technical visits carried out.

[redacted]

[redacted]

The procurement of vehicles will begin following the funding announcement in April 2022 following a specification freeze dependent on the outcome of the funding. The level of development of the project with engagement and vehicle specification agreement carried out by GSC to date means that the project can commence swiftly following award. This has shortened the programme enabling rapid delivery in time for the start of the 2022/23 Academic Year at the university.

The aim is to get the buses in operation from Autumn 2022, this is an ambitious timescale and is driven by the aim to align with the start of the new 2022/23 academic year at the University. This is to maximise the impact of a new intake of students and embed positive travel habits at the start of the year.

4.4.2 Charging Equipment

This element sets out how the 16 in-depot 150Kw rapid chargers for the Eastleigh depot will be procured. GSC will be the lead on the procurement of the chargers. During the development of the bid they have been carrying out market engagement (as described in 4.6) with infrastructure suppliers. Detailed discussions have been carried out with pricing quotes and technical visits carried out.

[redacted]

The procurement of the chargers will begin following the funding announcement in April 2022 following a specification freeze dependent on the outcome of the funding. The level of development of the project with engagement and charger specification agreement carried out

by GSC to date means that the project can commence swiftly following award. This has shortened the programme enabling rapid delivery in time for the start of the 2022/23 Academic Year at the university.

Permission has been sought from the landowner of the Eastleigh Depot.

4.4.3 Electrical Infrastructure and Connections

[redacted]

4.4.4 Procurement Plan

An indicative procurement plan has been developed for the three elements and is shown in Table 4.2. The chargers will be installed at GSC's depot in Eastleigh.

The significant level of development of the project carried out by GSC to date with market engagement and bus & charger specifications agreed means that the project can commence swiftly following award. This has shortened the programme enabling rapid delivery in time for the start of the 2022/23 Academic Year at the university. This is to maximise the impact on a new intake of students and embed sustainable travel habits that will benefit the project as a whole. This enables the programme to be ambitious with realistic timescales.

Task	Start	Finish
Confirmation of ZEBRA Funding	March 22	March 22
Finalisation of Bus Specification	March 22	April 22
Finalisation of Charger Specification	March 22	April 22
Finalisation of National Grid network capacity	March 22	May 22
Finalisation of tender specification and evaluation process	April 22	April 22
Invitation to Tender/Clarify for buses & chargers (running in parallel)	April 22	April 22
Supplier Submission Period	April 22	May 22
Tender Assessment Period	May 22	May 22
Award	May 22	May 22
Build Process for buses (based on Wrightbus programme)	May 22	August 22
Build and Installation Process for chargers	June 22	September 22
Phased Shipment of buses from factory to GSC depot	August 22	October 22
Final completion – livery etc	August 22	October 22
Inspection of vehicles	September 22	October 22
Test of charging process for buses	August 22	October 22

Training of drivers, management & maintenance staff	August 22	August 22
Marketing plan & publicity	August 22	December 22
Registration of any service changes (if required)	August 22	August 22
Launch of vehicles into service	September 22	October 22
Monitoring & Evaluation Reports (6mth intervals)	October 22	March 25

Table 4.2 Indicative Procurement & Delivery Plan

4.4.5 Risk Allocation & Transfer

GSC have agreed to undertake all risk including cost overruns for the procurement of the vehicles and chargers.

A risk based cost has been acquired from the DNO for the electrical connection that is valid until 31 March 2022. This should be covered by any announcement from DfT, expected in March 2022, and remain valid. However, if there is any delay in the announcement from DfT that leads to either local network capacity being taken, or cost increases the bus operator reserves the right not to invest. The bus operator is trying to do everything to ameliorate this.

4.4.6 Output Milestones

There will be contractual milestones within the procurement process for partial release of the ZEBRA grant by the Council.

These are:

- When order is placed,
- When first vehicle is delivered, and
- When final vehicle is delivered.

4.5 Sourcing Options

SCC and GSC have access to several procurement options which are compliant with European legislation and will be utilised to enable delivery of the Southampton ZEBRA scheme.

For the delivery of the vehicles GSC will use their existing New Vehicle Framework Agreements that are agreed annually with all UK bus manufacturer suppliers.

Should it be the case that either SCC or GSC need to procure any element through alternative routes they will carry out procurement exercises that meet with all relevant procurement legislation and own internal process and approvals.

4.6 Market Engagement

This section details the market engagement taken place to date, referring to any existing supplier or partnership arrangements (for buses, infrastructure or related services). Including the level of support from these parties and how expect the specifications to be deliverable.

4.6.1 Market Engagement to Date

To deliver the 32 all-electric zero-emission buses and the 16 in depot chargers Go South Coast, University of Southampton and SCC have carried out market engagement with bus manufacturers, Direct Network Operators (DNOs), infrastructure suppliers and neighbouring Local Authorities (Hampshire County and Eastleigh Borough Councils).

Market engagement for procurement at the local level will be run in conjunction with Go-Ahead Group Procurement and Property teams to ensure all necessary governance and compliance issues are addressed. There is a separate contract being signed with an electric supplier and once this is signed the supplier will confirm compound requirements, and these will be

appropriately developed into a tender pack. The provision for future expansion will also be considered.

Discussions have been taking place through the development of this FBC with suppliers of buses, electric chargers and power to site.

Bus Manufacturers

Go South Coast (GSC) has been undertaking independent assessment of bus running cards and technical data from vehicle manufacturers and smart chargers to ensure that buses can complete the running day through a partnership with Evenergi. This analysis is provided in Appendix 4.4.

Detailed discussions, pricing quotes and technical visits have taken place with a range of suppliers – including some demonstrators from suppliers, running routes from the depot to understand how they would work in a real life setting, gauge customer feedback and for local teams to understand potential vehicle options. We have quotes and programmes for delivery based on funding approval of late March 2022.

These discussions have been taking place with bus manufacturers Switch Mobility, ADL/BYD, Volvo, Wrightbus, and electrical connection and infrastructure suppliers SWARCO, EO energy and others. This would allow for buses to start to enter service from August through to October 2022. In addition to electrical connection and facilitation works, chargers would be installed and operative from September 2022.

Go South Coast has moved towards a procurement strategy for the project and accordingly provide letters of support from the preferred suppliers to this project in addition to the programmes set out highlighting how the parties will work together. These letters of support are included in Appendix 4.5-4.7 for Wrightbus, Swarco and SSE respectively).

Surveys and assessments have been undertaken to ensure the vehicles can complete the working day, that chargers can adequately charge buses overnight through a smart charging mechanism and enabling works can both fit on site and be connected to the electricity network. Below is the plan for Go South Coast Electrical connection and vehicle layout as well as the proposed charging regime for the buses to ensure that adequate charge takes place overnight based on run-in and charging factors.

GSC have been continually liaising with Wrightbus on the perceived performance of the Electroline product. Modelling and assessments have identified that [redacted] is best suited to the requirements of the Southampton operation. The modelling has looked at several of the UniLink routes in both differing weather conditions and passenger loads. This provides the confidence that the capacity of the vehicles can operate the routes without the requirement for opportunity charging. This has led to the higher cost of the vehicle to ensure that the vehicle is able to operate throughout the day on one overnight charge.

A draft of the MoU is in Appendix 4.8 and evidence of discussions with bus manufacturers is included at Appendix 4.9.

In Depot Charger

As part of the project Go South Coast have valid quotes for connection of electricity to the site from the Electricity Network District Operator (NDO) and IDNO (SSE). These plans take into account full on site connection and installation costs from SSE specifically for this project and include costs of:

- SWARCO [redacted];
- Off-site connection;
- On Site Electrical Connection including design of site and infrastructure specifications;
- Construction of appropriate frames/mounting posts and weather shields, install of SWARCO chargers for DC charging;

- Installation of CAT 6 data cabling/communication cabling from each charger to server room and;
- Install and commissioning, concrete bases and GRPs of LV Panels and Transformers, LV supply distribution.

[redacted]

4.6.2 Commitment

A joint letter from the Managing Director of Go South Coast and Go Ahead Group Chief Executive is attached at Appendix 4.10. This letter accepts that Go South Coast will be liable for additional costs for the project only subject to DfT issuing funding approval which allows an order for DNO connection to be made once this is known.

4.6.3 Financial Responsibilities and Ownership

The financial costs for the buses and the infrastructure are shown in Tables 4.3 and 4.4.

Bus Price	No of Buses	Total (inc. 3% risk)
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]

Table 4.3 Financial Breakdown for Vehicles

Infrastructure Price	
In Depot Charges (16 dual chargers)	[redacted]
Off-Site Electric Connection	[redacted]
On-Site Electric Connection	[redacted]
Total	[redacted]
75% of Total	[redacted]
25% of Total	[redacted]

Table 4.4 Financial Breakdown for Infrastructure

The financial breakdown of partners funding is proposed as follows and summarised below.

<u>Go South Coast</u>

- [redacted] Capital cost of all 32 Electric buses [redacted]

[redacted]

- Revenue Cost:
  - Back Office & Smart Charging System;
  - Maintenance;
  - Battery Replacement (Year 7); and
  - Electric supply costs.

The bus depot at Eastleigh is leased and appropriate permissions will be sought within the project timescale.

Southampton City Council

- 54% contribution to the 25% of Vehicle uplift costs at £[redacted], and
- 23% contribution to the 25% of the total infrastructure costs at £[redacted].

University of Southampton

- 24% contribution to the 25% of Vehicle uplift costs at £[redacted], and
- 16% contribution to the 25% of the total infrastructure costs at £[redacted].

Department for Transport

- 75% of the vehicle uplift costs (difference between all-electric and diesel) at £6,588,696, and
- 75% of the infrastructure costs at £3,217,024.

Funding Source	Vehicles	Infrastructure	Total
Southampton City Council	[redacted]	[redacted]	[redacted]
University of Southampton	[redacted]	[redacted]	[redacted]
Go South Coast	[redacted]	[redacted]	[redacted]
ZEBRA	£6,588,696	£3,217,024	£9,805,720
Total	£18,299,078	£4,289,365	£22,588,443

Table 4.5 Financial Breakdown

Buses, Electrical Charging and Power connection will be contracted by and owned by Go South Coast. Funds from the LTA will flow to bus operators via a Local Grant Agreement. All buses and chargers will be procured and owned outright by the bus operator and not leased. The assets owned by Go South Coast will be subject to an agreement drawn up to between bus operators and the LTA to guarantee the buses operate in Southampton for a minimum of seven years. If GSC were to lose the UniLink contact the buses, chargers and infrastructure will either be transferred to the new operator, or in agreement with the Council and University be transferred onto other GSC operated routes in Southampton.

An MoU exists between Go South Coast, Wright Bus and SWARCO to deliver the project as set out in the bid – this has been through using bus costings acquire form a Go Ahead Group procurement exercise. In addition quotes have been gained from other suppliers under the MoU and a formal procurement will take place after funding is secured to confirm prices – other potential suppliers will be invited to bid to undertake the work.

4.7 Output Based Specification

This section sets out the description of the buses and charging infrastructure being purchased for the Southampton ZEBRA project.

4.7.1 Bus Specification

In developing the bid Go South Coast has engaged [redacted]

The project is for 32 double deck double door all electric buses – the entire Unilink fleet – consisting of 14% of the Southampton fleet carrying 20% of the annual patronage. All other existing buses operated by Go South Coast (through Bluestar, QuayConnect & Salisbury Reds) in Southampton is Euro VI.

In total 3 high frequency and 1 low frequency routes will be operated consisting of service:

- U1 National Oceanography Centre (Eastern Docks) – Southampton Central Station – University of Southampton – Wessex Lane – Southampton International Airport & Southampton Airport Parkway Rail – 7/10mins frequency;
- U2 Mayflower Halls-Portswood-University of Southampton - Bassett Green – 10 mins frequency;
- U6 General Hospital - University of Southampton – City Centre - National Oceanography Centre – 20 mins frequency; and
- U9 Townhill Park - University of Southampton - Taunton's College - University Hospital Southampton – 2 journeys per day.

The specification has been agreed based on significant work with bus operators using the service frequencies, route coverage, conditions in Southampton (topography and congestion), operating days, and operator requirements (including need for double doors for quick loading and unloading at bus stops to reduce dwell times). This has driven the requirement for a larger battery capacity based on real world modelling using local parameters and experience from other GSC projects (e.g. Swindon and Salisbury). [redacted] without the need to swap for a diesel vehicle. This retains the air quality and carbon benefits.

The bus specification is as follows and supports enhanced PSVAR standards and considers protected characteristics. The Equality Impact Assessment provides further information on this.

[redacted]

- Dimension of each bus being:
  - [redacted]Overall length[redacted]
  - Overall width: [redacted]
  - Wheelbase: [redacted]
- Transmission consisting of [redacted];
- Unit Cost per Bus of [redacted]
- Buses will be covered by a [redacted];
- Buses will include contactless ticket machine and tap on, tap off (TOTO) to support capped/flat fares in Southampton and City Region over coming years;

- Buses will be equipped to deliver Real Time Information connectivity and will be Traffic Signal Priority (TSP) equipped to deliver TSP though server to server links to RTIG protocols;
- Buses will be equipped with on board CCTV, Next Stop Announcement and Display, Buggy and Disabled area, dementia friendly internal colour schemes and USB chargers at all seats;
- Vehicles will meet the requirements of enhanced accessibility standards and be compliant with the Public Service Vehicles Accessibility Regulations 2000 (PSVAR) – (https://www.legislation.gov.uk/uksi/2000/1970/contents/made) and incorporate equipment to identify the route, each upcoming stop, and the beginning and end of diversions as well as visibly, using at least one screen on any deck, with the lower deck screen visible from all priority seats. Information will also be made audibly, with announcements audible on any deck, including in the priority seats and wheelchair space. Buses will also include induction loops, in priority seats and the wheelchair space and provide an induction loop to aid direct communication between drivers and passengers who use a hearing aid.
- Buses will provide an additional flexible space in addition to the mandatory wheelchair space, suitable for a second wheelchair user and/or at least two unfolded pushchairs or prams.
- Additional on bus features will also include:
    - Camera Monitoring System,
    - Branch deflectors,
    - Fire suppression system,
    - Livery as specified as set out in Marketing (section 4.9),
    - Luggage racks,
    - Staircase Glazing, and
    - Ticket bin.

As set out in Section 2.9.2 these vehicles were chosen as they provided the best range performance, battery longevity (particularly after 5+ years) and support.

GSC [redacted]

GSC have taken the opportunity to model several of the routes in both differing weather conditions and passenger loads to give us confidence the capacity of the vehicle can operate the routes without the requirement of opportunity charging.

To that end GSC have sought a capacity guarantee from the manufacturer that if operated in line with their model and route rotation so that the batteries will have the same capacity at the end of year 7 as they do at year 1. The manufacturer are willing to warrant the batteries for an 8-year period and this is reflected in the quote shown at Appendix 4.12 with the vehicle delivery schedule shown in Appendix 4.13.

In terms of range, [redacted].

GSC [redacted] will have committed to weekly meetings throughout the initial bedding in process to review fleet availability and reliability for the previous week, including action plans for improvement.

GSC [redacted] will schedule regular Quarterly Meeting throughout the warranty period. These are to be a senior level review of both vehicle and aftersales performance. Availability and the corresponding reason for the fault shall be discussed, as well as ongoing campaigns

and parts supply. GSC will record the availability performance of the fleet and share this with [redacted].

[redacted]

4.7 Bus Charging Schedule

Independent assessment has been undertaken on the bus charging schedule by Evenergi. This shows buses charging, laying over, in depot and on route and is shown in Figure 4.2 and also in Appendix 4.4.

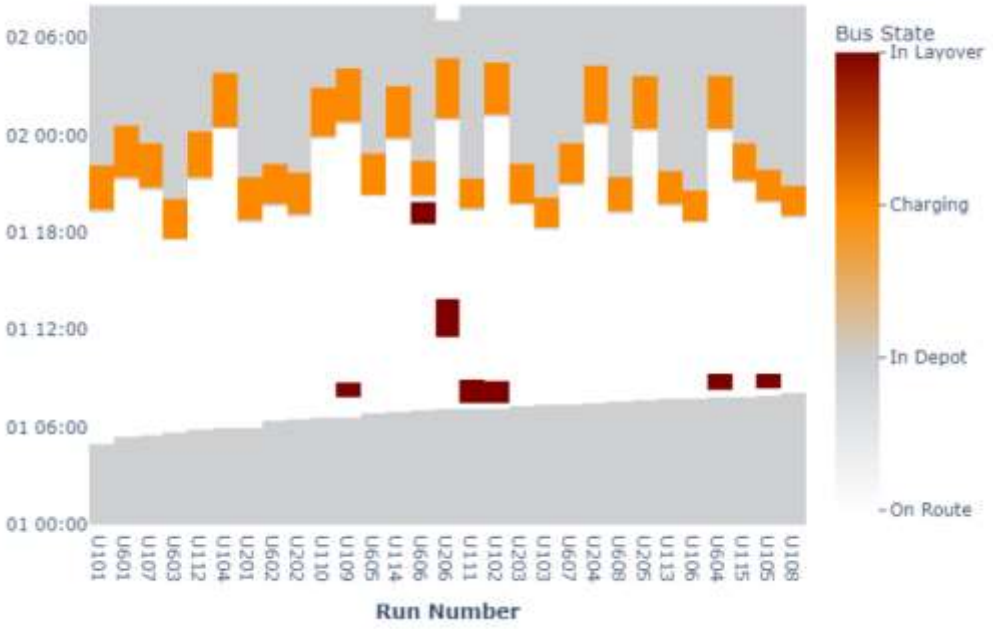


Figure 4.2 Bus Charging Schedule

4.7.3 Chargers and Electrical Connections

This element will include the [redacted] in-depot chargers and the DNO electrical connections.

Dual outlet chargers have been chosen as this provides a space efficient operation within the depot and allows two buses to be charged at the same time.

- [redacted] smart chargers consisting of:
  [redacted]
  - [redacted] cables;
  - Chosen as the two separate hardware components, the charger lends itself to bus depot installations where the parking of buses in close proximity leaves minimal room for a charger;
  - The expected product lifespan is a minimum of ten years and while all EV charging equipment supplied and installed by SWARCO is fully tested for reliability and safety, a service contract will be entered into to help ensure that equipment is maintained in full working order;
  - Charge time of [redacted];
- The service plan that will be procured as part of the project includes:
  - Service visit every six months;
  - Priority response time targeted at less than 24 working hours;

- 24-hour charge point monitoring available (with the eConnect back office management system) Annual preventative maintenance visit including mechanical and electrical safety checks;

SWARCO have substantial UK stock holding across their warehousing sites. Go South Coast is working with the supplier so that on order receipt stock will be assigned to enable delivery of the programme as set out in this document.

Figure 4.3 - [redacted]

SWARCO electrical chargers cost [redacted]. The quotation for this is provided in Appendix 4.11.

Go South Coast has been engaged with SSE as IDNO in developing the electrical specification and on site connection. The project will deliver Electrical Connection on site consisting of:

- Off site connection;
- On Site Electrical Connection including design of site and infrastructure specifications;
- Construction of appropriate frames/mounting posts and weather shields, install of SWARCO chargers for DC charging;
- Installation of CAT 6 data cabling/communication cabling from each charger to server room and;
- Install and commissioning, concrete bases and GRPs of LV Panels and Transformers, LV supply distribution.

On site civils and electrical connections will cost £[redacted].

DNO connections costs and off site works are estimated to be in the region of £[redacted]. The Eastleigh depot connection request is subject to an application to National Grid, due to existing constraints which cannot be quantified unless the connection application is made which has been submitted by Go South Coast. Currently desk top best estimates have had to be used due to National Grid statutory timescales.

Please note that Go South Coast reserves not to invest subject to the outcome of the DNO MOD application. The SSE quote is shown at Appendix 4.6

A Memorandum of Understanding has been developed between GSC, [redacted] is shown at Appendix 4.7.

4.8 Risk Management Strategy

This section details out the management of risk and uncertainty in the Southampton ZEBRA project.

The management of risk and uncertainty will be key to the successful delivery of the project. It will identify threats to project delivery and enable effective risk management actions to be assigned.

4.8.1 Risk Management Approach

The project has risk spread between three parties – the City Council, the University and the bus operator. The management of the overall programme and co-ordination of the grant programme will be undertaken by Southampton City Council as the local devolved grant administrator. Delivery of the programme will be by the bus operator who will be putting in a considerable number of their own finances into the project so need to have robust risk management practices.

This means risk needs to be managed in a coordinated way across the programme so that overall delivery can proceed. With a significant amount of work carried out already on

vehicle, charger and electrical connection specifications this has helped to de-risk early elements of the project – particularly for delivery and cost robustness.

A robust and systematic risk management process has been taken to identify, analyse, plan, and manage risk which will be applied through the life of the ZEBRA programme.

The risk management process is being managed to demonstrate that:

- There is a continuous approach to the management of risk across all parties;
- Risks have been identified and thoroughly assessed;
- Risks are being actively managed and mitigated;
- Effective communication of risks throughout the project teams, and where necessary escalation to the Steering Board level to ensure that issues can be managed; and
- The project can be delivered on time, quality and budget.

The risk register, in Appendix 4.14 summarises the type of risk, who has responsibility for the risk, planned steps to mitigate and monitor those risks and assigns a risk rating. The TCF ZEBRA Project Board has responsibility for the ZEBRA risk management strategy and register. Risk Management will be a standing agenda item for the Project Board meetings, the high priority risks are reviewed, and any issues would be escalated to the Board, so that senior managers are sighted on any issues at an early stage. Those attracting a risk rating of 4.0 (out of a total of 5) are most likely to be escalated.

4.8.2 Risk Identification

A risk register has been developed with a list of 22 programme risks which remain open. This has been developed jointly in a workshop between the City Council, University, bus operator and the DNO.

Once risks were identified, they were ranked by the hierarchy of risk category (High, Medium or Low).

The risk register provides a snapshot of the risks at the current stage of development and will be kept under continuous review by the Project Manager throughout the ZEBRA programme development and delivery.

The top 10 unmitigated risks that have been identified and set out in Table 4.6 include:

	Main Risks	Risk Description	Risk Score – Impact	Risk Score – Likelihood	Rating
1	Failure in delivery of power	Competing demands at Eastleigh depot, local grid network capacity, uncertainty regarding outcome of application to National Grid	5	3	High
2	Delay announcement and place of order	A delay from Government in announcing the award beyond March 2022, delays in ordering vehicles from manufacturer and loss of quote for electrical connection	5	2	High
3	Change in political support	Competing demands for funding from SCC, stakeholder concerns, election cycle, significant increases in costs	4	4	High

4	Insufficient resources to delivery bid (all partners)	Changes in Government funding, changes in personnel at SCC, University or operators meaning loss of continuity	4	3	High
5	Inability of all or any party to contribute to programme	Economic uncertainty as bus industry and academic sector recovers from Covid pandemic, SCC funding is withdrawn	4	3	High
6	Lease issues at Barton Park (Eastleigh depot)	Lease currently being renegotiated which could lead to issues in terms of permissions, cost and ability to facilitate power connection	4	3	High
7	Battery Life and Battery Replacement cost	Need to procure from alternative supplier owing to supply shortage / delivery dates / superior performance / change in group specification	4	3	High
8	Significant increase in costs - infrastructure	Cost estimates for chargers and/or electrical connection are low	4	3	High
9	Significant increase in costs - vehicles	Cost estimates for vehicles are low	4	3	High
10	Delay to delivery of new vehicles	Scale and timing of ZEBRA programme in England could have impact on bus manufacturers to deliver	4	2	Medium

Table 4.6 – Top 10 Risks Identified

The 21 programme level risks in the Risk Register were given an initial risk rating based on their likelihood of happening and the severity of that impact. The total number of risks per rating category are summarised in Table 4.7.

Impact on Business Objectives	Severity of Impact			
Significant (4)		7	6	1
Moderate (3)	2	2	0	
Minor (2)	2		0	0

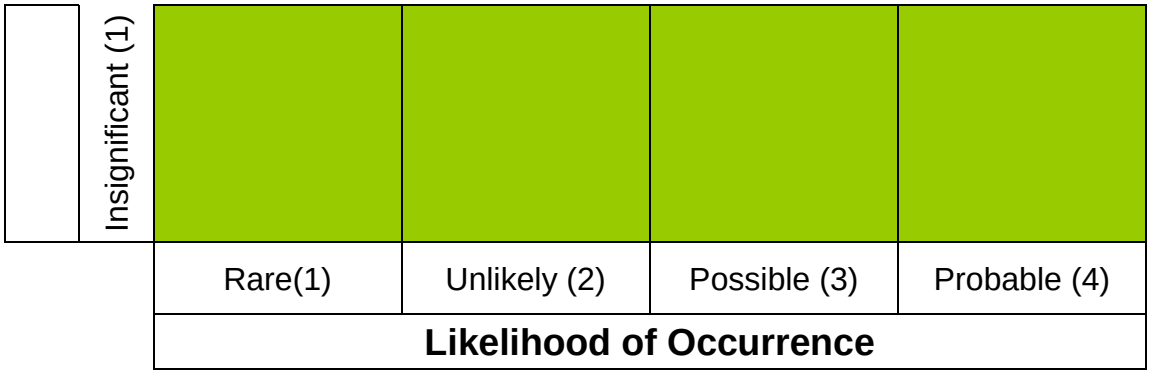


Table 4.7 – Initial Risk Assessment Unmitigated

4.8.3 Risk Mitigation

Following a risk mitigation process the impact of the risks were revised, the top 10 mitigated risk are shown in Table 4.8.

	Main Risks	Risk Mitigation	Adjusted Score Impact	Adjusted Score Likelihood	Rating
1	Significant increases in costs – infrastructure	Market engagement has been carried out with the chargers and further work with SSE have identified a more confident price. However, further application is required with National Grid to finalise costs which will be post bid submission. The MOD application is being progressed at the same time as the business case is being considered. The cost from SSE is a risk based cost based on knowns at the moment.	4	2	Medium
2	Requirement of opportunity charging (if required) not met	Battery warranty of 8yrs has been provided and a larger capacity battery pack being specified means opportunity charging is not required.	4	1	Low
3	Failure in delivery of power	SSE carried out further investigation of the electrical connection and cost is now a firmer quote - deadline of 31st March	3	3	Medium
4	Insufficient resources to deliver successful bid	Additional support has been brought into SCC and GSC to prepare bid and ensure delivery	2	2	Low
5	Battery life and Battery Replacement Costs	Independent modelling has identified that larger battery capacity is required (454kwh v 383) to cover day - but has increased cost	2	1	Low
6	Significant increase in costs – vehicles	Market engagement has been carried out with bus manufacturers with vehicle specification agreed. Delivery schedule agreed with Wrightbus	2	1	Low

7	Power outage/ brownout impacting on service delivery	Early engagement with DNO and supplier	2	1	Low
8	Power cost rise due to power being taken before project is funded	The has been early engagement with SSE who have provided a quote valid until end March 2022 – DfT state funding is to be announced by end of March 2022.	2	1	Low
9	Bus patronage not recovering to pre-Covid levels	Bus patronage at end of 2022 was ~80% of pre-Covid - before 'Plan B' was introduced. AM peak travel has not yet returned significantly	1	2	Low
10	Fluctuations in labour supply (delivery)	Covid Omicron variant has caused driver shortages in first weeks of Jan 22. Expected to be resolved with additional driver requirement during Q4 21/22	1	2	Low

Table 4.8 – Key Risks Once Mitigated

The risks were given an adjusted post mitigation risk rating based on their likelihood of occurring and the severity of that impact, summarised in Table 4.9.

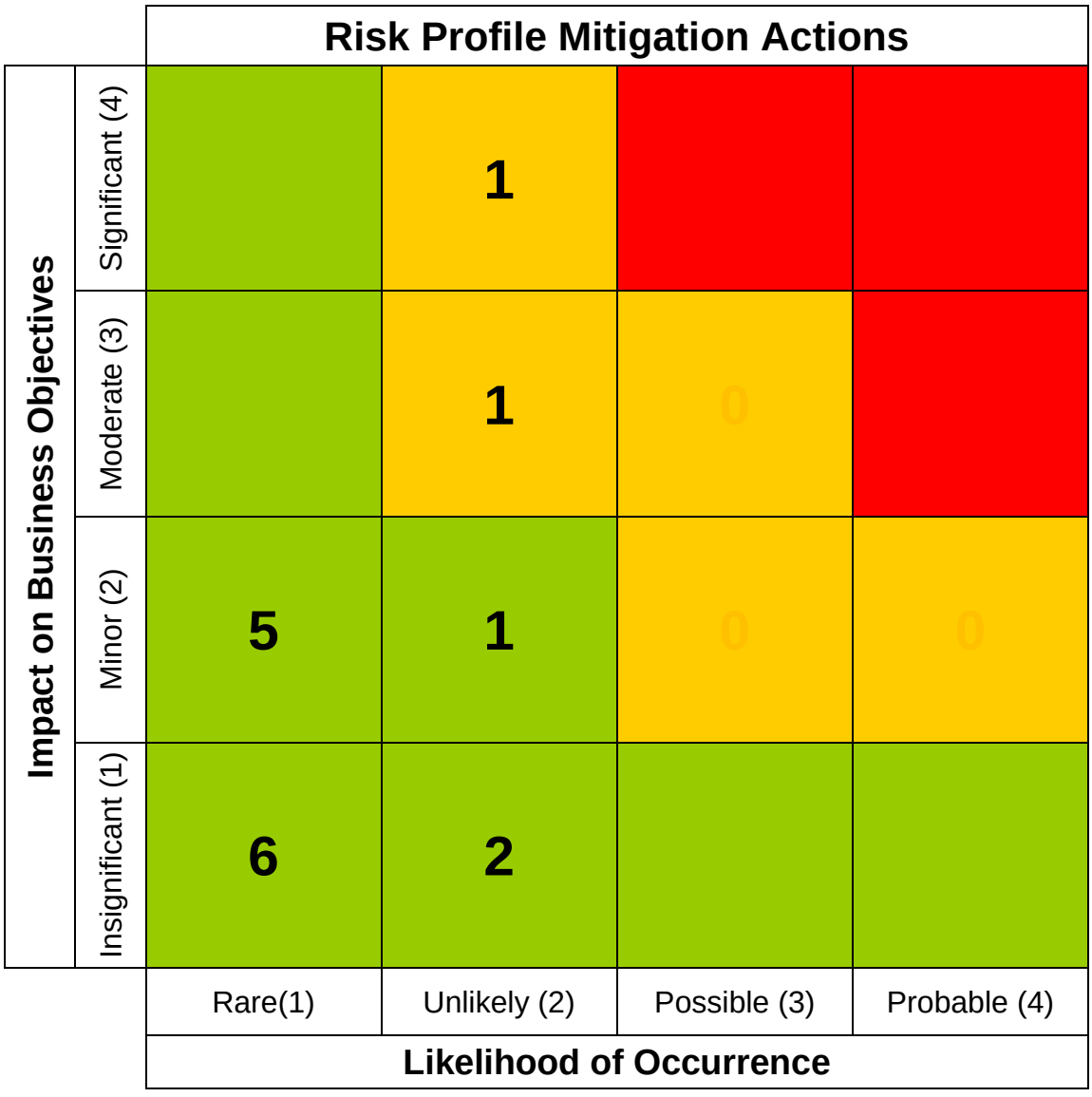


Table 4.9 Post Mitigation Risk Assessment

4.9 Marketing Strategy

[redacted]

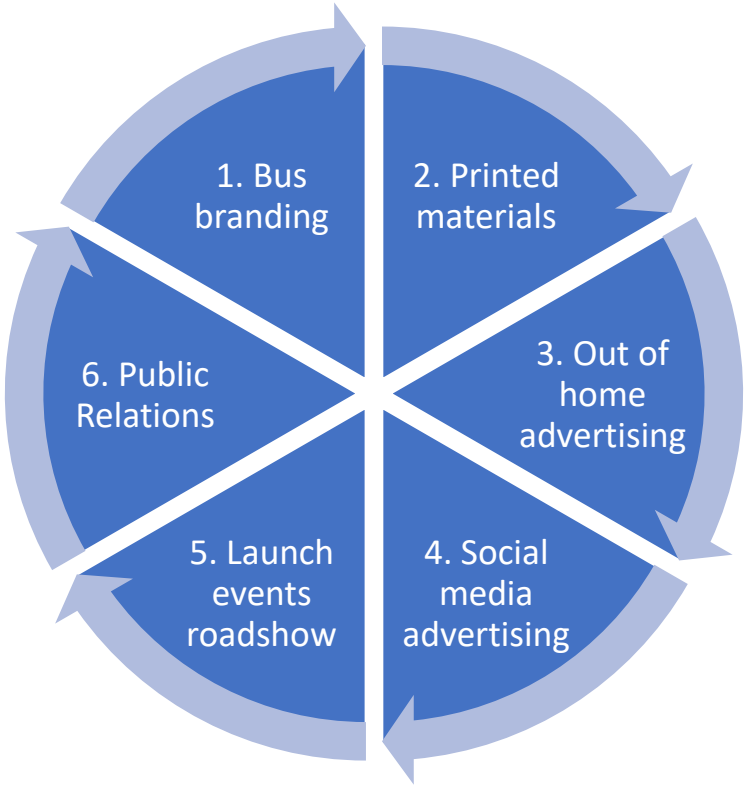


Figure 4.4 Marketing Materials Mix

4.9.1 Key Messages

The marketing messages will consist of the following elements:

Buses, Chargers and Depot branding

[redacted]

Figure 4.5 - Draft UniLink Electrics Branding

Point of sale printed materials to encourage existing bus users to switch to electric:

- Printed timetables will include promotion of the new buses on electrified routes and their benefits;
- Roadside posters at bus stops will include promotion of electrified routes;

Out of home advertising to encourage use of bus travel with the added benefit of green commuting:

- Advertisements will appear in The Southern Daily Echo (local newspaper),
- Leaflet door drops along the routes effecting promoting the electrified routes with discounted vouchers,
- Local Radio advertising on Wave 105 or Capital FM (local radio stations) to capture younger audience,
- Sponsorship of Prime Time Radio Shows on Wave 105 or Capital FM,
- On board advertising digital or static – Next stop digital displays,
- Real time information messaging 'why not try our new electric buses and commute green'.

Social media advertising for a wider reach

Boost engagement with out of home media with a on social media presence so the message is duplicated offline and online as well as links to video and bespoke advertising focussing in particularly on Facebook, Instagram and Twitter. These will be on various social pages, including UniLink, University of Southampton, SCC, My Journey, Bluestar, Go South Coast and Go-Ahead Group.

Events roadshow at key locations to engage with the target audience on the benefits of 'Commute Green'

Launch Events will take place in Central Southampton and the University's Campus sites along the routes subject to electrification in a compressed manner to create a snowball effect of promotional activity based on the new buses.

4.9.3 Communicating Key Messages

Key messages will be communicated to the target marketing in the following ways:

Print

- Printed Timetables will include promotion of the new buses on electrified routes;
- Roadside posters at bus stops will include promotion of electrified routes;
- Advertisements will appear in the Southern Echo;
- Leaflet door drops along the routes effecting promoting the electrified routes;
- Trade Press Articles on the roll out and development of the programme.

Digital & Radio

[redacted]

Social Media

[redacted]

[redacted]

Public Relations

[redacted]

4.10 Procurement, subsidy control and TCA compliance

4.10.1 Grant Management

To ensure that there is best value there will be a Local Grant Agreement requiring the bus operator to carry out all procurements based on a genuinely fair, open and transparent competition in which all eligible suppliers can participate. This will also act as a mitigation measure to ensure that bus operators are not passing on a subsidy to their chosen bus manufacturers and infrastructure suppliers. Section 4.4 shows what has been done to date.

To ensure that these procedures also meet DfT and SCC's objectives of the ZEBRA funding, it is proposed that a further 'proportionate business case' process is undertaken prior to any order being taken.

It should be noted that the operator is proposing to put in over 50% of the cost of the buses and that this provides an incentive to ensure that their own procurement procedures provide best value and meet their own in house company objectives.

Staged release of the grant on a quarterly bases will be in line with the procurement process of the operator and its supplier contracts. This has not yet been fully determined. Each grant payment will require detailed evidence relating to the payment made by the operator to the appropriate supplier, together with contractual details including timescales and specifications to ensure compliance with the agreed ZEBRA funding process.

4.10.2 Subsidy Control

The partners have secured Counsel legal advice regarding Subsidy Control/EU State Aid rules.

Any funding awarded must be spent in accordance with Subsidy Control / State Aid rules.

Subsidy Control / State Aid arises where:

I. funding is provided from state resources (including grants from central of local government etc or subsidised services), AND

II. the funding / measures favour certain undertakings or operators etc, AND

III. the measure / funding has the potential to distort competition, AND

IV. the measure / funding could affect trade between member States.

All four elements must be in place for unlawful financial Aid to be present. To mitigate against Aid arising there are a number of measures that can be relied upon, including use of competition to award funding and use of De Minimus provisions where appropriate.

To remove the subsidy control risks, the introduction of an element of competition with the bidding process for funds is required, in a way that ensures all undertakings have equal access to funding (regardless of whether they are local, national, or international

undertakings or part of the initial bidding consortium). This will remove II) and III) above. Competition and bidding arrangements must be fair, transparent, and genuine.

The EU State aid rules now only apply in limited circumstances, which do not include this project. The new rules are contained in the UK-EU Trade and Cooperation Agreement (**TCA**), which require public authorities to consider on a case-by-case basis whether financial support could fall within the definition of "*subsidy*" and if so whether it would comply with six key principles. Support may be considered lawful if it satisfies the principles and does not fall within a prohibited category, for example, unlimited guarantees. Unlawful subsidy can be challenged in the courts by way of judicial review, and for this reason the decision-making process around granting subsidy is particularly important.

Subject to the detail in the rest of our advice, Counsel consider that:

- The Council will not itself receive unlawful subsidy as it will pass the ZEBRA Grant in full to GSC and as a result the subsidy control rules will not be engaged;
- The ZEBRA Grant will fall within the definition of "*subsidy*" when paid by the Council to GSC, which means the Council must as the next step satisfy itself that the ZEBRA Grant is consistent with the six key TCA principles. We have set out in this note why we consider it would be reasonable for the Council to conclude that this would be the case, and recommend that it populates the government's suggested checklist (available here) with its own analysis and conclusions. We would be happy to provide further support if that would be helpful;
- The Council also wishes to provide the Additional Council Grant (defined in paragraph **Error! Reference source not found.**), and so will need to include this in its a ssessment against with the six TCA principles. Of particular importance will be the principles concerning proportionality, necessity and the positive benefits outweighing the negative effects on trade and investment. This is because although there is no legal limit around the intensity / proportion of costs which can be funded under the subsidy rules, one was commonly used under the State aid rules. This included previous government schemes, for example, the Ultra-low Emissions Bus scheme. In addition, exceeding the (75%) limit on support in the government's ZEBRA scheme would remove any protection the Council may have (which is unclear) from making a grant in accordance with a scheme;
- There are good grounds for concluding that there will be no indirect subsidy resulting from the Grants (defined as the ZEBRA and Additional Council Grants) being used to pay more than a market rate for the buses and infrastructure as long as GSC tenders the contracts, using a transparent competitive procedure equivalent to one under the Public Contracts Regulations 2015. From what we have read, this appears to be the case.
- Once the Grants have been provided, the Council will need to comply with the TCA transparency obligations by publishing the required information on the government's transparency website within six months. The ten-year limitation period for challenge by the European Commission under the State aid rules does not apply and instead a challenge seeking an order for recovery must be brought within one month (calculated by reference to publishing the required information on the website and any request received for additional information). This means that the Council could take a practical approach to risk if it has any concerns and not allow drawdown until the limitation period has expired.
- The transfer of the Grants to GSC would not trigger the public procurement rules in the sense of requiring the Council to run a tender to select the recipients. It is also unlikely to result in them being obliged to comply with the Public Contracts Regulations 2015, although there is a possibility that any works contracts for the charging infrastructure could be subject to the Regulations if more than 50% is funded by the Council. This will need to be considered in more detail as thinking around the approach to procurement develops. In any event, it may be beneficial for GSC to comply with the

Public Contracts Regulations 2015 to ensure value for money, and so this should not be an obstacle to delivery.

There is the power to provide funding that would otherwise amount to Aid through the De-Minimus process, which can assist in relation to supporting some smaller, locally based undertakings. This applies where an operator has received aid in the current year and previous two financial years that amounts to no more than €200,000 (the limit for transport related undertakings). That must encompass ALL state funding from ANY source over the three year rolling period so any company that receives subsidies or other grant funding from other state sources will need to be carefully audited to ensure they meet De-Minimus levels, and the limits apply to the whole registered company (not just the locally based arm of it). However, given the level of annual BSOG payments, it is unlikely this will apply locally, other than for the very smallest operators.

Any mechanisms for awarding funding to operators will need to be designed and implemented to meet the above restrictions in relation to any funding that is used to enhance third party / private sector commercial or subsidised vehicles in any way.

The full legal counsel advice is provided in Appendix 4.16.

4.11 Summary

The following can be summarised from the Commercial Case:

- Both the City Council, University and bus operator have extensive experience in procurement of projects similar to ZEBRA;
- An outline procurement strategy has been developed for each element of the project with extensive market engagement to date to come to a specification for the buses, chargers and electrical connection. This allows for a quicker implementation of the project following any funding announcement;
- SCC must ensure that allocated grant is passed onto the operator in a way that represents best value for the tax payer, and that can use own evaluation to assess the chosen suppliers consistently;
- Legal advice from Counsel has been obtained; and
- A significant and targeted marketing campaign is being prepared that will ensure that the scale of the change is promoted to all relevant parties and public.

5 Financial Case

5.1 Overview

The Financial Case considers all financial aspects of our proposal and demonstrates the affordability, future proof and long term sustainability of introducing zero-emission buses across the Southampton area.

It will:

- Set out the summary of the project and the costs for the various elements – zero emission buses, warranties, battery replacement, and charging infrastructure (5.2);
- Provide the total costs, ask from the DfT and level of local contributions (5.3);
- The changes from the Expression of Interest (5.4);
- The funding profile and accounting year (5.5);
- Long-term financial viability of the project including battery replacement (5.6); and
- Assessment of the financial risks to the project (5.7).

The total capital cost of the project is £22,588,443 and the total ZEBRA Grant funding requested on this proposal is £9,805,720 with [redacted] allocated to vehicles and [redacted] to infrastructure.

The scheme will be co-funded by the bus operator Go South Coast (£[redacted]), Southampton City Council (£[redacted]), and the University of Southampton (£[redacted]) respectively. Go South Coast is committed to the underwriting of the additional funding required over and above the ZEBRA grant to purchase electric buses for the respective services.

Element	Description	ZEBRA Ask	Bus Operator Funding	Third Party Funding	Total Cost
		£m	£m	£m	£m
Vehicles	32 Wrightbus Streetdeck Electroliner BEV (454kWH) Double Deck Electric Buses	[redacted]	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted] in Depot SWARCO chargers and on & off site electrical connections	[redacted]	[redacted]	[redacted]	[redacted]
Total		**9.805**	**12.784**		**22.588**

Table 5.1 Funding Summary

The funding includes:

- Battery replacement costs of £[redacted] at 7 years funded by GSC; and
- Diesel bus costs (to be used in grant calculations) of £[redacted].

Tables in this section are subject to rounding.

5.2 Project Summary

The Southampton ZEBRA proposal costs total £22,588,000 with £[redacted] for purchase of the 32 all electric double deck buses and £[redacted] for the infrastructure of 16 In-Depot chargers plus on and off site electrical connections, and £[redacted] for ongoing costs.

the total ZEBRA Grant funding requested on this proposal is £9,805,720 with £[redacted] allocated to vehicles and £[redacted] to infrastructure.

Match funding from the bus operators, Southampton City Council and the University of Southampton totals £12.782m.

The funding summary is set out in Table 5.2, and is subject to rounding.

Element	2022 Prices
Zero Emission Buses Total*	[redacted]
ZEBRA Funding (ex battery)	£6,589,000
Bus Operator Funding	[redacted]
Local Contribution (LTA)	[redacted]
Local Contribution (Third Party – UoS)	[redacted]
Infrastructure Total	[redacted]
ZEBRA Funding	£3,217,000
Bus Operator Funding	[redacted]
Local Contribution (LTA)	[redacted]
Local Contribution (Third Party – UoS)	[redacted]
TOTAL FUNDING	**£22,588,000**
Total ZEBRA Funding	£9,805,000
Bus Operator Contribution	[redacted]
Total Local Contributions (LTA)	[redacted]
Local Contribution (Third Party – UoS)	[redacted]

Table 5.2 Funding Summary

(* - this includes 3% risk contingency and battery replacement at year 7 funded by GSC)

Local Contributions and Third Party funding is from Southampton City Council and the University of Southampton.

5.2.1 Zero Emission Buses

The project will deliver 32 all-electric double deck buses to operate on the UniLink network in Southampton.

Extensive market engagement (as set out in 4.4.1) has been carried out by GSC with four UK bus manufacturers. The chosen vehicle will be a [redacted] kwh with Wheelchair access via ramp. Buses have cost of £[redacted]. A total cost for 32 buses of £[redacted], with [redacted]% risk contingency this increases to £[redacted]. There is an £[redacted] for battery replacement in Year [redacted]. An equivalent ICE diesel double decker costs £[redacted]. This provides a gap of £[redacted] between cost of a replacement ICE diesel and the electric bus.

This is excluding battery replacement costs at year 8.

Figure 5.[redacted]

Table 5.3 sets out the cost of the ZEB, equivalent diesel and 75% and 25% of the cost differential. Cost estimates and quotes are discussed in Section 3.2 and are included in Appendix 4.12.

	£
Cost of ZEB **(Wrightbus Streetdeck BEV)**	[redacted]
Cost of Equivalent Diesel	[redacted]
Cost Differential per bus	[redacted]
75% of Cost Differential	[redacted]
25% of Cost Differential per bus	[redacted]

Table 5.3 – Breakdown of Southampton ZEBRA Bus Costs

Table 5.4 sets out the costs of the 32 electric buses, an equivalent cost for 32 diesel buses, and the difference between the prices with a 75% ZEBRA ask and 25% local match.

Bus Price	No of Buses	Total (inc. 3% risk)
[redacted]	32	[redacted]
[redacted]	32	[redacted]
	Difference	[redacted]
	75% of Difference	[redacted]
	25% of Difference	[redacted]

Table 5.4 – Total bus costs for 32 vehicles

The Whole Life of project is 17 years

5.2.2 Warranties

The buses come with a 12 year warranty.

5.2.3 Battery Replacement Costs

A total of £[redacted] at year [redacted]. This will be met by GSC.

5.2.4 Infrastructure

The project will deliver [redacted] chargers at GSC's Eastleigh depot.

GSC have carried out market engagement as set out in 4.4.1 with charging infrastructure suppliers. The chosen supplier is SWARCO and product is [redacted]. Each charger charges two buses and this can take [redacted] hours to get to full charge. These cost £[redacted] inclusive of commissioning, delivery, service plan and 'E-connect Fleet' app. This is a total of in depot charging of £[redacted]

Quotes for the chargers are included in Appendix 4.11.

Figure 5.2 – Charging infrastructure

On and off-site connections have been discussed with the DNO – SSE – and have provided costs for both electrical connections required. The off-site connection is £[redacted] and on-site is £[redacted]. This includes project management costs for SSE, surveys, design of site and infrastructure specifications, construction and installation of the chargers, installation of data comms, and then commissioning of all units and comms.

The total infrastructure cost is [redacted] – inclusive of [redacted]% risk contingency.

Table 5.5 sets out the costs of the charging infrastructure, the on and off-site electrical connections and the ZEBRA grant request at 75%.

Infrastructure	£m	Note
In Depot Chargers (16 double chargers)	[redacted]	Supplier (SWARCO) estimate
Off-site electrical connection	[redacted]	Based on 'All Electric Bus Towns' bid + 25% contingency
On-site electrical connection	[redacted]	SSE estimate based on discussions with National Grid and a risk based quotation that is in advance of an application to get a firmer cost which is being progressed following submission of Business Case.
Total Cost	**4.289**	
ZEBRA Grant Request (75%)	3.217	
Local Match Funding (25%)	1.072	

Table 5.5 Southampton ZEBRA Infrastructure Costs

Cost estimate for the chargers that would be used by the supplier specifically for this project; electrical connection charge assessed through the All Electric Bus Towns Bid' with 25% risk assumption; full on site connection and installation costs from SSE specifically for this project inclusive of costs of Vehicle Chargers, Off site connection, On Site Electrical Connection including design of site and infrastructure specifications, Construction of appropriate frames/mounting posts and weather shields, install of SWARCO chargers for DC charging and installation of CAT6 data cabling/communication cabling from each charger to server room. Also including install and commissioning, concrete bases and GRPs of LV Panels and Transformers, LV supply distribution as well as supply and install of cabling terminations for Transformers, LV Panel and Chargers, Armco barrier supply and install to protect equipment, and set up/on site facilities such as welfare and storage. Further information on the connection costs is in Appendix 4.11.

We have a quote for on-site electrical connection including design of site and infrastructure specifications, cabling and barrier supply under an IDNO agreement in terms of a partnership between Southampton City Council, Go South Coast, SSE, BYD and SWARCO in April/May 2021 within well-developed partnerships which enables early mobilisation to deliver. We do not have an electrical connection as the bid timescale does not allow statutory turnaround for DNO supply. We have based the cost based on connection to another depot within Go South Coast and have applied a 25% risk cost.

5.3 Total Costing & Ask

5.3.1 Total Project Cost

The total costing for the project is £22.588m. This comprises of £[redacted] for the 32 all-electric vehicles, £[redacted]m for battery replacement at year [redacted] and £[redacted] for the charging infrastructure.

The costings are set out in Table 5.6, inclusive of [redacted]% risk contingency.

Element	£m
32 All Electric Buses	[redacted]
Battery Replacement	[redacted]
16 In Depot Chargers	[redacted]
On and Off-Site Electrical Connections	[redacted]
Total Project Cost	**£22.588**

Table 5.6 Total Project Cost

5.3.1 Funding Sources

The ZEBRA fund from the DfT will provide:

- 75% of the uplift cost difference between purchase of a new zero-emission bus and an equivalent EURO VI diesel; and
- 75% of the total cost of the charging infrastructure

The funding for the project will come from a variety of sources – the DfT's ZEBRA fund, bus operator contribution, and third party from local sources. Figure 5.7 shows the breakdown of the total £22.588m and Table 5.7 shows the funding ask from DfT and local match for each element.

- DfT ZEBRA Grant - £9.806m,
- Bus Operators - £[redacted]m,
- Southampton City Council - £[redacted]m, and
- University of Southampton - £[redacted]m.

	£ms				
Element	**Total**	**DfT Ask**	**GSC**	**SCC**	**UoS**
32 All Electric Buses	18.297	6.588	[redacted]	[redacted]	[redacted]
Infrastructure	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Project Cost	**22.588**	**9.806**	**12.784**		

Table 5.7 DfT Ask and Third Party Funding

REDACTED

Figure 5.3 Percentage of Overall Funding Split

5.4 Changes vs EOI

There have been changes between the EOI stage and the preparation of this Business Case. The number of buses and geography remain the same.

Following further market engagement the total value of the bid for vehicles and infrastructure has increased from £[redacted]. This will be an additional £[redacted] of ZEBRA grant ask, and £[redacted] of local match funding from bus operators, the Council and the University.

This is shown in Table 5.8.

	EoI Costs (£ms)				FBC Costs (£ms)			
Element	**Total**	**DfT Ask**	**GSC**	**Third Party**	**Total**	**DfT Ask**	**GSC**	**Third Party**

Buses	14.944	5.208	[redacted]	[redacted]	18.297	6.588	[redacted]	[redacted]
Infrastructure	1.385	1.031		[redacted]	4.291	3.217	[redacted]	[redacted]
Total Project Cost	**16.329**	**6.239**	[redacted]		**22.588**	**9.806**	**12.784**	

Table 5.8 Southampton ZEBRA Changes from EoI

This has resulted from:

- An increase in the cost of the new zero-emission vehicle from £[redacted] estimated in the EoI stage to £[redacted]. The original estimated was based on initial enquiries by GSC based on double deck purchases for GSC's Bluestar operations to wider Go-Ahead Group specifications and prices. The updated increase cost followed formal quotations from the bus manufacturers following a tendering process carried out by GSC. The final higher quality specification from the preferred manufacturer (Wrightbus) has determined an increase in cost. The inclusion of double door buses means that there is additional costs. Wrightbus quote is the best value based on range and ability to undertake the duties required – the prices have increased due to revised manufacturer pricing, the use of group pricing and a requirement for larger battery packs. Outline of the market engagement to date is set out in Section 4.4, and quotations in Appendices 4.9 and 4.19;
  The total cost of the vehicles is £[redacted] compared to £[redacted] at EoI stage;
- Detailed assessment by SSE and the DNO into the off-site electrical connections to GSC's Eastleigh depot identified that further infrastructure work is required, and that there is a local network constraint to supply. This requires additional funding as it will help to increase the local electricity supply and pump prime any further investment in electric buses in GSC's fleet that operate from Eastleigh. The connection request is subject to an application to the National Grid, due to existing constraints which cannot be qualified unless a connection application is made. The total cost of the on-site infrastructure has increased to £[redacted]. This work is required to be done to provide the necessary power supply to the GSC's Eastleigh depot for the 16 chargers. The specification and quotations is set out;
- Modelling has identified that due to the long operating day for some buses (notable those on the U1 service) [redacted], vehicles run a risk of returning to depot with less than [redacted]% battery charge. This has led to a need [redacted];
- [redacted];
- The increase in costs has seen an increase in the third party match contribution from SCC and the University of Southampton to match this. Local match contribution has increased from [redacted].

5.5 Funding profile

The proposed funding profile for the Southampton ZEBRA project is shown in Table 5.8. An extract from the funding model and the associated assumptions are in Appendix 3.1.

5.5.1 Vehicle & Infrastructure Investment

We have developed our proposal for battery electric buses as a 17 year project that considers:

- Purchase 32 new battery electric double deck buses in Year 1 (2022) with ZEBRA, GSC, SCC and UoS funding. The roll out of the buses is being timed with the start of the start of the 2022-23 academic year to ensure maximum exposure and publicity;
- Purchase the dedicated infrastructure of [redacted] chargers at 1 depot location in Eastleigh with the ZEBRA and co-funding from GSC and SCC. The dedicated infrastructure includes:
    - Installation of [redacted], and a charging management back office system; and
    - Energy Infrastructure.
- This deployment plan is selected in order to:
    - Forward the zero emission benefits by introducing early zero emission buses to the fleet;
    - Support the further aspirations of transitioning the wider regional fleets to zero emission buses; and
    - Develop social learning of the zero-emission system to capture the social value across the network.
- Southampton City Council is working closely with the respective bus operators and the University of Southampton to ensure the implementation of the deployment plan that includes:
    - Go South Coast procurement and delivery of 32 x double deck buses;
    - Go South Coast procurement and delivery of [redacted] at 1 depot locations (Equipment and O&M); and
    - All delivery partners are committed to the underwriting of the additional funding required over and above the ZEBRA grant to purchase electric buses for Southampton City Council.
- All delivery partners are committed to fund cost overruns on both the electric bus purchase and the accompanying infrastructure for the ZEBRA project.
- Battery replacement for the electric fleet in year [redacted] (funded separately by the operators). This is for battery warranty purposes but also to optimise the value proposition of the electric bus utilisation and cost profiles. The battery replacements will be fully funded by the bus operators of this scheme.
- Tax and VAT
    - Corporation Tax Super Deduction: The LTA in collaboration with the Bus Operators of this bid have noted the reference to the Corporation Tax Super Deduction. The Operators are currently taking consulting to fully understand the impact of the Super Deduction facility on the ZEBRA project.
    - The advice by the DfT that VAT should not be included on the capital spend for ZEBRA.

5.5.2 ZEBRA Grant Ask

The total capital cost of the project is £22,588,443 and the total ZEBRA Grant funding requested on this proposal is £9,805,720 with [redacted] allocated to vehicles and [redacted] to infrastructure.

Table 5.8 and 5.9 below provide a full breakdown of the cost for both vehicles and required infrastructure. The cost numbers include a [redacted]% risk contingency.

	ZEBRA PROPOSAL		TOTAL
	2022	2023	

New electric buses	Number	Single	0	0	0
	Number	Double	32	0	32
	Bus Cost (£m)		[redacted]	[redacted]	[redacted]
	ZEBRA Ask (£m)		6.589	0	6.589
Infrastructure	Infrastructure Cost (£m)		[redacted]	[redacted]	[redacted]
	ZEBRA Ask (£m)		3.217	0	3.217
Total Project Cost (£m)					22.588
Total ZEBRA Ask (£m)					**9.805**

Table 5.8 Funding Profile

Type of Bus	Cost Per Bus	Number of Buses	Total Cost of Buses
Electric Buses			
Single Deck	0	0	0
Double Deck	[redacted]	32	[redacted]
Total Electric Bus			[redacted]
New ICE Bus			
Single Deck	0	0	0
Double Deck	[redacted]	32	[redacted]
Difference between ICE and Electric fleet			[redacted]
ZEBRA Grant Request for 75% of difference			**£6,588,696**
Battery Replacement Cost at Year 8			[redacted]
Infrastructure			
In Depot Chargers			[redacted]
Off-Site Electrical Connection			[redacted]
On-Site Electrical			[redacted]
Infrastructure Total			[redacted]
ZEBRA Grant Request for Infrastructure			**£3,217,024**
Total ZEBRA Grant Ask			**£9,805,720**

Table 5.10 Breakdown of ZEBRA Grant Ask – Totals include [redacted]% risk contingency

Notes on the funding profile:

- We are in ongoing discussions with the relevant supplier parties for the scheme and will continue to refine the cost assumptions for the total cost of the scheme as well as the ZEBRA grant ask. In particular around infrastructure costs.
- We are including separately the current letters from suppliers, particularly on quotes from bus suppliers.
- The risk contingency of [redacted]% is included to account for changes in cost of materials, infrastructure across the scheme.
- This includes the costs of Figure 5.10.

If the bid is successful, Southampton will be able to capitalise DfT grant funding.

5.5.3 Third Party Funding

Third party funding for our proposal has come from partner organisations in the bid – Southampton City Council, University of Southampton and Go South Coast. The breakdown of the third party funding is shown in Table 5.11. Written statements of support from the relevant budget holders at each organisation is included in Appendix 5.1 (SCC S151 Letter) and letters of support from the University and GSC in Appendix 6.2. This confirms the source of the funding and that it is within each organisation's budgets.

Funding Source	Vehicles		Infrastructure		Total	
Southampton City Council	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
University of Southampton	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Go South Coast	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
ZEBRA	£6,588,696	[redacted]	£3,217,024	[redacted]	£9,805,720	[redacted]
Total	£18,297,078		£4,289,365		£22,588,443	

Table 5.11 – Third Party Contributions

5.5.4 Accounting Implications

Southampton City Council will be the financially accountable body for the Southampton ZEBRA project. With the Executive Director of Finance and Commercialisation, John Harrison, as the Section 151 Officer.

The project will be accounted for by SCC in line with the CIPFA Code of Practice for Local Authority Accounting.

SCC will act as the distributor of funding based on the funding profile developed in the ZEBRA programme as set out in Appendix 6.1 to Go South Coast. Where any funding is being passed to third parties a Service Level Agreement will be entered into that sets out the roles and responsibilities of each party, the funding, delivery programme with milestones, and the project evaluation process. This will be done in one payment in line with the expected payments from the Department.

The standard financial procedure rules for approving the receipt of grant funding and incurring the associated expenditure will be followed by SCC.

Spend will be monitored monthly and reported to the ZEBRA Project Board monthly. Annual spend will be reported to Full Council and relevant Cabinet Member(s) in SCC.

The University would utilise its existing commercial and contractual links with Go South Coast when transferring contributions associated with the bid.

5.4 Long term financial viability

We have developed the Southampton ZEBRA project as a 17-year long term view of the total cost of ownership of the bus fleet as part of this financial model.

The financial profile considers:

- The emulation and optimisation of the entire bus fleet both as ICE and battery electric buses to determine the performance and energy requirements of the fleet and its

associated costs. While considering each of the routes schedules, and route characteristics (topography and climatic conditions)

- Technology development and cost curves including battery, infrastructure and vehicle development, and battery replacement costs, capital vehicle costs (i.e. 2023), as well as fuel and electricity costs
- Detailed cost assumptions from supplier quotes for vehicles, infrastructure, upgrades and usage costings for the current fleet
- Electrical power will be supplied from the National Grid but will be sourced through 100% renewable providers. This is reflected in our commercial case

The table below shows the costs and well to wheel emissions profile for the bus fleet comparing the Business as Usual scenario (i.e. the fleet remains as ICE buses) against a fully electric scenario.

- The main cost driver is currently the fuel cost, as this net of the BSOG award.

	Scenario	15-yr NPV (2022-2036)*	15yr CO^2 tonnes	TCO per km (p/km)
1	Diesel	[redacted]	21,553	0.64
2	Electric Bus + plug-in	[redacted]	107	1.12

Table 5.12 15-year Total Cost of Ownership and Emissions profile

*Totals without risk contingency (3%)

Figure 5.5 below shows the excess cost for the Battery Electric Bus (BEB) scenario over the Diesel Business as Usual (BaU). One can see that the BEB requires investments in the first two years and in 2030 and 2031. These years correspond to when buses and batteries are bought. Over the other years, there are operational savings due to the lower fuel and maintenance costs of BEBs. This highlights the importance of this ZEBRA grant to support the initial capital cost difference in 2022 and 2023 between ICE and the electric fleet.

The benefits are clear from an emissions standpoint, but also from a total cost of ownership perspective.

Figure 5.5 - 17-year Total Cost of Ownership profile ICE vs BEB fleet

Table 5.13 shows the funding profile template of this project noting the sources of funding.

Cost Items	Total
Number of Buses	

Number of Single Deck buses delivered	0
Number of Double Deck buses delivered	32
Cost of vehicles	
Total Cost of Vehicles (with risk contingency 3%)*	[redacted]
Proposed sources of funding	
ZEBRA Grant	£6,588,696
Funding from Local Government (SCC)	[redacted]
Funding from operators	[redacted]
Other HMG Funding	£0
Funding from other third party (UoS)	[redacted]
Infrastructure	
Total cost of infrastructure (with risk contingency 3%)	[redacted]
ZEBRA Grant	£3,217,024
Funding from Local Government (SCC)	[redacted]
Funding from other third party (UoS)	[redacted]
Funding from operators	[redacted]
Other HMG Funding	£0
* Includes battery replacement costs ** Does not include battery replacement costs	

Table 5.13 ZEBRA Funding Profile Template

Operating Expenses of the Proposed Southampton Scheme	
Cost incurred by LTA (with risk contingency of 10%)	[redacted]
Cost incurred by Operator (with risk contingency 3%)	[redacted]
Cost incurred by other public sector entity (with risk contingency 3%)	[redacted]
Cost incurred by other private sector entity (with risk contingency 3%)	[redacted]
Total operating expenses (with risk contingency 3%)	[redacted]

Table 5.14 Operating Expenses

5.5 Assessment of financial risk / Risk management strategy

The financial risks that have been considered in the development of our financial model are:

- Patronage
  - Increase in passenger numbers don't materialise post Covid or with reduced numbers at the University leading to the Authority's and Operators financial difficulty;
  - Potential introduction of fiscal measures aimed at increasing patronage in the UK and creating an additional funding source for sustainable travel, i.e. active travel. Time and scale yet to be determined; and
  - In particular the continuation and dynamics of the BSOG and the potential impact on the fuel/energy costs associated with running bus services.

- Utilisation. Where the fleet does not achieve the expected mileage, can affect the utilisation profiles and in turn the cost breakdowns on charging equipment, batteries and vehicles.
- Governance/administration. Member/Senior officer approval for potential scale of Equity Investment with the Authorities are the electric buses over the life of the project.
- Energy Costs. Changes to cost assumptions such as the cost of electricity. This is market dependent
- Energy supply. Issues with the energy supply to power the electric buses, dependent on energy utilities and grid companies.
- Cost escalations. Increase in cost of electric buses due to increased supply/demand affecting viability of the business model. This is market dependent.
- Market supply. Unable to meet project/DfT timetable due to delays in procurement/delivery of Electric Buses. This is market dependent.
- Delay of start. Where the project start is delayed affecting the cost and financial assumptions, as well as the recovering of the expenditures.
- Approvals. Delays on approvals or works such as depot or grid upgrades
- Internal support. Loss of political/senior management support during the period of the investment/operation.
- Reputation. Impact on the Authority's reputation for future grant funding
- Contract structure. Ownership model for the Electric Buses and its market suitability

The table below also shows a breakdown of the risk allocation between Southampton City Council, the University of Southampton and the local operators included on this bid. This risk profile will continue to be refined.

Risk Type	LTA	Operator
Public perception	Full Risk	Minor Risk
Patronage risk	Shared risk	Shared risk
Bus maintenance	No risk	Full Risk
Bus fuel volume risk	No risk	Full risk
Bus fuel index risk	Full risk	No risk
Bus fuel availability risk	Full risk	No risk
Bus asset residual value	Shared Risk (dependent on service)	Shared Risk (dependent on service)
Human resource cost risk	No risk	Full risk
Delivery KPIs	No risk	Upside/Downside Risk
Mileage risk	No risk	Full risk
Off-site depot upgrades	Shared risk	Shared risk
On-site depot upgrades	Shared risk	Shared risk

Table 5.14 Risk allocation in a contract structure

A risk register has been developed and is included in Appendix 4.14.

5.6 Summary

The following can be summarised from the Financial Case:

- The Southampton ZEBRA project to delivery 32 double deck double door zero emission buses and associated charging infrastructure and electrical connection has been through a thorough development process;
- The overall programme value is £22.588m with £9.806m to come from the ZEBRA grant, £10m investment from the bus operator, and £2.28m coming from local sources – SCC and University of Southampton;
- There has been an increase in cost of £6.259m, with ZEBRA grant ask increase of £3.567m and local match from bus operators and third parties of £2.7m;
- This increase is due to
    - Increase in vehicle costs from original estimates due to high battery capacity requirements following in depth modelling and higher vehicle specification – double doors, USB, next stop announcements and TOTO, and
    - An increase in a risk based cost for the electrical connection to the Eastleigh Depot following more in depth analysis by SSE.
- This increase will provide additional benefits for bus operating range and a high quality high specification product for passengers
- That the warranty, battery replacement and whole life costs of the project have been considered and there is long term viability across the investment;
- Risk has been assessed and proportionately applied across the project areas; and
- That the Section 151 officer for Southampton City Council has signed the project off

6 Management Case

6.1 Overview

The management case explains the robust arrangements that are in place for the delivery, risk management, monitoring and evaluation of the Southampton ZEBRA proposal.

It will:

- Provide an overview of the governance arrangements between the partners – Southampton City Council as the lead, the University of Southampton as the contractor of the UniLink bus services, Go South Coast as the operator of the UniLink bus services, and the delivery partners for the buses, charging infrastructure and promotion (6.2);
- How the project will be delivered, with assurance and approvals (6.3);
- The level of support from stakeholders and partners (6.4);
- How the contract arrangement will be developed and procured (6.5);
- A project plan for delivery of the 32 all-electric buses and the charging infrastructure with the key milestones identified so that delivery of project can be completed by 2023 (6.6);
- A strategy for communications and promotion of the new buses (6.7);
- What the key risks and uncertainties for the project are, how they were identified, managed and mitigated (6.8); and
- How the project will be monitored and evaluated both locally and with the DfT (6.9).

6.2 Governance Arrangements

The section explains the key project team for the Southampton ZEBRA project, governance structure and key roles and responsibilities.

6.2.1 Governance Structure

The governance, decision making and approvals process for the delivery of the 32 all-electric buses on the UniLink network in Southampton will follow the internal process of Southampton City Council, Go South Coast and the University of Southampton.

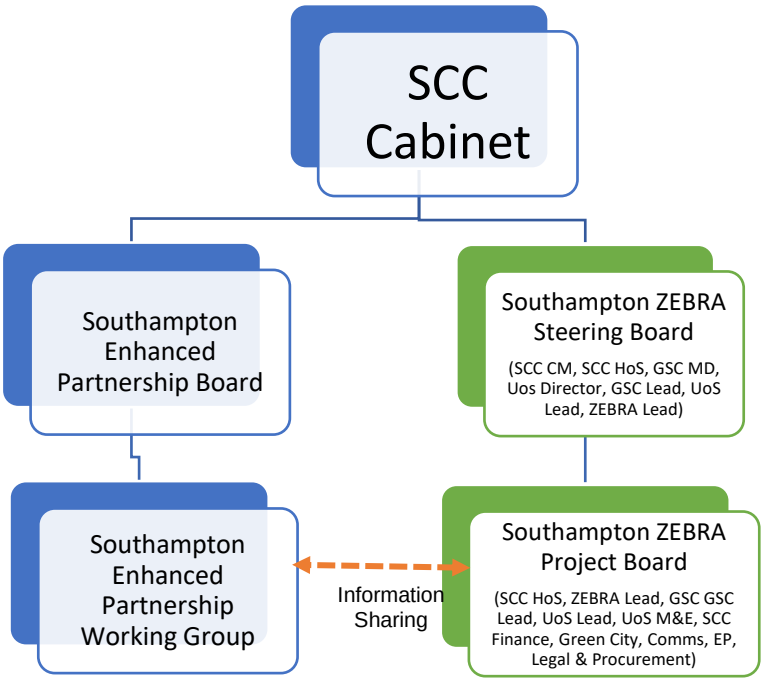


Figure 6.1 Southampton ZEBRA Governance Structure

Figure 6.1 shows the governance structure for the Southampton ZEBRA project, with the relationship shown to the Enhanced Partnership governance. This is to enable lessons learnt to be shared and that one of the outcomes of the BSIP is to have a fully zero emission bus fleet in Southampton by 2030.

6.2.2 Key Roles

Southampton City Council's Cabinet is a fully elected committee chaired by the Leader of the Council Cllr Dan Fitzhenry. Cabinet reviews all strategic projects and funding and provides the ability to determine key policies and strategies for the Council. Therefore, Cabinet will provide corporate and strategic direction to the project. The role of Cabinet in the delivery of this project will include:

- Approval for the appointment of suppliers, acceptance of grant funding and/or spending over £1,000,000;
- Provide strategic direction, when required, to the Southampton ZEBRA Steering Board;
- Reviewing and challenging the delivery of the scheme in relation to time, cost, and quality requirements.

Where approval to accept funding and associated spend is over £2,000,000 this requires approval at Full Council.

The Cabinet Member for Growth (and Deputy Leader) Cllr Jeremy Moulton sits on Cabinet. The Southampton ZEBRA scheme will be within the oversight of Cllr Moulton. Approval will be sought from Cabinet and Full Council to accept the funding with authority to spend at meetings in July 2022. This will follow an expected decision in March 2022 from DfT and local elections in May 2022. Due to the expected value this requires approval at Full Council and July is the first meeting following the elections. Delegated authority to the Steering Board to make decisions throughout the lifespan of the ZEBRA project to point when buses are in service to senior officers in consultation with Cllr Moulton will be sought. This ensures that at the start of the implementation of the ZEBRA programme in Summer 2022 all necessary approvals are in place.

Go South Coast's Board consists of four directors who look after respective areas of the business as well as wider senior management team who support the day-to-day and strategic running of the business. The Managing Director for GSC, Andrew Wickham, heads the Board.

6.2.3 Project Management

Figure 6.1 has set out the governance structure in an organogram, this section provides explanation of each element of the hierarchy.

To ensure that the Southampton ZEBRA proposal is delivered to budget it will report to the **Southampton ZEBRA Steering Board**, chaired by SCC Executive Director for Place. The membership is as follows:

- SCC Executive Director Place – TBC,
- SCC Executive Director Finance & Commercialisation (S151 Officer) – John Harrison,
- GSC Managing Director, Andrew Wickham,
- University of Southampton Director ……..,
- SCC Head of Green City & Infrastructure (SRO) – Pete Boustred,
- GSC Head of Partnerships & Strategy – Paul Walker,
- University of Southampton, Associate Director, Environment & Sustainability – Adam Tewkesbury, and
- SCC ZEBRA Project Lead.

This Steering Board will meet on a bi-monthly basis as a minimum and will be responsible for providing direction to the ZEBRA scheme, making key decisions and appointment of suppliers throughout the life of the scheme. This will be through delegated authority to senior officers on this board in consultation with Cllr Moulton, as Cabinet Member for Growth.

The delivery management at a day-to-day level will be the responsibility of the **Southampton ZEBRA Project Board**. It will meet as a minimum monthly and its membership is as follows:

- SCC Head of Green City & Infrastructure (SRO) – Pete Boustred,
- SCC ZEBRA Project Lead,
- GSC Head of Partnerships & Strategy – Paul Walker,
- University of Southampton, Associate Director, Environment & Sustainability – Adam Tewkesbury,
- SCC Finance Business Partner – Vicki Remsbury,
- SCC Legal – Sarita Riley,
- SCC Procurement – Jane Hapgood,
- SCC Green City Lead – Steve Guppy,
- SCC Communications Manager – Zoe Bearne,
- GSC Head of Marketing & Communications – Nikki Horner,
- GSC General Manager for Bluestar & UniLink – Richard Tyldsley,
- SCC Enhanced Partnership Lead.

The project will be managed by Southampton City Council through the Green City & Infrastructure service area. Within this service area the delivery will be led by ZEBRA Project Lead (1xFTE) who will have the responsibility for the day to day running of the ZEBRA Programme. They will have responsibility for delivery of the Programme to budget, time and quality as set out by the Business Case. They will be responsible for preparing reports and briefings to inform the approval process and submitted for consideration at the ZEBRA Steering Board. They will also be the primary point of contact for the DfT and liaise with the DfT's chosen consultants to develop a robust Monitoring & Evaluation Strategy (see 6.9).

Delivery of the project at GSC will be led by Head of Partnerships & Strategy Paul Walker.

The Senior Responsible Officer (SRO) is Pete Boustred Head of Green City & Infrastructure. Pete is a key leadership figure within SCC and part of the Place Leadership Team under Executive Director Place. As SRO he will have overall accountability to for ensuring that the project meets its objectives and delivers the projected outputs and outcomes. SRO has the necessary authority to make day-to-day decisions, seek decisions from Steering Board as required and to drive the project forward through to completion.

6.2.4 Level of Support

SCC is working closely with Go South Coast and the University of Southampton to develop this project. The commitment from both parties to the project and the operation of the zero emission buses on UniLink in Southampton for at least the 17 years of the project is demonstrated in support letter in Appendix 6.2.

Go South Coast (GSC), part of the Go-Ahead Group, are the local bus operator (Bluestar & UniLink) and are partners in the bid as the current operators of the UniLink services. GSC have developed the finances for the bid and will operate the buses once delivered. A letter of support co-signed by the local Managing Director, Andrew Wickham, and the Group Chief Executive, David Brown, is attached. This sets out GSCs support for the bid and the level of investment that they are putting into the proposal. GSC are also committing to operate the buses on the UniLink services/in Southampton for minimum of 5 years.

University of Southampton – as the owner of the UniLink brand and tenderer of the services. The University is one of the leading research institutions in the country and is putting forward an ambitious plan to reduce carbon emissions from operations. The University has already started to decarbonise its own fleet with a fleet of vans operated by the Estates Department. A letter of support is included from the University stating their support and the level of match funding from them.

We are also working closely with SSE to develop this project and their full support to the project and commitment to deliver the necessary electric connections is shown in their letter of support in Appendix 4.7.

6.2.5 Previous Experience

Over the past 9 years there has been a significant amount of partnership working between the bus operators, SCC and the University on projects which have been delivered to time and to budget. through projects such as Better Bus Fund, Local Sustainable Transport Fund (LSTF), Access Fund, Clean Bus Technology Fund, and the current TCF and FTZ programmes.

- Better Bus Fund and LSTF – delivered WiFi, next bus stop announcements, USB charging, and the Solent Go multi operator smartcard from 2012;
- LSTF & Access Fund – University has acted as monitoring & evaluation agency through the Centre for Sustainable Travel Choice, and are active participants in the Southampton Workplace Travel Fund;
- Clean Bus Technology Fund (CBTF) – delivered Euro VI compliant buses for all operators in 2019; and
- TCF - £57m joint programme between Southampton and Hampshire on four corridors between City Centre and Hampshire. Includes Portswood-Eastleigh corridor that includes the University's main Highfield campus due to be delivered by 2023 and competition of tap on tap off ticketing; and
- Solent FTZ - £28m joint programme led by Solent Transport (partnership of Hampshire, Isle of Wight, Portsmouth & Southampton) on innovative transport activities being implemented to 2024. This includes launch of a first Mobility as a Service (MaaS) platform outside of a major ITA that will include all buses operating in Southampton.

In each of these examples good governance arrangements have been put in place with robust project management principles applied.

GSC have also been involved in projects outside of Southampton that have been innovative including a previous implementation of all-electric buses in Salisbury (see box).

In late 2021, the wider Go Ahead Group undertook a study which pulled together the impact of electric projects already rolled out – it highlighted the challenges encountered by Go Ahead Operating Companies, who have already completed the transition to operating Fleets of Electric Buses. The report intends to provide advice to those Operating Companies who have not yet made this change and provide a concept of joint learning and shared best practice. Alongside the bus operator team involved in this bi already have learnings from the Salisbury 3 electric bus project in 2019/2020 which is included in the report it shows that the team can rely upon existing experience of both implementation and operation to enable effective mobilisation rather than just being paper based experience. This has also led to the desire to third party assess manufactures claimed which has been done as part of this bid.

The study of implementation which is attached at Appendix 4.1 shows that each site experienced its own unique problems during installation and setting up of the charging infrastructure. Detailed site case studies are described throughout this document, providing explanations of how these problems were solved. Being a new technology, a greater degree of product familiarisation was required for Engineers and Drivers. Several makes of vehicle are currently in operation and have been under trial, which provide some comparisons.

Salisbury Reds Case Study

Salisbury Reds, part of Go South Coast family of operators, operate 3 ADL E200 BYD Electric buses as part of their fleet, operating Park and Ride services. The duty cycle of these vehicles, which is a short distance park and ride service, is such that they return to the depot with a remaining battery charge of approximately 60%. It takes approximately 4 hours for a full re-charge. The charging system currently has a capacity for up to 4 vehicles, with charging facilities installed for 3 vehicles. A Charge Management System (CMS) is not installed with this system. If CMS was incorporated into the charging system, coupled with the current duty cycle, the existing supply could be able to charge up to 10 vehicles. Any additional vehicle charging above this, would require an upgrade of the electrical supply, at extra cost, assuming the electricity substation has sufficient capacity.

The electricity provider for Salisbury is Scottish and Southern Electricity (SSE). During the initial site visit, SSE did not give a full and detailed explanation of the process and the specific tasks that GSC were expected to organise. This became apparent as time progressed. Electricity providers normally deal with house building and other similar development companies, who are familiar with the processes involved and assume the customer has a similar technical knowledge. The requirement for GSC to arrange the installation of an electricity meter was not mentioned until the final stages of the project, just prior to the launch date. This necessitated strong negotiation by GSC to ensure the meter installed in time. GSC logically assumed that the quote given for the full completion of the project would have including meter installation. For the Southampton bid we have taken a different approach, embedding SSE within the project team taking an IDNO approach to roll out and partnership rather than contractual relationships.

Lessons Learned

1. Obtaining the vehicles and chargers from BYD was the easiest part of the project, as the costs and delivery dates were relatively fixed.
2. Project Management from SSE failed to provide the expected level of service, communication, and attention to detail.
3. It was evident that there was a lack of effective communication between UK Power Networks (UKPN) and the internal departments with SSE.
4. Time delays will be incurred when agreements are required for power supplies need to be routed over independently owned land.
5. A generous amount of time should be allowed for the project. It is better to complete a project early, rather than running past a deadline to safeguard company reputation.

6.3 Assurance & Approvals

6.3.1 Financial Approvals

Southampton City Council will be the Accountable Body for the Southampton ZEBRA Programme. Following any formal offer of funding there will be a need to add the funding to SCC's Cpaital Programme. As the value of this project exceeds £2m, the Financial Regulations at SCC require it to be presented at Full Council with authority to spend. After a

call-in period for scrutiny of 5 working days the project will be formally added to the Capital Programme. The process is shown in Figure 6.2.

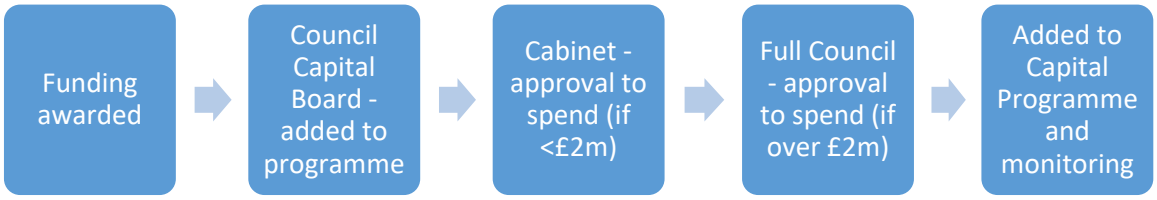


Figure 6.2 – Overview of SCC's Approvals Process

After being added to the Capital Programme the project will be managed via the Council's existing internal gateway process for managing scheme delivery.

Through the previous projects that SCC has delivered, the authority has learnt that they are best delivered through a partnership based approach, with multi-agency project teams co-ordinating at a regular level, and where possible in shared offices to deal with issues quickly and meet the critical success criteria. Establishing project boards is essential for the effective management of the projects which involve key stakeholders. Key aspects such as Early Contractor/Partner Involvement, a clear governance framework and appropriate placement of project risk are vital to ensure a successful project is delivery. Each project has benefited from a clear communication strategy and close liaison with network management to ensure major works can be coordinated effectively across the City. SCC has a defined project management system that follow the principles of good project management as set out by the Association of Project Management (APM) and uses a staged gateway system.

6.3.2 Assurance Process

The transfer of funds from SCC to the bus operator partner will be via quarterly payments, following receipt of funding from DfT using a Local Grant Agreement. The bus operator will need to follow its own internal financial governance arrangements, given that GSC will be providing over 50% of the total capital cost of the buses they have significant incentive to ensure that their procurement and financial management processes are adhered to.

As the Accountable Body SCC will need to be satisfied that the funds being passed are spent in the correct and transparent way. Given the value of the funding evidence in terms of a proportionate local business case will need to be produced. This is ensure good governance and oversight of the projects. This will be independently assessed for due diligence at SCC to ensure that the objectives of ZEBRA are met and that it represents good value for money, as well as meeting DfT requirements. SCC already has a funding arrangement in place for CBTF, this would be replicated for the ZEBRA proposal. This would include an assurance process to ensure that funds are spent in a correct, transparent and effective way.

The assurance process will require funding claims by the operator including quotes for works, claims for new vehicles, invoices, demonstration that buses will continue to operate in Southampton for at least 5 years – including redistributed Euro VI buses.

As the Accountable Body for financial decision making and monitoring, with the SCC Executive Director for Finance & Commercialisation performing the role of Section 151 officer. The Accountable Body will involve providing formal statements, auditing and accounting for legal requirements and official records. SCC will also need to satisfy its own legal, financial and official recording procedures.

Democratic accountability is through the SCC Cabinet attended by the Cabinet Member for Growth.

6.4 Contract Management

The University of Southampton have provided Uni-link bus services since 2001 and Go South Coast have been contracted to operate the network since 2008, with the current contract running until 2028. Whilst Uni-link was initially provided to connect University residential and academic campuses in Southampton, all routes are operated commercially and are open to public passengers with regular links to stations, the city centre and hospitals in the city. The contract focuses on providing a high quality service, and includes a commitment by both the University and Go South Coast to prioritise carbon reduction and technology innovation when developing services. It includes a 5 year fleet refresh cycle to ensure we operate modern, efficient, low emission vehicles. It is a strategic aim for the University and the contract to operate a zero emission fleet as soon as practicable, and we hope that this application provides an opportunity to do so sooner than previously expected.

6.5 Project plan

The project plan for the delivery of the Southampton ZEBRA project - a zero emission fleet for the UniLink services and supporting infrastructure is shown in Table 6.1. The plan shows the delivery timescales for the charging infrastructure and new energy infrastructure. There are clear interdependencies between each of these which are brought out in this section.

This section should be read in conjunction with Section 4.3 of the Commercial Case which outlines the procurement strategy.

6.5.1 Key Dates

Based on March funding approval, SCC, Go South Coast, Wright Bus, SSE & SWARCO have developed an ambitious, yet practical and achievable programme and is included within the MoU.

The proposal would be implemented during 2022/23 financial year and would be aligned with the start of the 2022/23 academic year for the University. This is to ensure maximum exposure of the new vehicles to a new intake of students at the University. It would help to bed in sustainable travel activities at a key transition point.

For each element of the project plan it has been assumed that a Council Cabinet decision will be made in April 2022 and Full Council approval in July 2022, following a decision on ZEBRA funding by the Department of Transport in March 2022. This is due to the local elections in May 2022 and the timetable for Full Council meetings in Southampton. Details are provided in Section 6.3.

A requirement of the DfT funding is that all buses are to be in operation within 2 years of any announcement (i.e. by March 2024).

An outline delivery programme is set out in Table 6.1 with a detailed programme in Appendix 6.1.

The key dates are:

- Award of funding March 2022;
- Procurement and finalisation of specifications for buses and chargers, including outcome of MOD application to National Grid May 2022;
- Manufacturing of buses June-August 2022;
- Delivery of the chargers and electrical connection Summer 2022; and
- Phased delivery of buses August-October 2022.

This plan is ambitious and has been designed to coincide with the start of the 2022/23 Academic Year at the University to maximise the impact of the new vehicles at a crucial point in people's lives embedding sustainable travel habits.

	2022												2023								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Item																					
Approvals																					
Bid Submitted																					
DfT ZEBRA Fund Award																					
SCC Approvals Process																					
Mini Competition & Business Case																					
Electric Buses																					
Commercial Agreement (MoU)																					
Bus Purchase Order																					
Bus Specification Freeze																					
Vehicles Delivery Schedule																					
Vehicles 1 & 2 Delivery																					
Product Training																					
Driver Familiarisation																					
Charger Integration, Route Tests & Optimisation																					
Vehicles 3-4																					
Vehicles 5-8																					
Vehicles 9-12																					
Vehicles 13-16																					
Vehicles 17-20																					
Vehicles 21-24																					
Vehicles 25-28																					
Vehicles 29-32																					
Infrastructure																					
Commercial Agreement (MoU)																					
Charger Purchase Order																					
Charger Delivery																					
Charger Testing & Commissioning																					

Electrical Connection Upgrade																					
Monitoring & Evaluation																					
Pre-Scheme Survey																					
Project Monitoring																					
Initial Survey																					
6 Month Survey																					
12 Month Survey																					

Table 6.1 Southampton ZEBRA Project Summary Plan

6.5.2 Electric Buses

As part of the Market Engagement carried out by GSC as part of the preparation of the bid the specification of the new electric buses has been defined in advance of award – see Appendix 4.12. This means the project has past key milestone and that the identified bus manufacturer is able to mobile for fabrication rapidly.

The buses have been specified to meet the minimum:

- Double doors to aid easy and efficient loading and unloading of passengers to reduce bus stop dwell time;
- USB chargers and WiFi enabled;
- Next stop audio and visible announcements;
- Wheelchair space and ramp for access/egress;
- Dementia friendly interiors; and
- Induction loops.

As the buses will support students, staff and visitors to the University of Southampton, as well as residents, the implementation timeframe is driven by the academic year. With orders placed in April 2022 with the preferred bus manufacturer, GSC are programming that the buses will be delivered in late Summer 2022. This will enable the buses to start entering service for the start of the 2022/23 academic year in September 2022. This is an ambitious programme and the early work has enabled the bus operator to be best placed to start quickly.

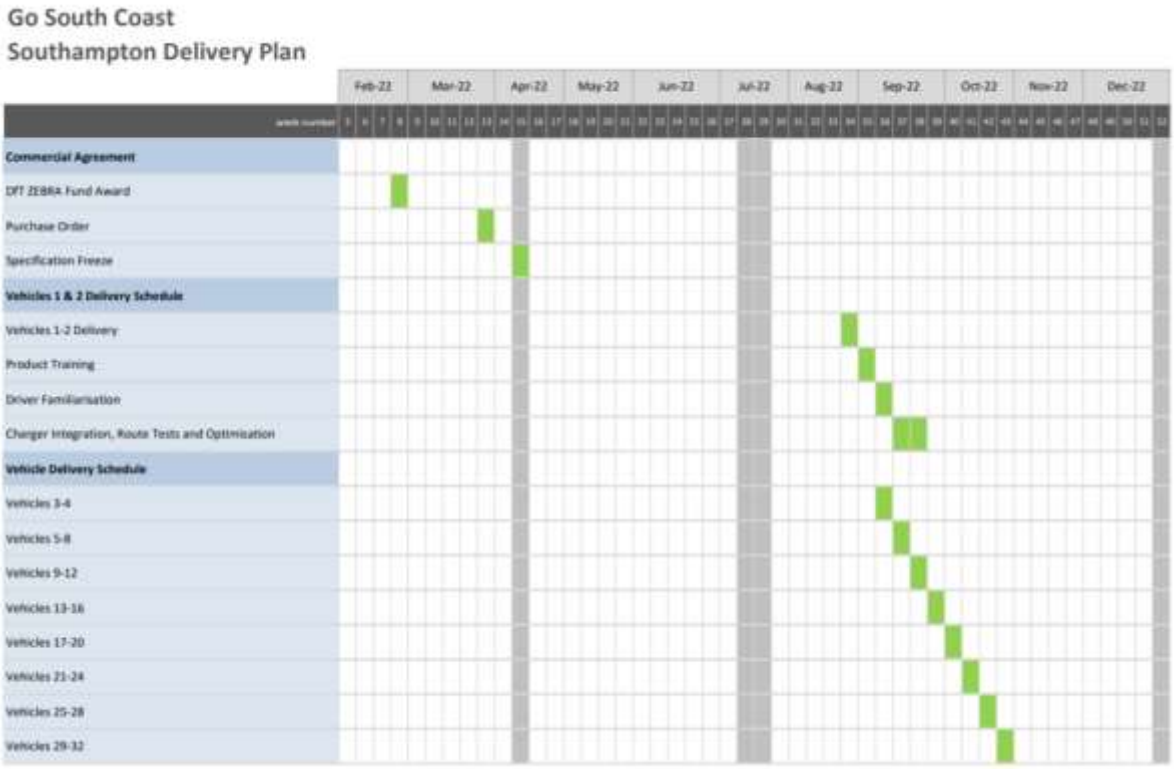


Figure 6.2 [redacted] Indicative Delivery Plan

The proposal is a phased approach with vehicles delivered from [redacted] in small batches (2-4 vehicles) to allow for testing, storage and optimisation before entering service. The first 2 vehicles will be delivered in advance in August 2022 to allow for product training with engineering staff and driver familiarisation at GSC. These vehicles will then be tested for chargers, routes and optimised. This will enable the remaining 30 buses to be efficiently and effectively introduced.

Those remaining 30 buses will be delivered on a weekly basis starting in mid-September 2022 for seven weeks. As each bus arrives it will be subject to training, testing, integration and optimisation. By November 2022 all 32 buses will be in operation.

This timetable has been developed jointly with [redacted] and shown in Table 6.2.

Week	29/8	5/9	12/9	19/9	26/9	3/10	10/10	17/10	24/10	31/10
Stage	Testing & Training Period		Mobilisation Period							
Cumulative Number of Buses	2	2	4	8	12	16	20	24	28	32

Table 6.2 Bus Delivery Timetable

6.5.3 Charging Equipment

Through supplier engagement with SWARCO we have been able to establish the timescales that are required for the supply and installation of the [redacted] chargers and associated equipment to be installed.

The programme for this has been determined by the wider works to upgrade the electrical connection to the Eastleigh depot.

The installation of the chargers is programmed to be undertaken in Summer 2022 in advance of the buses being delivered.

6.5.4 Electrical Connection

[redacted]

6.6 Stakeholder Support

Southampton City Council (SCC) is working in partnership with local bus operator GSC (run the UniLink and Bluestar brands in Southampton). GSC are partners in the proposal and have developed the costs and early investigative work with SSE and the University. The University of Southampton, as the owner of the UniLink brand, are also partners in the proposal. The partners in the Southampton ZEBRA project are committed to the funding and delivery of the project as a long-term investment in improving the quality of life for people in Southampton and transforming the bus offer.

We have secured support from a wide range of stakeholders who have expressed their support. With this support the project will be a success.

The Southampton ZEBRA proposal has support from a range of organisations, including local bus operators. Letters of Support are in Appendix 6.2.

<u>Bid Partners</u>

- Go South Coast – bus operator partner in bid with support to transition buses to zero emission by 2030
- University of Southampton – contractor of the UniLink services who want to make their campuses and operations zero carbon by 2030

<u>Neighbouring Authorities</u>

- Hampshire County Council (HCC) – neighbouring highway authority location for the Bluestar depot in Eastleigh.
- Eastleigh Borough Council (EBC) – neighbouring authority where the Bluestar depot is located. Have own air quality issues along A335 Southampton Road between the depot and Southampton. This will benefit from new electric vehicles running along it.
- Transport for South East (TfSE) – sub-national transport body for Southampton who support the project as part of the wider strategy to decarbonise the South East's transport by 2050

Health Community

- Southampton Director of Public Health – support for the project as part of drive to improve air quality in Southampton and reduce health inequalities
- University Hospital Southampton NHS Trust – support from major NHS Trust in Southampton as part of drive to reduce air pollution and for the Trust to be carbon neutral by 2045 with U6 serving the University Hospital Southampton

Business Community

- SSE Energy Solutions – as a local Energy Supplier they have done initial investigative works with GSC to understand the scale and feasibility of the proposal. These include illustrative costs, based on typical development of a bus depot for charging capability, and investigation into the grid connection;
- Southampton Airport – destination for the U1 service and ambitions to grow the proportion of people, both staff and travellers, travelling to the airport by public transport including bus;
- National Oceanography Centre (NOC) – a large employer that is served by UniLink services who have a keen interest in being an environmentally conscious organisation;
- Go! Southampton (Business Improvement District) – support on behalf of 640+ businesses in City Centre.

Other Transport

- South Western Railway – main train operating company at Southampton Central served by UniLink services who are supporting TCF work at the station.

6.7 Communications and Stakeholder Management

Communications are a critical part of this project and early and continued engagement has been had with the bid partners at GSC and the University of Southampton. We have also engaged with stakeholders such as Hampshire County Council, Eastleigh Borough Council, businesses in the area include the Port and Southampton Airport.

6.7.1 Communications Management

Within SCC there is a dedicated Transport Communications Team who have Communication & Engagement Officers assigned to various projects. There is a lead on bus related initiatives as part of the Enhanced Partnership remit. At the bus operator and the University there are dedicated Marketing Team. They are responsible for developing a comprehensive and consistent communications plan for pre, during and post project implementation and engagement. There will be constant liaison between the parties and Communications is represented on the Project Board.

Three brands will be used:

- **UniLink** – the name of the bus service which is well established and a strong brand in Southampton – where buses are open to all users – students and the public, it is owned by the University of Southampton. The bus operator will lead on the ;

- **Connecting Southampton (City Region)** – the name of the transport delivery programme – which already has a dedicated website set up: https://transport.southampton.gov.uk/ . This brand will be used on communications on wider bus improvements and on-site information; and
- **My Journey** (https://myjourneysouthampton.com/) – the highly regarded award winning sustainable travel brand for Southampton & Hampshire (developed from LSFT funding). My Journey will work with the bus operator to promote and market the of schemes as they open, working with residents, businesses and schools along the corridors to maximise exposure, and providing general support for sustainable and active travel promotion. This carries on the partnership working already established between SCC and HCC through the Access Fund.

Examples of where successful joint communications campaigns and strategies have been developed and implemented include LSTF, MyJourney,

Appendix 4.15 has a copy of the Southampton ZEBRA Communications Plan including public engagement, key messages, and plan for engagement.

6.7.2 Stakeholder Engagement

Detailed engagement has been carried out with GSC and the University of Southampton as delivery partners for the project. All of which have senior management awareness and support for the Southampton ZEBRA project.

Stakeholder mapping has been carried out to identify our main stakeholders and their level of involvement. Table 6.3 summaries them.

Principal Stakeholders	Stakeholders	Interested Parties
Partners in the project delivery	Supporters of the Project	Wider beneficiaries of ZEBRA project
Bus Operator – GSC	Hampshire County Council	Voi
University of Southampton	Eastleigh Borough Council	Other bus operators
SSE	Southampton Airport	South Western Railway
	National Oceanography Centre	Southampton Workplace Travel Plan Networo
	Go! Southampton	Residents
	Hampshire Chamber of Commerce	Businesses
		Members of Parliament
		University Hospitals Southampton NHS Trust
		ABP Port of Southampton

Table 6.3 – Southampton ZEBRA Stakeholders

Letters of support to the Southampton ZEBRA project have been received from the majority of these stakeholders. The letters of support are in Appendix 6.2.

6.8 Risk Management Strategy

A robust and systematic risk management strategy has been developed in order to identify, analyse, plan and manage risk which will be applied throughout the life of the Southampton ZEBRA project.

The current risk register is set out in Appendix 4.14, and contains a total of 22 live risks which remain open.

The risk register provides a snapshot of the risks at the current stage of development of the project and will be kept under continuous and regular review throughout the project development.

As part of this review process, risk are regularly re-assessed, prioritised and rated. A mitigation strategy has been developed for all 'significant' risks. Effective control measures are being established to ensure risks are maintained at a level acceptable to the two authorities.

The stated aim is to be "best in class" but proportionate to the size and the stage of development of the project.

The time devoted to quantifying and managing risks will be proportionate to the size of the risk. Table 6.4 identifies and summarises the top five high-level risks affecting the overall ZEBRA project.

Risk ID	Name of Risk	Risk Owner	Last Action or Current Action	Risk Rating
6	Failure in delivery of power	GSC SSE	SSE carried out further investigation of the electrical connection and cost is now a firmer quote - deadline of 31st March. DNO Eastleigh depot connection, this request is subject to an application to National Grid which due to existing constraints which cannot be qualified unless the connection application is made beyond the DNO application	4
5	Change in political support	SCC	Use of Enhanced Partnership Board to provide updates and decision making	4
22	Delay in announcement and placement of order	All	DfT timescales have been confirmed	3
20	Significant increases in cost – infrastructure	All	Market engagement has been carried out with the chargers and further work with SSE have identified a more confident price. However, further application is required with National Grid to finialise costs which will be post bid submission	3.5
1	Insufficient resources to deliver successful bid -	SCC	Using additional funding to recruit staff and opportunities for consultancy support, recording monthly reporting	3.5

Table 6.4 Risk Management – main identified risks

The Risk Register summarises the type of risk, who has responsibility for the risk, planned steps to mitigate and monitor those risks and assigns a risk rating. The ZEBRA Project Board has responsibility for the ZEBRA risk management strategy and register. Risk Management will be a standing agenda item for the Board meetings, the high priority risks are reviewed and any issues would be escalated to the Steering Board, so that senior

managers are sighted on any issues at an early stage. Those attracting a risk rating of 4.0 (out of a total of 5) are most likely to be escalated.

At this stage of development all costs have a 3% risk allowance added. The price for the electrical connection is a risk based cost based on the unknown issues regarding local grid capacity that is expected to be resolved in Spring 2022.

6.9 Monitoring and Evaluation

Monitoring and evaluation are key activities for any learning so that we can progressively improve performance and delivery. This allows for systematic learning from past and current activities – 'what works/what doesn't work' and 'why' so that good practice can be replicated in the future with mistakes and poor outcomes avoided.

6.9.1 Introduction

SCC, University of Southampton and Go South Coast are happy to work with the appointed DfT consultant for wider assessment of the ZEBRA programme. This is vital to able to demonstrate what lessons can be learnt from Southampton's scheme and what we can learn from other ZEBRA schemes. We will be happy to share data with the DfT appointed consultant and participate in programme level evaluation activities. Where commercially sensitive data is being requested a Data Sharing Agreement will be produced between all parties.

6.9.2 Monitoring & Evaluation Aims

The monitoring and evaluation undertaken for the Southampton ZEBRA proposal will support the following evaluation aims:

1. Provide accountability and audit trail for the scheme investment;
2. Learn about the delivery of zero emission buses in Southampton;
3. Generate and share knowledge about the success of the scheme in achieving the stated objectives and benefits; and
4. Improve future initiatives for zero emission buses in Southampton and nationally as part of the wider DfT learning and roll out of 4,000 zero emission buses.

6.9.3. Monitoring & Evaluation Objectives

The objective of the Southampton ZEBRA proposal is to provide zero emission, in this case electric, buses in Southampton on the UniLink network. This is the first stage in delivering an all zero emission bus network in Southampton, subject to future funding, by 2030.

Our monitoring and evaluation is set against the following objectives:

- Decarbonisation of Southampton's transport network, and of the University's operation;
- Improving air quality in Southampton;
- Strengthening working relationships between SCC, the bus operators and the University for the long-term benefit of passengers, people living, working and visiting Southampton, and the University's population;
- Encouraging more people to travel by bus;
- Understanding the challenge of introducing zero-emission buses to support their wider roll out in Southampton and rest of the country; and
- Partnership working with suppliers to support the development of suitable zero-emission buses.

At a local level the impact on the level of carbon emissions, bus reliability, real-time emissions assessment, bus journey quality, punctuality and passenger experience are areas that would be investigated. This would be led by the Transport Research Group (TRG), along with the Environmental Services department, at the University of Southampton.

The TRG will also carry out academic research into the impacts of Zero-Emission Buses covering vehicles and on passenger demand.

TRG MSc Research Project - The Scope for Electric Buses in Southampton: A Life Cycle Analysis

Southampton City Council, in conjunction with a local bus operator, are currently bidding for funding from the Department for Transport under the Zero Emissions Bus Regional Areas (ZEBRA) scheme. This project will examine the life-cycle costs and benefits of electric buses compared to the diesel services they will replace. This will include consideration of capital costs, operating and maintenance costs, demand impacts and environmental effects. Particular attention will be paid to whether electric buses have a 'sparks effect' in terms of increasing demand and the determination of the optimal replacement strategy, including the cascading down of the diesel fleet.

Reporting from this proposal would enable an assessment of the learning for further roll out of electric, and other alternative fuels, buses in an urban setting. This would provide real world experience of impact on reliability and range with heavy passenger loadings. The popularity of the UniLink services means that during academic term times buses operate at higher loadings, during non-term times it provides an assessment of the impact of lower levels of loadings. This would provide a different analysis compared to peak and off-peak loadings for commuter based bus travel.

The assessment is also likely to include:

- Impact on University's carbon emissions,
- Impact on Southampton's city wide carbon and NO2 emissions,
- Impact on the bus passenger experience and patronage, and
- Wider public and user perceptions about electric buses.

6.9.3 Logic Map

To support the objectives and logic map has been developed that shows a clear rationale and route for the investment and expected outputs, outcomes and impacts. This is shown in Figure 6.3.

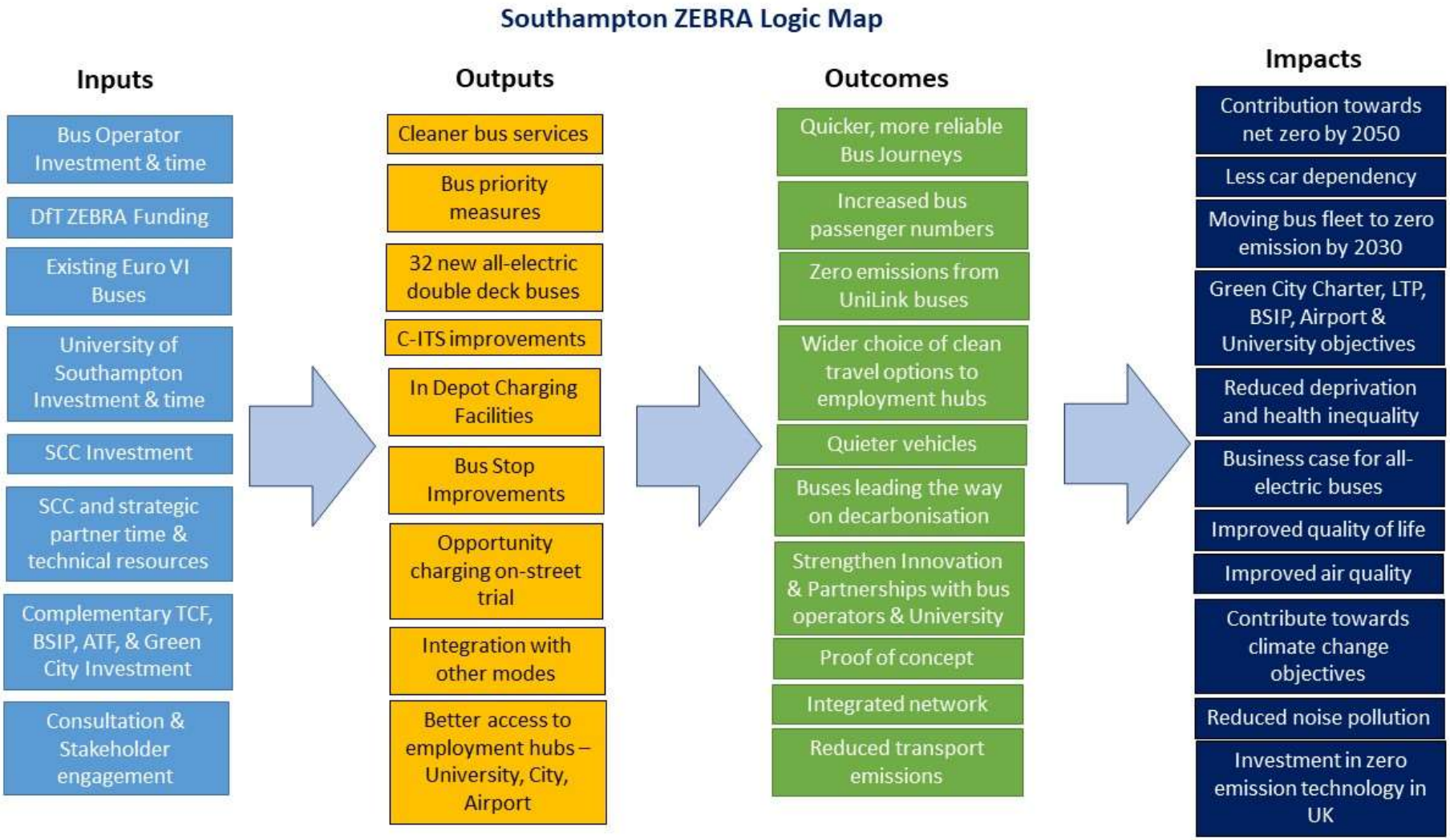


Figure 6.3 – Southampton ZEBRA Logic Map

6.9.4 Monitoring & Evaluation Data

Three elements of data are considered to be vital to the monitoring and evaluation of this project.

- Bus operations
- Transport, air quality and carbon impacts
- Scheme

We will plan to collect the monitoring data set out below, to be shared with the Department on a quarterly basis and collated by the programme-level evaluator.

Bus Operations

This will be of most importance for the bus operators locally and nationally. This monitors the impact of the electric buses on the operations both in terms of passenger numbers (the 'spark' effect) and operational costs. These will be monitored in partnership with the bus operator and TRG.

Baselines for bus patronage, vehicle speeds and mode split will be used from 2019 (as a pre-Covid year) and 2021 as a pre-scheme year. We will also look at comparator corridors to assess the impact against services where there is no investment in zero emission buses. These have been chosen both TCF and non-TCF corridors as well to isolate any impacts from that investment as well as zero emission buses.

- Project Services - U1, U2, U6 & U9 (all UniLink)
- Comparator Services – BS4, BS17/18 (both Blustar operating on Shirley Road)
- Project Corridors – A33 The Avenue, A335 Bevois Valley Road-Portswood Road (also receiving TCF investment)
- Comparator Corridor – A3057 Shirley Road (non-TCF), A33 Millbrook Road West (TCF)

The data requirements, data collection methods and data sources for the bus operations element are set out in Table 6.5.

Area	Data Requirements	Frequency	Methodology	Source(s)
Bus Operations				
Zero-Emission Buses	Number Purchased	Quarterly	Returns	GSC
	Number in Operation	Quarterly, 6 & 12mth after	Returns	GSC
	Number of ICE buses replaced	Quarterly, 6 & 12mth after	Returns	GSC
	Charging Methodology chosen	Inception & Conclusion	Returns	GSC
	Number of in depot chargers installed	Quarterly, 6 & 12mth after	Returns	GSC
	Number of on-street chargers installed	Quarterly, 6 & 12mth after	Returns	GSC
	Capacity of chargers once operational	12mth, and annually after	Returns	GSC/SSE
	Time of day of charge and tariff	Quarterly, 6 & 12mth after	App database	GSC/SSE

	Performance of batteries	12mth, and annually after	App database cross referenced with supplier specification	GSC
	Capacity of on-street chargers	12mth, and annually after	App database	SSE
Bus Patronage	Average daily patronage levels for baseline and comparator	Quarterly, 6 & 12mths after, then annually after	Ticket machine data	GSC
	Revenue	Quarterly, 6 & 12mths after	On and off bus revenue	GSC
	Mileage	Quarterly, 6 & 12mths after	Telematic data	GSC
	Operational cost per mile	Quarterly, 6 & 12mths after	Calculation	GSC

Table 6.5 Bus Operations Monitoring & Evaluation Criteria

This monitoring will allow understanding of bus travel and whether it is more attractive for passengers when newer, zero emission buses are available. It will demonstrate the running costs for a zero emission fleet compared to a traditional diesel fleet.

Transport Impact, Air Quality and Carbon Emissions

This will look at the wider transport impacts and the impacts on air quality and carbon in Southampton. This will continue to look at the monitoring of air quality in the city and the impacts on transport movements across all modes of transport in the city. This includes private vehicles, other buses, trains, cycling and walking in order to be able to provide some understanding on how introduction of zero emission buses encourages modal shift away from private car, and also abstraction from other modes, to use of public transport.

The transport impact monitoring will make use of an existing series of traffic and modal split counts done by SCC annually. We will use previous years – 2019 and 2021 – to provide a baseline pre and post Covid. This will be added to with other counts using existing Bluetooth or new Artificial Intelligence sensors being installed as part of TCF. This monitoring will show change in demand for various modes across time and on different corridors (as per Bus Operations).

Air quality monitoring will continue within the 11 AQMAs in Southampton and 2 affected AQMAs in Eastleigh to provide the understanding of the impact a change in bus fleet make up has on air quality. Regular monitoring is carried out as part of SCC (and EBC for Eastleigh) and is included in the respective Council's Air Quality Action Plans.

Carbon emission monitoring will provide understanding of changes in CO^2 emissions and compare to diesel buses in operation.

The data requirements, data collection methods and data sources for the bus operations element are set out in Table 6.6.

Area	Data Requirements	Frequency	Methodology	Source(s)
Transport Impacts	People mode share at City Centre Inner Cordon	Quarterly, 6 & 12mths after for 5 yrs post	Annual On-Site Counts	SCC

	Average speeds of car and bus	Quarterly, 6 & 12mths after for 5 yrs post	On-site counts, permanent traffic counters	SCC
	Journey times for car and bus	Quarterly, 6 & 12mths after	Bluetooth/AI sensors, RTI	SCC
Carbon Impacts	Average daily ZEB mileage	Quarterly, 6 & 12mths after	Telematics	GSC
	Average daily ZEB energy consumption	Quarterly, 6 & 12mths after	App	GSC
	Average daily diesel milage and fuel consumption for each route – baseline and comparator	Quarterly, 6 & 12mths after	Calculations	GSC
	Average ZEB well-to-wheel greenhouse gas emissions	Quarterly, 6 & 12mths after	Calculations	GSC & UoS
	Average battery state of charge before and after charging	Quarterly, 6 & 12mths after	App	GSC
	Time of day ZEB charged and electricity tariff and electricity generation source	Quarterly, 6 & 12mths after	App	GSC/SSE
Air Quality	AQMA information for the affected AQMAs	Annual 2017, 2019, 2021, 2022, 2023 and beyond for at least 5 years	Annual Air Quality Reports	SCC

Table 6.6 Transport, Air Quality & Carbon Impacts Data Collection

We would expect that this project alongside the delivery of the Southampton TCF programme, other initiatives in the Bus Service Improvement Plan and Active Travel Fund will contribute to the Council and LTP4 objectives.

Project Impacts

This will look at the project specific outcomes and outputs to provide an understanding of the success of the project to time, budget and specification. This will enable learning on how to best deliver a project and strengthen the relationship between the local authority, bus operators and the University.

Area	Data Requirements	Frequency	Methodology	Source(s)
Scheme Costs	Purchase cost per bus	Inception & Conclusion	Quoted and actual costs	GSC
	Purchase cost per ICE bus	Inception & Conclusion	Market costs	GSC
	Average operational cost/ZEB (£/mth)	Conclusion, 6 & 12mths after	Calculation	GSC
	Average operation cost/ICE (£/mth)	Conclusion, 6 & 12mths after	Calculation	GSC
	Cost of electric fuelling infrastructure	Inception & Conclusion	Actual costs	GSC/SSE
Project	Financial Spend	Quarterly, 6 & 12mths after	Reporting to Project Board against spend profile	SCC
	Progress	Quarterly	Report to Project Board against agreed programme	SCC

Table 6.7 – Project Impacts Data Collection

All data will be reported in an electronic format, using a common format such as CSV or Microsoft Excel.

6.9.5 Resourcing & governance

The monitoring and evaluation will be led by SCC as the project lead with support from GSC and the University. The lead will be the Project Manager within Green City & Infrastructure team, who will be the Enhanced Partnership Lead – to be fully recruited. The SRO for the Monitoring & Evaluation will be SCC Transport Policy Team Leader Iain Steane. The lead for the bus operators will be Paul Walker, Head of Partnerships & Strategy.

Costs for monitoring and evaluation are included in the infrastructure costs for the buses, batteries and infrastructure and using existing SCC budgets used for monitoring & evaluation for the LTP (~£100k pa). A Data Sharing Agreement will be developed between SCC, GSC, the University and the DfT's consultant for the sharing of data including any necessary commercially sensitive data.

The Project Board will provide the oversight of the monitoring and evaluation. Quality assurance will be provided by the University of Southampton's Transport Research Group headed by Prof John Preston. The TRG will also provide an independent assessment of the impact of the introduction of zero emission bus and life cycle analysis as set out in 6.7.2.

At this stage of development there are risks associated with the data – its quality, availability – particularly pre-Covid traffic on roads that are not routinely counted, and consistency. With the on-going Covid pandemic risks surround levels of bus patronage, numbers of students attending in-person courses, any isolation periods or changes to services due to driver availability.

6.9.6 Milestones

In developing the programme for data collection several milestones have been identified.

- Pre-Scheme by June 2022 – data collation exercise on baseline for UniLink services, comparator services, air quality, and traffic data;
- During (Summer 22-Spring 23) – quarterly reporting on project impacts (financial, progress, outputs – buses & charging infrastructure);
- Post (Spring 23) – immediate post scheme reporting on deliverables and outputs – costs, buses, charging infrastructure;
- Post (6mth Autumn 23, 12 months Spring 24 and annually for 5yrs) – project metrics, bus operator outputs, wider transport, air quality and carbon impacts.

6.10 Summary

The following can be summarised from the Management Case:

- That the Southampton ZEBRA project has a strong governance structure, including Southampton City Council has the Accountable Body, and good experience in delivering transformative transport projects in Southampton to timescale and specification;
- The project team is experienced, resourced and has access to expertise to deliver the project;
- That the approvals and assurance processes are in place to deliver the project
- A robust risk identification and mitigation system has been put in place for Southampton and that risk will be managed throughout the project lifespan;
- The Southampton ZEBRA project is well supported from a wide range of stakeholders in Southampton;

- There is a robust and well-defined monitoring & evaluation programme that will enable learning to be shared and for the project to progress to a successful conclusion and meet its objectives.