Full Business Case

Zero Emission Bus Regional Areas (ZEBRA)

1 - SCHEME DETAILS	
1.1 - SCHEME & APPLICANT'S INFORMATION	
Scheme Name:	**ZEBRA – South Yorkshire**
Scheme Location / Address:	South Yorkshire (Barnsley, Doncaster, Rotherham, Sheffield)
Applicant Organisation:	South Yorkshire Mayoral Combined Authority (SYMCA)
Contact Name and Role:	Ben Hardy, Principal Project Manager
Address:	11 Broad Street West, Sheffield, S1 2BQ.
Email:	
Telephone:	
Other Delivery Partners and Roles:	• **Stagecoach** – operator to run the electric buses on the 221 and 22x. • **Barnsley Metropolitan Borough Council (BMBC)** – local authority area for the proposed electric buses. • **Doncaster Metropolitan Borough Council (DMBC)** – local authority area for the proposed electric buses. • **Rotherham Metropolitan Borough Council (RMBC)** – local authority area for the proposed electric buses. • **Sheffield City Council (SCC)** – local authority area for the proposed electric shuttle bus service. • **Arup** – technical consultancy support. • **EY** – DfT's delivery partner. • **DWF** – external legal advisor.

2 - EXECUTIVE SUMMARY

2.1 – Summary description of the scheme

The government has made available up to £270 million of funding, as part of the Zero Emission Bus Regional Areas (ZEBRA) scheme. This funding will support the government's commitment to decarbonisation, help to deliver the 4,000 Zero Emission Buses (ZEBs) the government committed to, as well as support partnership working between transport authorities, bus operators and other key stakeholders. The initial ZEBRA fund set out by the government totalled £120 million. However, the October 2021 Spending Review increased this fund by £150 million, meaning a total of £270 million is now available through the fast track and standard processes.

As part of the standard ZEBRA process, the South Yorkshire Mayoral Combined Authority (SYMCA) ZEBRA proposal includes the first roll out of ZEBs across our region, which is a vital first step in achieving our ambition for a fully zero emission bus fleet by 2035. The South Yorkshire proposal involves all four local authorities and crosses two Clean Air Zones (CAZs).

23 single decker electric buses are proposed for the 221 and 22x commercial bus services, all of which will run from the Rawmarsh depot in Rotherham. Of these 23 new buses, 10 will be specifically for the 221, and a further 10 specifically for the 22x. An additional 3 buses will be used as contingency vehicles across both services. These additional buses are necessary for in-service operation, out of service mileage, vehicle scheduling/positioning, maintenance and testing. Our proposal also includes a new electric city centre shuttle bus service in Sheffield. This will involve four new electric single decker buses, one of which will be a contingency vehicle.

In summary, a total of 27 new single decker electric buses are proposed across the whole of South Yorkshire. The project funding requirements are as follows, which includes optimism bias and inflation:

- DfT (ZEBRA): £8,351,721
- SYMCA: £2,683,051
- Stagecoach: [redacted]
- Other private (iDNO): [redacted]

Total: £15,588,978

2.2 - Please provide an update on any key changes and developments since the submission of the ZEBRA Expression of Interest (EoI)

The key changes since the submission of the EoI are outlined below:

General changes

- Allowance for infrastructure maintenance has been removed from the capital estimate, reducing the capital cost by [redacted].

- The proposed charging infrastructure has been refined based on the route analysis and feedback from vehicle and infrastructure suppliers so that:
  - The pantograph chargers at Rotherham Interchange are now 300kW rather than 450kW, resulting in a saving of [redacted] ([redacted] per charger).
  - The fast chargers at Sheffield Interchange are now 100kW chargers rather than 150kW chargers, resulting in a saving of [redacted] [redacted] per charger).

- Contingency/optimism bias has been included.

- Forecast inflation has been accounted for.

- The costs for the proposed electric vehicles have been revised based on supplier quotes that respond to clearer specification and route requirements, from [redacted] to a blended average of [redacted] per vehicle.

- The costs for the diesel equivalent vehicles have been revised based on supplier quotes that respond to clearer specification and route requirements, from [redacted] to [redacted] per vehicle.

- The allowance for upgrading the electrical connection to the point of connection at Rotherham Interchange, Rawmarsh Depot and Sheffield Interchange has been revised based on quotes from the DNO online tool. This has led to a saving of [redacted]

- Battery replacement has been included at a unit cost of [redacted] per battery in year 8.

Additional costs have been provided (although not included in the funding profile) as this will be covered by SYMCA:

- A [redacted] allowance for marketing.
- A [redacted] allowance for professional fees has been included to support procurement.
- A [redacted] management allowance has been included to ensure the SYMCA can deliver and oversee the scheme.

City Centre Shuttle Bus

Through the route analysis, it was determined that pantograph charging would not be required for the electric city centre shuttle bus. As such, the infrastructure costs have decreased (now allowing for depot fast chargers only). This reduces the capital cost by £359k.

The removal of the need for pantograph charging in Sheffield will also reduce some delivery risk, with a key element of the Sheffield proposal no longer required. There would be a slight downside with not having the pantograph chargers in Sheffield, as there won't be pantograph chargers for other commercial buses to use in the future – which might have helped speed up the transition of diesel commercial buses to electric in Sheffield. However, on balance, as the pantograph chargers are not critical for the running of the shuttle bus operation, its inclusion in this bid does not represent value for money.

[redacted]

22x / 221
For the 22x and 221 services, Stagecoach will own the electric buses rather than the previous proposal of SYMCA owning the vehicles and leasing them to Stagecoach.

2.3 – Strategic Case summary

This chapter sets out the strategic context for the bid, describing the current bus market in South Yorkshire, showing trends in our region, as well as outlining the fundamental need for the ZEBRA scheme based on the poor air quality, current lack of investment in Zero Emission Buses (ZEBs), as well as our ambitions to have a fully ZEB fleet by 2035.

It should be noted that there are references to both 2035 and 2040 within the report with regards to ambition dates for a fully ZEB fleet. To provide some clarification on this, our Transport Strategy (Local Transport Plan agreed in 2018), set out plans for a zero-carbon public transport system by 2040. However, since then, the declaration of the climate emergency by South Yorkshire Leaders, and the creation of an Energy Strategy to help address these challenges, highlights the need for urgent action. The result of this urgency is the acceleration of our target date for a zero-emission bus fleet operating in the region, bringing this forward by five years to 2035. As such, 2035 is the key ambition date within this business case, but some references are also made to 2040, which is the Transport Strategy target date.

The strategic case demonstrates the need for this project based on:

1. Evidence of poor air quality across South Yorkshire (two Clean Air Zones plus Air Quality Management Areas) which the ZEBRA scheme will directly address.

2. The lack of any ZEBs in our region and the lack of any ZEB infrastructure, which is a barrier to future ZEB roll out.

3. The high level of ambition of our region to have a zero-emission public transport fleet by 2035. This can only be met by investing in the South Yorkshire bus fleet.

The strategic case also demonstrates a strong alignment with DfT's objectives and strategic priorities, which are summarised below:

- We would support the government's commitment to decarbonisation by reducing the transport sector's contribution to CO2 emissions. Our proposals to electrify the 221 and 22x would provide an annual saving of around 2,000 tonnes of CO2 per year.
- We would support the roll-out of 4,000 ZEBs the government committed to, by rolling out 27 ZEBs across South Yorkshire.
- We would support the electric bus manufacturers in the development of the technology through the monitoring data which will be obtained through the scheme delivery.
- We would support partnership working through the Bus Services Improvement Plan (BSIP), as well as our ZEBRA partnership with Stagecoach on the 221 and 22x services. We would also have a close partnership with the electric city centre shuttle bus operator. The electric shuttle bus would be a new tendered service, so the operator is currently unknown.
- We would provide a greater understanding of the challenges of introducing ZEBs and supporting infrastructure, to help inform future government support for ZEBs. Our schemes are challenging from a technology perspective due to the route lengths and topography. As such, they would form great opportunities for learning.

2.4 – Economic Case summary

Electric buses provide a wide range of benefits to users and the wider community alike. With the transport sector being the lead cause of noise and air pollution in the UK and producing 27% of the nation's total emissions in 2019, it is particularly pertinent to move towards less polluting forms of travel *(DEFRA noise pollution: economic analysis, Environmental Protection UK)*. Electric buses are a key tool in reducing emissions that cause climate change, as well as reducing air pollution levels that curtail the lives of numerous urban residents.

As part of the standard ZEBRA process, the South Yorkshire Mayoral Combined Authority (SYMCA) ZEBRA proposal includes the first roll out of ZEBs across this region, which is a vital first step in achieving an ambition for a fully zero emission bus fleet by 2035. The South Yorkshire proposal involves all four local authorities and crosses two Clean Air Zones (CAZs).

The economic case assesses the full impacts of this project by determining value for money for the taxpayer. These impacts include those costs and benefits which accrue to the environment, society, businesses and government. This economic evaluation assesses the value for money arising from the investment in 27 new electric buses in South Yorkshire, through electrification of routes 221 and 22x and the introduction of a new electric shuttle in Sheffield City Centre. The Department for Transport's Greener Bus Model ('GBM') is used to model the quantifiable costs and benefits of replacing the existing fleet with an electric one. The Do-Minimum scenario assumes replacement of the current fleet against an equivalent fleet of Euro VI diesel buses.

The additional non-monetised benefits that may arise from this scheme, including reductions in preventable early deaths linked to air quality and the effect of reductions in noise pollution are considered in the latter part of this analysis.

A Net Zero emission bus fleet also forms a key part of South Yorkshire's Bus Service Improvement Plan programme. Upgrading the existing buses to electric is a minimum requirement for achieving a highly efficient public transport network, which responds to the needs of existing and future users. An electric fleet can contribute to raising the profile and resilience of the network, and increase the patronage on all types of journeys, which currently stands at just 9% of all trips to work (*South Yorkshire Bus Service Improvement Plan 2021).* The environmental benefits of this shift will be felt throughout the community, benefiting a group wider than simply those who use the bus for travel.

There is a good case for South Yorkshire's ZEBRA bus scheme which demonstrates that there is a large benefit associated with the reductions in Carbon, NO_X and PM. This is particularly important given the issues with air quality in South Yorkshire. The non-monetised benefits indicate this reduction in emissions is particularly instrumental in reducing some of the effects linked to poor air, such as preventable early deaths from respiratory problems.

[redacted]

2.5 – Commercial Case summary

Overview

The proposed Commercial approach has been designed to ensure that the project obtains value for money both in terms of the buses and charging infrastructure procured by SYMCA and those which will be secured by Stagecoach as the operating partner for routes 221 and 22x.

Market engagement undertaken during December 2021 has provided confidence that the proposed operating and technical solutions, including the need for opportunity charging on routes 221 and 22x, are correct for the project. The supplier engagement process has also ensured that robust cost assumptions have been fed into final business case.

A summary of the funding requirements are as follows:

- DfT (ZEBRA): £8,351,721
- SYMCA: £2,683,051
- Stagecoach: [redacted]
- Other private (iDNO): [redacted]

Total: £15,588,978

Whilst it is recognised that the SYMCA project team will require some additional resources, especially to support the technical aspects of the project, it is also envisaged that the project will draw on the existing resources and experience of Stagecoach from their delivery of other electric bus projects in the UK. The most relevant being the recent introduction of opportunity charging buses into Kilmarnock. It might also be possible to draw on any relevant experience of the operator awarded the City Centre Shuttle (CCS) operating contract.

Commercial Strategy

The commercial case is based on securing assets owned by either SYMCA or Stagecoach supported by a procurement strategy which aims to ensure value for money in the purchase of both the buses and supporting charging infrastructure. The proposed agreement between SYMCA and Stagecoach for routes 221 and 22x will ensure the long-term use of the assets within the Combined Authority area maximising the local benefits of the scheme over the medium to long term.

The buses for the Sheffield City Centre shuttle will be owned by SYMCA allowing them to be used on other tendered services in the future if necessary. It is not proposed to charge the CCS operator for the four electric buses as these costs would only be recovered by the operator through the operating contract price. However, it is proposed to put a lease agreement in place which will cover the operator's maintenance and repair obligations and return conditions.

The reasons for selecting routes 221 and 22x are discussed in **Section 3.2.5** of the **Strategic Case**. Stagecoach was chosen following a selection process where all operators in the region were offered the opportunity to collaborate with SYMCA in the ZEBRA scheme. From these

discussions, it was clear that the only viable operator at that time was Stagecoach. Other operators did not want to be considered as a partner for this particular fund in South Yorkshire.

On routes 221 and 22x, both of which are commercial services, Stagecoach have offered to procure both buses and the charging infrastructure for their Rawmarsh depot. The benefits of this approach are examined within the commercial case. The opportunity charging infrastructure to support the operation at Rotherham Interchange will be owned and operated by SYMCA to allow the potential use by other services in the future.

[redacted]

Procurement Strategy & Preferred Option

The preferred procurement option is to undertake separate tendering processes for both vehicles and infrastructure to maximise competition and ensure value for money across all elements of the procurement.

The assets required and the proposed procurement approaches are summarised as follows:

- 4 x 9.5-10 m single electric deck buses for Sheffield City Centre shuttle procured by SYMCA through a separate tender using an existing public sector framework agreement.
- 4 x 100kW DC chargers plus installation at Sheffield Interchange through a separate tender possibly using an existing public sector framework agreement.
- 23 x 12m single deck electric buses for use on routes 221 and 22x purchased by Stagecoach using their existing bus purchase framework agreements
- 23 x 150kW depot chargers for Stagecoach Rawmarsh depot purchased by Stagecoach through a separate tender.
- 2 x 300kW opportunity charging units for routes 221 and 22x located at Rotherham Interchange and owned and purchased by SYMCA.

The tender specifications for the buses and chargers will be output based with suppliers having to demonstrate the ability of the products to meet the operating and performance requirements of the routes.

It is anticipated that the chargers for Sheffield and Rotherham Interchanges will be combined into one tender to reduce the resources required to run this tender process.

Market Engagement

Early supplier engagement sessions with a selection of bus manufacturers and infrastructure suppliers took place during December 2021. The supplier engagement process was supported by both technical and operating managers from Stagecoach.

Through this exercise, a pre-meeting briefing pack was shared with a number of vehicle and infrastructure suppliers, who were invited to provide responses through dedicated sessions. The briefing pack included a route analysis for each of the three routes so bus manufacturers could offer the most suitable product in their range to match the operating requirements. It is important to note that this was not an official procurement exercise, and other suppliers may have an opportunity to respond to the tender(s) when any formal Invitation to Tender is issued.

The aim of the early market engagement exercise was as follows:

- Gather market insight on the appropriate parameters of the scheme e.g. suitable vehicle specification, charging regime and charging infrastructure, etc.
- Understand supplier views on the various opportunity charging regimes
- Clarify the likely timescales for delivery, including understanding of dependencies and risks
- Seek feedback on the proposed approach to procurement
- Understand technology roadmaps and developments which will impact on product availability offering during 2022/23
- Seek feedback on the route analysis document and their feedback on the potential technology and operational approach to support the conversion of these routes
- Understand their experience of delivering similar projects through presentation of case studies

In summary the market engagement process has:

- Informed the proposed procurement approach
- Provided assurance on the charging regime for each of the routes
- Validated the indicative costs being used in the business case; and
- Confirmed the likely timescales for the supply of buses and infrastructure including the installation and commissioning process which has been fed into the procurement programme shown in **Section 5.4**

Detailed feedback from the market engagement exercise is summarised in **Section 5.5**.

Since the supplier engagement sessions in December 2021 the following activities have also taken place:

- [redacted] attended a site visit to Rotherham Interchange on the 11 January 2021, on a no fee no obligation basis, to undertake a high-level initial assessment of the feasibility of installing opportunity charging masts at the interchange.

- [redacted] have agreed to undertake a route test of routes 221 and 22x using one of their existing electric buses to verify their energy consumption forecasts for these routes. This exercise will help verify assumptions as the project progresses.

2.6 – Financial Case summary

Total capex eligible for ZEBRA funding, with and without inflation, is provided below.

	Without Inflation	With Inflation
Vehicle replacement capex	£ 10,844,116	£ 11,798,398
Infrastructure capex	£ 3,545,912	£ 3,790,580
Total Capex - Eligible for Grant Funding	**£ 14,390,028**	**£ 15,588,978**

These cost items had Optimism Bias (OB) applied already, therefore it is worth noting they will not be an exact match with the draft model input data. The Greener Bus Model (GBM) applies OB rates to input values, hence the values in the GBM are without OB. The GBM also applies discounting.

The diesel bus cost used for the grant calculation is £4,453,350. ZEBRA grant funding is sought for 75% of the premium for electric vehicles, and 75% of the infrastructure cost, as shown below. Total grant funding is £8,351,721.

	Electric	Diesel	Grant funding sought
Vehicle replacement capex	£ 11,798,398	£ 4,453,350	£ 5,508,786
Infrastructure capex	£ 3,790,580	£ -	£ 2,842,935
Total capex	**£ 15,588,978**	**£ 4,453,350**	**£ 8,351,721**

The other funding sources are shown below. This excludes battery replacement costs, operating costs and revenue, and additional costs to the Combined Authority to manage the scheme. Stagecoach (the Operator), will fund [redacted]. A quote of [redacted] private match funding has been offered through an iDNO, with the remainder funded by SYMCA through CRSTS.

	SYMCA	ZEBRA	
Vehicle replacement capex	£ 2,494,612	£ 5,508,786	£
Infrastructure capex	£ 188,439	£ 2,842,935	£
Total capex	**£ 2,683,051**	**£ 8,351,721**	**£**

[redacted]

The majority of costs can be supported by supplier engagement and therefore the level of risk is considered low. Financial risk has been managed through the application of a contingency allowance through an OB rate that is aligned with WebTAG.

The proposed electric services will generate an annual saving to the operator(s) through lower vehicle maintenance and operating costs, mainly as a result of reduced energy costs and the 22p/km BSOG incentive scheme. This saving will ensure long term financial viability. SYMCA will incur an annual cost to maintain the charging infrastructure at Rotherham and Sheffield Interchanges; [redacted] These maintenance and revenue calculations are based on the assumptions in the GBM to ensure consistency with the economic case and are indicative estimates. Actual maintenance costs will likely rely on a service agreement with the chosen supplier, with revenue dependent on the electricity price agreed between SYMCA and the operator.

A city centre shuttle bus service is not currently in operation. As such, the long-term financial viability of the service requires [redacted] funding to fund the total maintenance and operating costs of the electric service, as well as additional costs to run the service such as driver costs.

It is estimated that the city centre shuttle service would require around [redacted] per year [redacted], over a minimum of 5 years, to cover the cost for the operator to run the electric bus service.

2.7 – Management Case summary

The Management Case describes the overall deliverability of our ZEBRA proposal and considers the practical aspects such as implementation timescales and our approach to managing the project risks.

Our proposal will see 27 single decker buses and supporting charging infrastructure being operational and delivering benefits across South Yorkshire as early as September 2023. We have confidence in our ability to do this based on:

- Extensive market engagement during December 2021 and January 2022, helping to provide confidence in the costs provided, the risks which might be encountered, as well as the timescales of the different aspects of delivery.
- Close engagement with Stagecoach during the business case development for the 22x/221 proposals, including involvement in the market engagement process. This strong working relationship will continue during project delivery.
- Letters of support from all four local authorities, the Mayor, and Stagecoach – demonstrating a very high level of support for this scheme, and a willingness on all sides for this project to succeed.
- Our track record on delivering major projects.

Key highlights from this Management Case include:

- Deliverability – we are confident that we can deliver both the 221/22x and City Centre shuttle bus projects by September 2023. We anticipate the timescales for both projects would be similar, even with separate procurements for the different aspects of the proposal.
- Governance – we have effective existing governance procedures which we have used for delivering other major capital schemes in South Yorkshire. These procedures would continue to be used for the ZEBRA delivery. The ZEBRA project will be specifically overseen by the Transport and Environment Board and the SYMCA.
- Delivery team – we have identified key individuals within a delivery structure for all aspects of our ZEBRA proposals. We will make use of our Engineer's Framework in cases where additional technical resources are needed for delivery. Even though it will be the first ZEB project to be delivered in South Yorkshire, our region has vast amounts of experience in delivering complicated and pioneering projects – a recent example is the award-winning Tram-Train project in Sheffield and Rotherham.
- State aid – is applicable for the 221/22x proposals albeit a legitimate one. State aid is not applicable for the City Centre Shuttle. External legal advice was obtained, as part of our business case development.
- Risk – our approach to risk management is set out and our ZEBRA risk register has been provided. Our current top risks involve the DNO works and connections (programme and cost implications). We have tried to mitigate this risk by engaging with the local DNO as well as an IDNO, and using the DNO online tool. We have also factored in an appropriate level of risk contingency in case the costs are higher than forecast.

- Stakeholder management/communications – our approach has been outlined within the Management Case, including a tailored approach based on the individual stakeholder requirements.
- Monitoring and Evaluation – our approach aligns with SYMCA's assurance framework and DfT's ZEBRA requirements.

2.8 – Appendix list

Appendix A – Route Analysis (Commercial Case)
Appendix B – Proposed Bus Specification Summary (Commercial Case)
Appendix C – Legal Advice Document *[not included in web version but summary included within the FBC text]*
Appendix D – Letters of Support

2.9 – Chapter Page Numbers

3 - STRATEGIC CASE

3.1 PART 1 – DEFINING THE PLACE

3.1.1 Overview summary of the proposed scheme

Our ZEBRA proposal involves the first Zero Emission Buses (ZEBs) across all four districts of South Yorkshire. These buses will directly address the climate emergency, the Air Quality Management Areas (AQMAs) and the two Clean Air Zones (CAZs) across South Yorkshire. The scheme can be broken down into two key sub-projects:

1. **Electrification of Stagecoach's 221 and 22x bus routes**

   Electric Buses

   This proposal involves 23 new single decker electric buses on the 221 and 22x commercial bus services. These new buses would be owned by Stagecoach and purchased through the ZEBRA scheme with contributions from SYMCA and DfT. Various commercial models were considered, including a leasing model, but the preferred and proposed commercial model for ZEBRA will be for Stagecoach to own these vehicles. Further details on the commercial model are set out in the Commercial Case.

   These 23 new electric buses include 10 on the 221 route (Rotherham to Doncaster) and a further 10 on the 22x route (Rotherham to Barnsley). Three more electric buses will be used as contingency vehicles across both services. All 23 new electric buses would be based at Stagecoach's Rawmarsh depot, just outside Rotherham town centre. **Figure 3** within **Section 3.1.2** shows the location of these routes.

   Infrastructure

   The proposal also includes depot charging at Stagecoach's Rawmarsh bus depot. In addition, two pantograph chargers are proposed at Rotherham Transport Interchange (RTI). Modelling of the 221 and 22x bus services, as well as market engagement during December 2022, has demonstrated that rapid chargers would be needed, in addition to depot chargers, to operate these routes as electric.

2. **A new electric city centre shuttle bus in Sheffield**

   Electric Buses

   The second part of our ZEBRA proposal involves the creation of a new electric city centre shuttle bus service in Sheffield. Four single decker electric buses are proposed, which includes one contingency vehicle. This would be a new tendered service with all operators given the opportunity to submit a tender. [redacted] support would be needed by SYMCA / SCC over the five-year period to support this tender. It should be noted that this electric shuttle bus proposal aligns very well with the wider ambition to improve the air quality Sheffield City Centre, through the imminent creation of the 'Category C' clean air charging zone. From late 2022, certain categories of vehicles, including buses, would need to pay to

enter the city centre (Euro 6 buses or better will be exempt). The proposed electric city centre shuttle bus would travel within the proposed clean air charging zone.

Infrastructure

As Sheffield Transport Interchange (STI) is owned by South Yorkshire Passenger Transport Executive (which will soon be part of SYMCA), [redacted] it is proposed that these buses would be based at STI. Overnight 'depot' charging would therefore be included at STI for the shuttle bus service. [redacted] Our modelling has shown that opportunity charging infrastructure would not be required for the operation of this shuttle bus service.

As the new electric shuttle bus service would be tendered, we don't yet know which operator would run the new service. With regards to engaging with the bus market to operate this service, it is important to provide some context to the wider bus contracts in our region. Currently, South Yorkshire has over a hundred local bus contracts with operators. First, Stagecoach, TM Travel, Powells and South Pennine all have operating contracts with South Yorkshire Passenger Transport Executive (SYPTE), within Sheffield, that includes full daytime bus workings, similar to the proposed electric city centre shuttle bus. These operators continue to bid for work and have confirmed interest in future contracts including the proposed electric city centre shuttle bus. [redacted] It is considered that there is a very low risk that contracted services do not receive bids, and full daytime work within Sheffield is the most popular contract work for our bidders. As such, on this basis, we anticipate that at least three, and probably five or more bids, would be received for operating the electric shuttle bus if the ZEBRA project goes ahead. Based on knowledge of our current tendered service timescales, it is considered that the tendering would take between 4 and 6 months depending on how it falls within our internal SYMCA reporting cycles. This is reflected in the programme, as shown in the Management Case.

In summary, our full ZEBRA proposal involves:

- **27 new single decker electric buses.**
- **Depot charging infrastructure at Stagecoach's Rawmarsh depot.**
- **Two pantograph chargers at RTI.**
- **Overnight (plug in) charging infrastructure at STI.**

3.1.2 Define the area where the ZEBs will operate

South Yorkshire is centrally located in the UK and home to 1.4m residents and over 47,000 businesses.

The region has close ties to the adjacent city regions of Leeds, Manchester, and the East Midlands. **Figure 1** shows the extent of the South Yorkshire boundary.

Figure 1 – South Yorkshire Boundary

Led by the Mayor of South Yorkshire, SYMCA brings together the local authorities of Barnsley, Doncaster, Rotherham and Sheffield, and the private sector through the Local Enterprise Partnership (LEP). The Mayor, SYMCA and the LEP have a shared purpose to create a stronger, greener and fairer South Yorkshire.

Our South Yorkshire ZEBRA proposal will facilitate the first roll out of ZEBs across all four local authority areas of South Yorkshire. **Figure 2** shows these four local authorities within the context of the strategic highway network.

Figure 2 – South Yorkshire – Location for the ZEBRA scheme

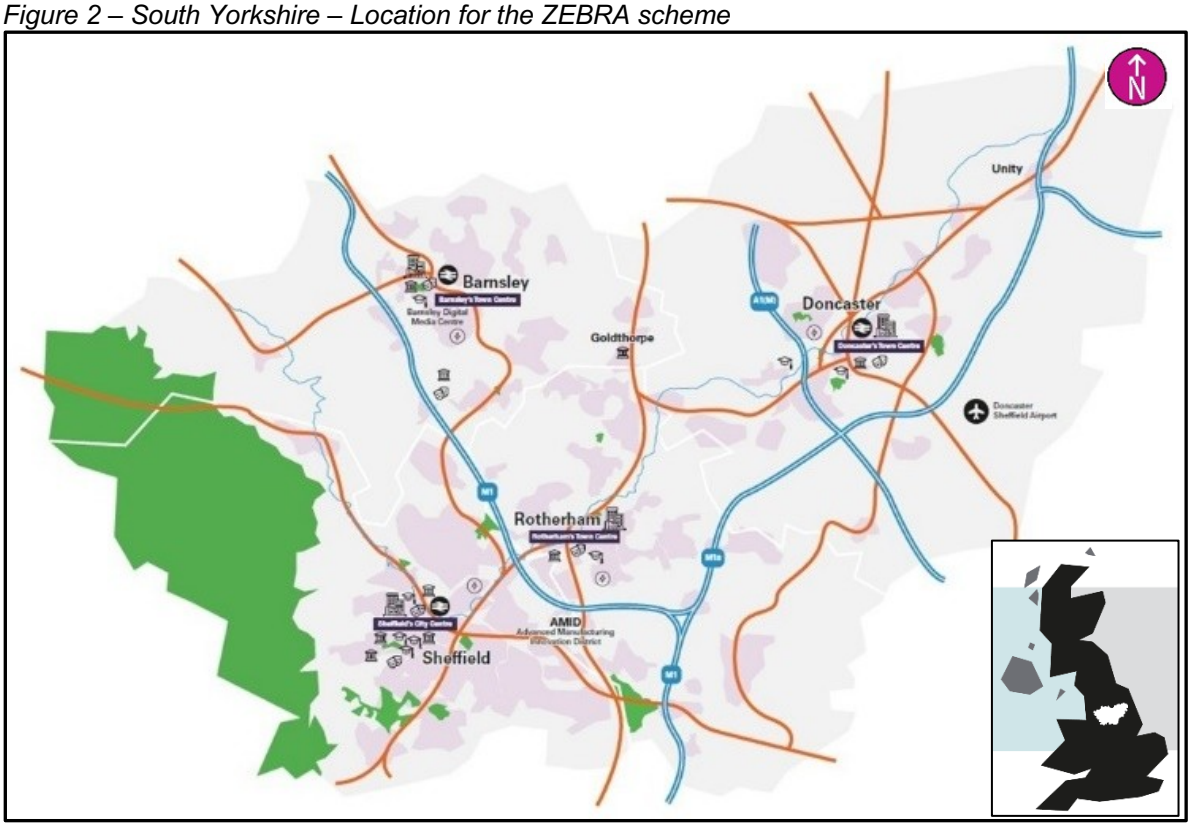
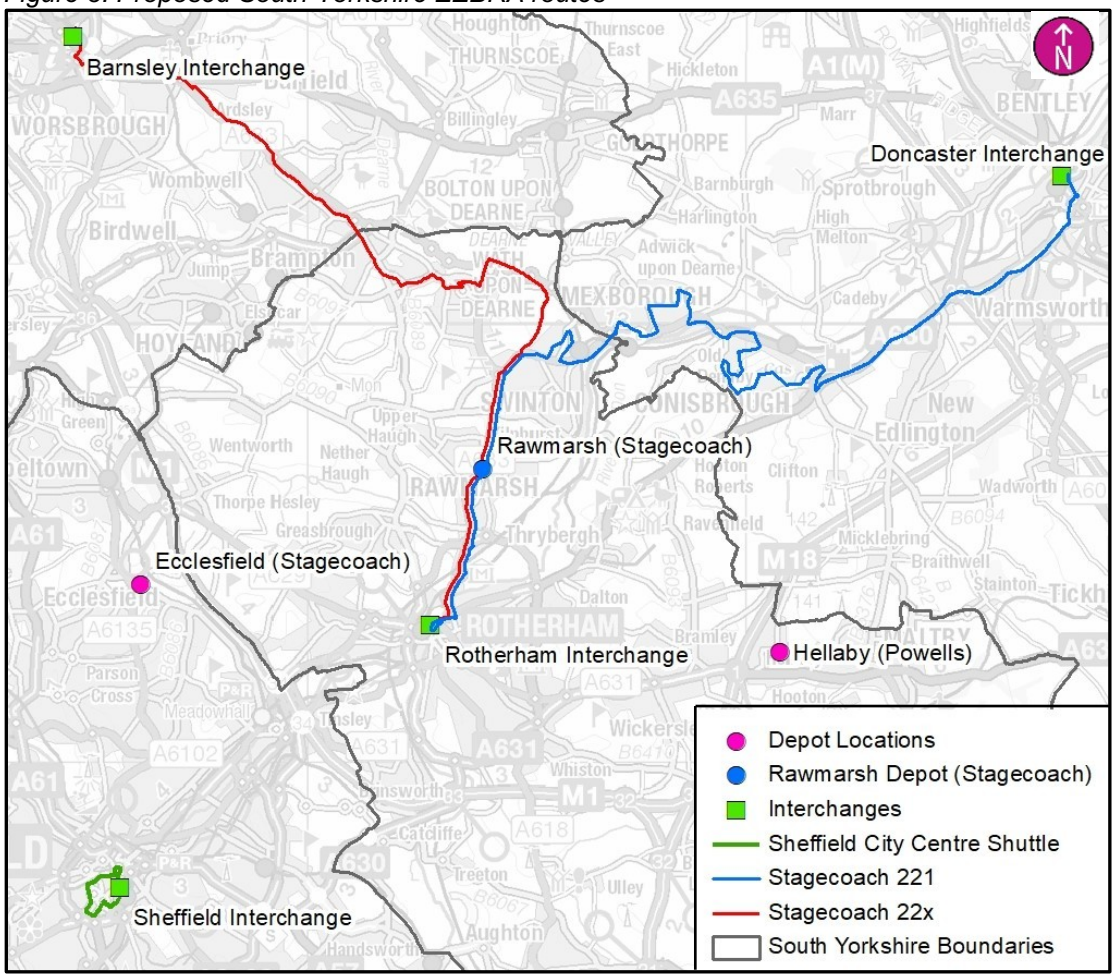


Figure 3 shows the proposed routes across South Yorkshire where the ZEBs will operate. These routes include the 22x (Rotherham to Barnsley), 221 (Rotherham to Doncaster), as well the proposed new electric Sheffield city centre shuttle bus.

Figure 3: Proposed South Yorkshire ZEBRA routes



The 221 and 22x are long distance interurban routes which link three local authority areas across South Yorkshire – Barnsley, Rotherham and Doncaster. These routes also target the CAZ and AQMAs across South Yorkshire, which will be discussed further in **Section 3.1.4.**

Figure 4 [redacted] electric city centre shuttle bus [redacted] will help to improve connectivity and accessibility across the city centre, linking key destinations [redacted] there would also be increased integration with other zero emission public transport modes such as the Supertram and Tram-Train.

SYMCA recently delivered the award winning Tram-Train project in South Yorkshire (2019 Global Light Rail Awards winner). This was a government funded Tram-Train project, delivered in partnership between South Yorkshire Passenger Transport Executive – soon to form part of SYMCA, Stagecoach Supertram and Northern Rail, which piloted the pioneering technology which allows passengers to make a single continuous journey, connecting tram stops with conventional railway stations. The zero emission Tram-Train connects Sheffield City Centre to Parkgate Shopping Centre, via Rotherham Central Railway Station.

Due to the nature of Tram-Train being zero emission transport, lessons learnt from delivering this scheme will be implemented in our ZEBRA project. Further details on the Tram-Train lessons learnt, relevant to ZEBRA delivery, are outlined in **Section 3.2.1.**

For our Sheffield City Centre ZEBRA project, the bus stops used for the electric city centre shuttle bus would be in very close proxmity to the Supertram and Tram-Train stops, helping to create a more integrated multimodal zero emission public transport offering. As mentioned previuosly, the Tram-Train service calls at Rotherham Railway Station, which is in very close proximity to the 221 and 22x Stagecoach services, which would become electric through the ZEBRA scheme.

Our ZEBRA projects (both the city centre shuttle and the 22x / 221) will therefore help to create a multimodal integrated zero emission public transport offering across the whole South Yorkshire region. This would create marketing opportunities around 'go green all the way' with the integration of the ZEBs, Supertram and Tram-Train offerings. Further details of our marketing strategy is shown in **Section 5.8.**

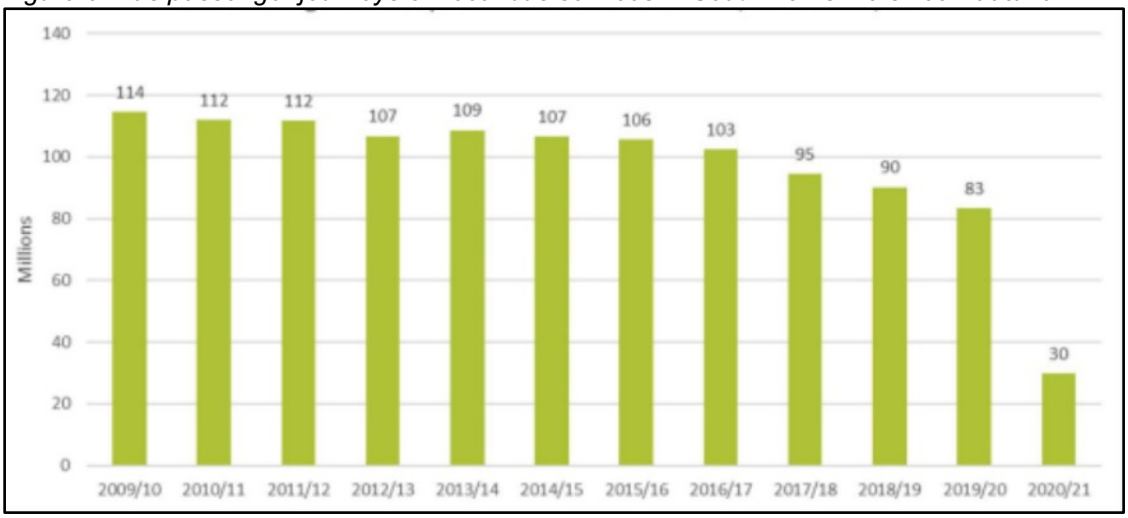
As discussed in **Section 2.2**, work is ongoing to identify [redacted] to run the shuttle bus over the minimum five-year period. As such, in mitigation an alternative option has been provided, which would use the same number of electric buses (4) and the same infrastructure in the city centre and be based at the same location (Sheffield Interchange). This alternative option would use existing tendered bus service budgets, so it would not need [redacted] as is the case of the city centre shuttle bus.

3.1.3 Background of the local bus network in the area

The South Yorkshire bus network is one in decline. Over the last decade, annual passenger miles have fallen by 23 million, bus miles operated have reduced by 11.5% and funding is 48% less than it was in 2010. Currently, for many people, the bus does not present a viable choice, either in where the network runs, or the times of operation, or through affordability, or even through issues of security and accessibility. This cannot continue.

Bus patronage in South Yorkshire has been in steady decline for over a decade. Passenger journeys in South Yorkshire fell from nearly 115 million in 2009/10 to just over 90 million in 2018/19 (the last full year before the Covid-19 pandemic) – a fall of over 21%.The Covid-19 pandemic has accelerated this decline over the last 18 months, as illustrated in **Figure 6** below.

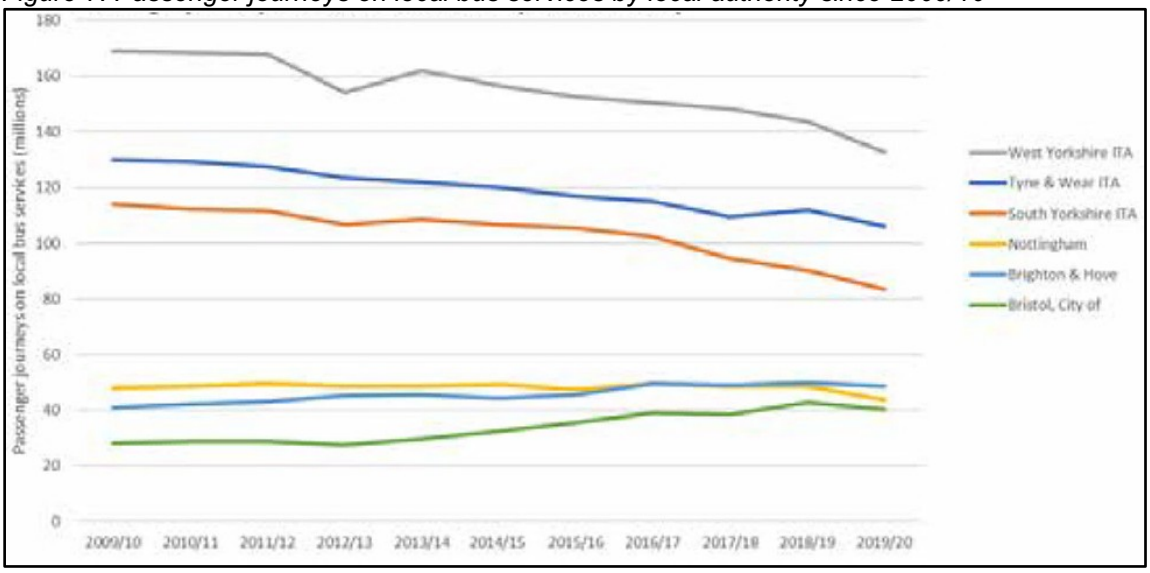
Figure 6: Bus passenger journeys on local bus services in South Yorkshire since 2009/10



Source: SYPTE from bus operators

This is not an uncommon trend in metropolitan areas outside London, such as West Yorkshire and Tyne and Wear local authority areas, as shown in **Figure 7**, although the decline in South Yorkshire has been steeper. In Tyne and Wear, where there was a small increase in bus use before the pandemic, the overall decline over the same period was around 14%, whilst in West Yorkshire, the decline was around 15%. The figure below also shows that some urban areas have bucked the national trend of patronage decline, although some of the more recent increases are modest. These examples are characterised by a large dominant urban centre and a large principal bus operator, and so might not be directly comparable to South Yorkshire, but there are lessons to be learnt from some of these other areas.

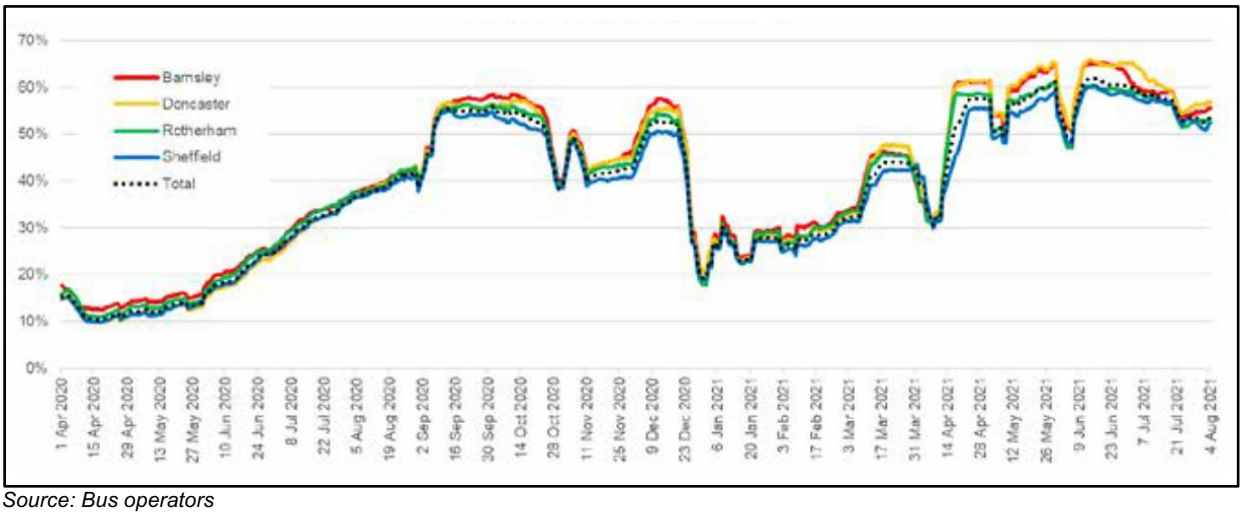
Figure 7: Passenger journeys on local bus services by local authority since 2009/10



Source: DfT

The latest overall patronage figure in South Yorkshire is just under 74% of pre-Covid levels (taken as January 2020), measured at mid-September 2021. There are variations in the recovery in each local authority area, with Barnsley at 76%, Doncaster also at 76%, Rotherham at 70% and Sheffield at 68%. This difference is shown in **Figure 8** below.

Figure 8: Bus Patronage by local authority as a percentage of pre-Covid (January 2020) levels since 2020



Source: Bus operators

The commercial bus operators within South Yorkshire are shown in **Table 3-3** of **Section 3.1.5**. By far the largest two operators within South Yorkshire are First and Stagecoach, which between them operate around 96% of the annual bus mileage across the region.

Some services which are not commercially viable can be designated as socially necessary. These are paid for by the local authorities but commissioned centrally by South Yorkshire Passenger Transport Executive (SYPTE) following the Tendered Services Criteria Model on their behalf. As of April 2021, there were 93 routes supported by tendered services, representing 140 service numbers, and covering 85,490 weekly miles, equivalent to 4.45 million miles each year. The tendered services budget for 2020/21 was £5.8m.

It is evident that there will be a change in commuting patterns, at least in the short term, driven by new models of hybrid working. What this means for bus patronage is not clear at this time, but this does suggest a need for some future flexibility in the bus network to respond to the changes, whatever they may be.

Around 9% of journeys to work across South Yorkshire are currently made by bus. Compared with this, 71% of residents currently travel to work by car, and this proportion has increased since 2001. In 2019, 62% of all journeys in South Yorkshire were undertaken by car. Buses struggle to compete with private vehicle usage in South Yorkshire, for many reasons, as outlined in the South Yorkshire bus review (further details in **Section 3.3.1**).

In summary, although the bus patronage levels are currently in decline, buses still form a critical element of the South Yorkshire transport network – connecting people to jobs, education, shops, health and leisure facilities, as well as family and friends. Their importance in supporting the inclusive, green future that South Yorkshire wants and needs, cannot be underestimated. The bus has to have the necessary support to play its full role in the future transport network of South Yorkshire. Targeted interventions have been proposed and are being delivered to improve bus journey times and reliability across the region. This includes the existing Transforming Cities Fund (TCF) projects such as the Sheffield City Centre TCF project (also known as Connecting Sheffield), which aims to improve the City Centre environment by creating new green spaces alongside direct, safe and attractive walking and cycle routes. New bus corridors will simplify routes, allowing buses to cross the City Centre more quickly and avoid congestion hot spots, helping to improve bus service reliability.

https://connectingsheffield.commonplace.is/proposals/city-centre-proposals

Another related TCF scheme is the Abbeydale Road and Ecclesall Road bus corridor improvements, which will give greater priority to buses on the Southwest side of Sheffield. This will reduce delays for people travelling on buses to and from this area to the city centre.

https://connectingsheffield.commonplace.is/proposals/abbeydale-road-and-ecclesall-road

In addition to the TCF projects, there will also be future projects which will be delivered through the Bus Services Improvement Plan (BSIP) and the City Region Sustainable Transport Settlement (CRSTS). This includes targeted bus priority improvements. This highly ambitious programme of works will seek to address the trend of declining bus patronage. Together with the ZEBRA proposals, travelling by bus would become a more attractive proposition not only from a journey time and journey time reliability perspective, but it will also be a much cleaner form of transport, improving the air that people breath, as well as helping to tackle the climate emergency. Further information is provided in **Section 3.2.2** (Complementary proposals / projects) which highlights that the ZEBRA benefits could be maximised by delivering these associated projects in tandem.

3.1.4 The case for change - why this area and why now?

Air quality challenge in South Yorkshire

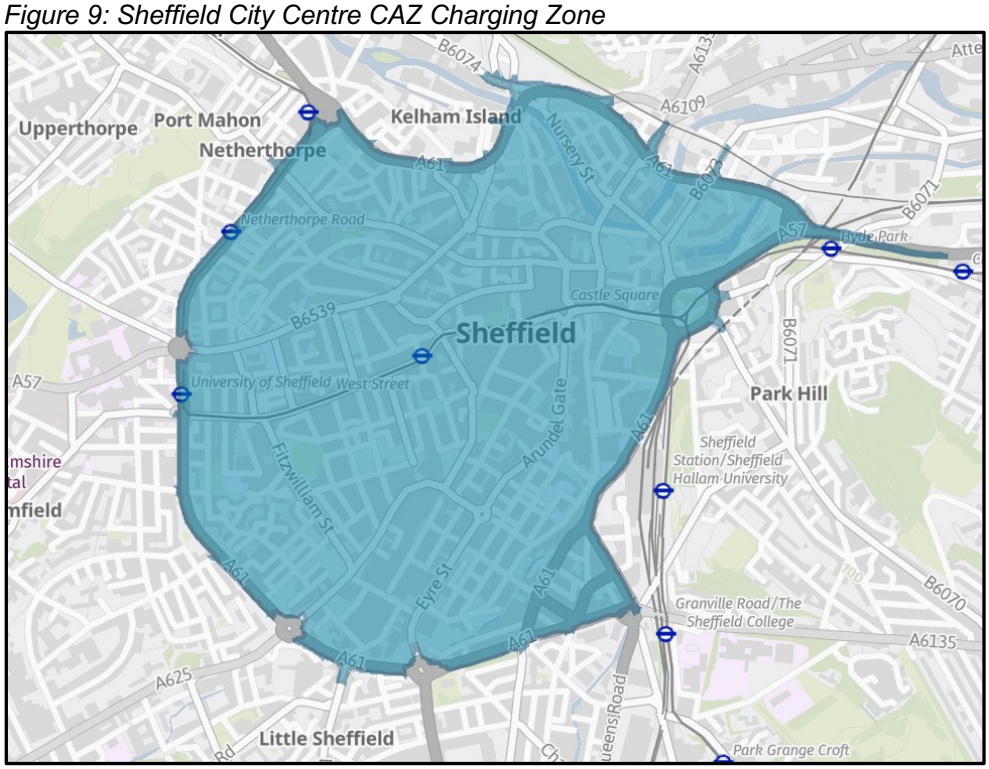
In South Yorkshire, there are 28 areas declared as AQMAs for exceedances of the pollutant NO2. The entire urban area of Sheffield has been identified as an AQMA, in addition to 6 locations in Barnsley, 7 in Rotherham and 8 in Doncaster. Each of these AQMAs has an Air Quality Action Plan (AQAP), setting out measures which will reduce emission levels.

Air pollution contributes to 500 deaths a year in the Sheffield alone. The harm done includes lung cancer, cardiovascular disease, and stroke. The biggest cause of this pollution is transport, especially diesel vehicles. Sheffield has been in breach of legal limits for NO2 since January 2010. In October 2021, Sheffield City Council (SCC) published its CAZ charging zone, to tackle the high levels of NO2 within the urban centre. **Figure 9** shows the proposed charging area within the city's ring road.

From late 2022, some people will have to pay to enter the city centre after Council leaders agreed to introduce the 'Category C' CAZ. Buses, taxis, vans and lorries that do not meet the necessary emissions standard will have to pay to drive in and around the zone. Euro 6 buses or better would be exempt from the charge. LGVs, taxis, coaches, buses and HGVs not meeting the necessary standards would be charged:

- £10 per day for LGVs and Taxis.
- £50 per day for coaches, buses and HGVs.

Figure 9: Sheffield City Centre CAZ Charging Zone



The proximity of the South Yorkshire ZEBRA proposal alongside the region's air quality issues (CAZ / AQMAs) is shown in **Figure 10** below.

The ZEBRA proposals, would enhance the Clean Air Plans (CAP) by:

- Allowing to move directly from diesel to ZEB. Funding for the CAP is only sufficient to allow upgrade of the cleanest class of diesel vehicle.

- Markedly improving the degree to which fleet upgrades achieve savings in zero emissions, as well as helping to reduce carbon emissions which is not viable under current funding opportunities.

- Directed proposals under the CAP involve rerouting of buses to address an air quality hotspot. Improving the fleet beyond Euro 6 diesel will reduce the proportion of buses which must be diverted to achieve compliance, giving more flexibility to meet passenger needs within air quality constraints.

Rotherham and Sheffield, key areas of the South Yorkshire ZEBRA proposal, have plans to address the CAZ and AQMAs under a joint Sheffield–Rotherham CAP, with a combination of vehicle fleet upgrades and traffic management measures. Delivery of the traffic management measures was approved by the Rotherham Council cabinet, with fleet upgrades dependent upon securing Clean Air Fund monies, dependent on submission of a joint business case with SCC. Such proposals include highway improvements on the A633 at Rawmarsh High Street and bus priority including 450m of bus lane reallocated from traffic lanes. Note, the 221 and 22x buses, both proposed to become electric through ZEBRA, travel through Rawmarsh High Street, which demonstrates that our proposal is targeting areas of greatest air quality need.

Looking at Rotherham specifically, the wider South Yorkshire Transforming Cities Fund (TCF) Tranche 2 programme includes 1.4km of new bus lane, 4.5km of new separate cycleway, and

1km of improved cycle routes through a combination of traffic reduction, infrastructure improvements, as well as two new tram-train park and ride sites to support the decarbonisation objective.

A project that is currently being developed involves the upgrade of up to 42 diesel Community Transport (CT) minibuses to electric. This will include the necessary charging infrastructure at the four CT depots across South Yorkshire. These depots are in Sheffield, Doncaster, Rotherham and Barnsley. This will be a complementary project to the ZEBRA proposals where we will combine any lessons learnt and take away any best practice from CT vehicle and infrastructure procurement process. This project is currently at the business case stage, but lessons will be shared between both the CT and ZEBRA projects.

A further project currently being progressed involves the roll out of 109 electric vehicle chargers across South Yorkshire. This project is being funded by the Get Building Fund (GBF) from Central Government, with a total funding allocation of £1.8m. This project will facilitate the roll out of 95 fast chargers, 2 fast chargers, and 12 rapid chargers across the region. Any lessons learnt will be included in the ZEBRA project.

Figure 10: South Yorkshire ZEBRA proposals – targeting the CAZ and AQMAs

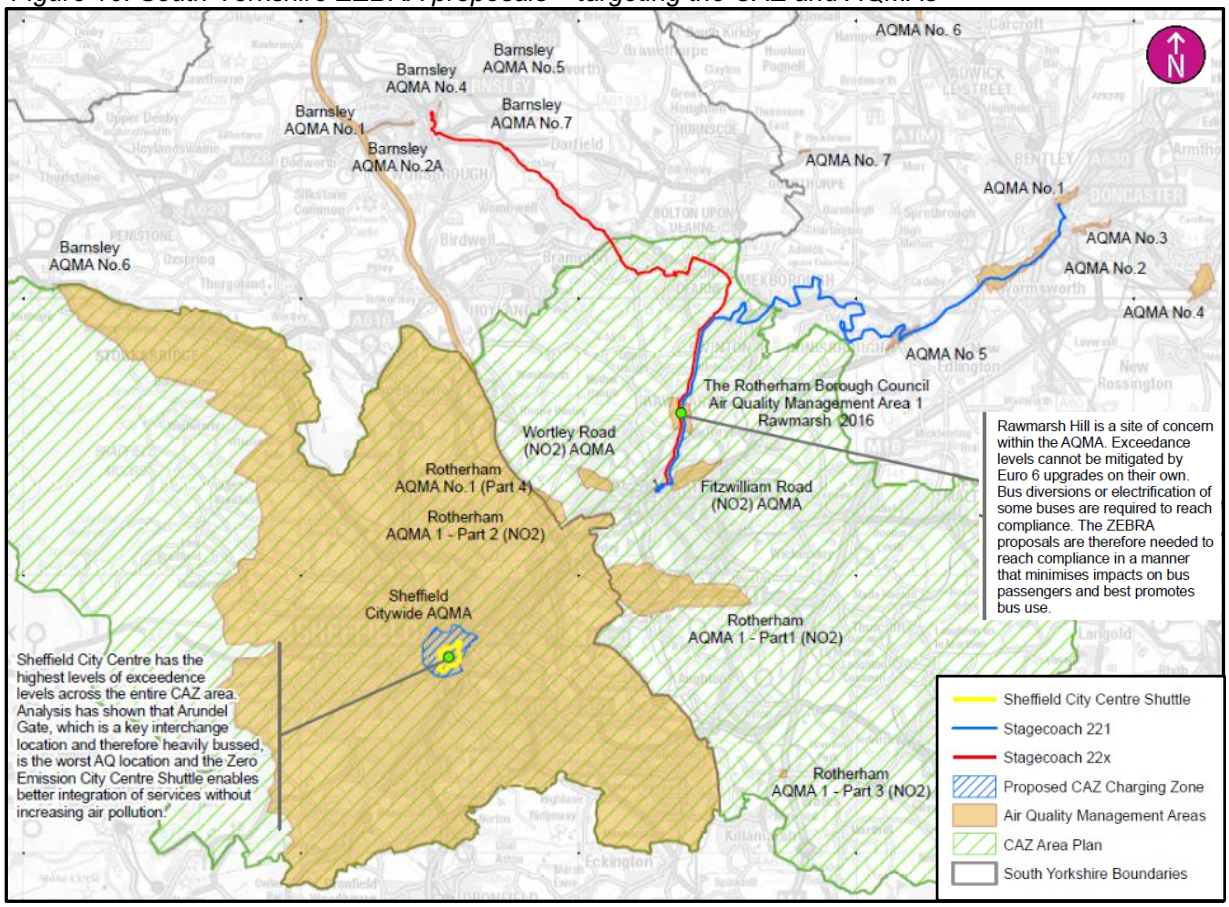


Figure 10 shows that our ZEBRA proposals would not only address the CAZ in Sheffield but would also address some of the key AQMAs across the region.

Impact of the ZEBRA proposal on Air Quality (NOx emissions)

221 bus service

SYMCA's 'Electric Bus Toolkit' (EBT) was used to calculate the NOx emissions saved by introducing ZEBs on the 221 service (further details on the EBT are provided in **Section 3.2.7**). The air quality calculation from the toolkit is done by comparing the existing situation with a zero-emission fleet with no emissions. The existing situation is calculated in the model based on the distance travelled by the buses and knowledge of the vehicle emissions from the type of bus currently used.

This analysis, performed by Arup in November 2021, determined that there would be an annual saving of around 8.5 tonnes per year in NOx emissions by introducing ZEBs on the 221, as per our ZEBRA proposal.

22x bus service

Analysis using the EBT of the current buses used on the 22x route, as well as the distance travelled by these buses, has shown that there would be an annual saving of around 0.9 tonnes per year in NOx emissions by introducing ZEBs on the 22x, as per our ZEBRA proposal. It should be noted that one of the key reasons as to why there is a difference in NOx savings when comparing the 221 and 22x, is due to the 221 service using Euro 4 buses (more polluting for NOx) compared to the Euro 6 buses used on the 22x (less polluting for NOx). These newer and cleaner Euro 6 buses will be cascaded to other routes in South Yorkshire, replacing older and dirtier buses. This would therefore have a knock-on effect on improved air quality through the cascading of existing buses.

Details of what will happen to the existing vehicles used on the 221 and 22x is outlined in **Section 3.2.4**. A direct impact of air quality improvements resulting from a new electric city centre shuttle bus cannot yet be made. This is because the shuttle bus service doesn't currently exist.

Impact of the ZEBRA proposal on South Yorkshire Zero Emission Bus Fleet

There are currently no ZEBs in operation within South Yorkshire (fleet breakdown provided in **Table 3-3** of **Section 3.1.5**). To meet the ambition of a full ZEB public transport fleet by 2035, and to tackle the large air quality issues across our region (CAZs and AQMAs), urgent action is needed now.

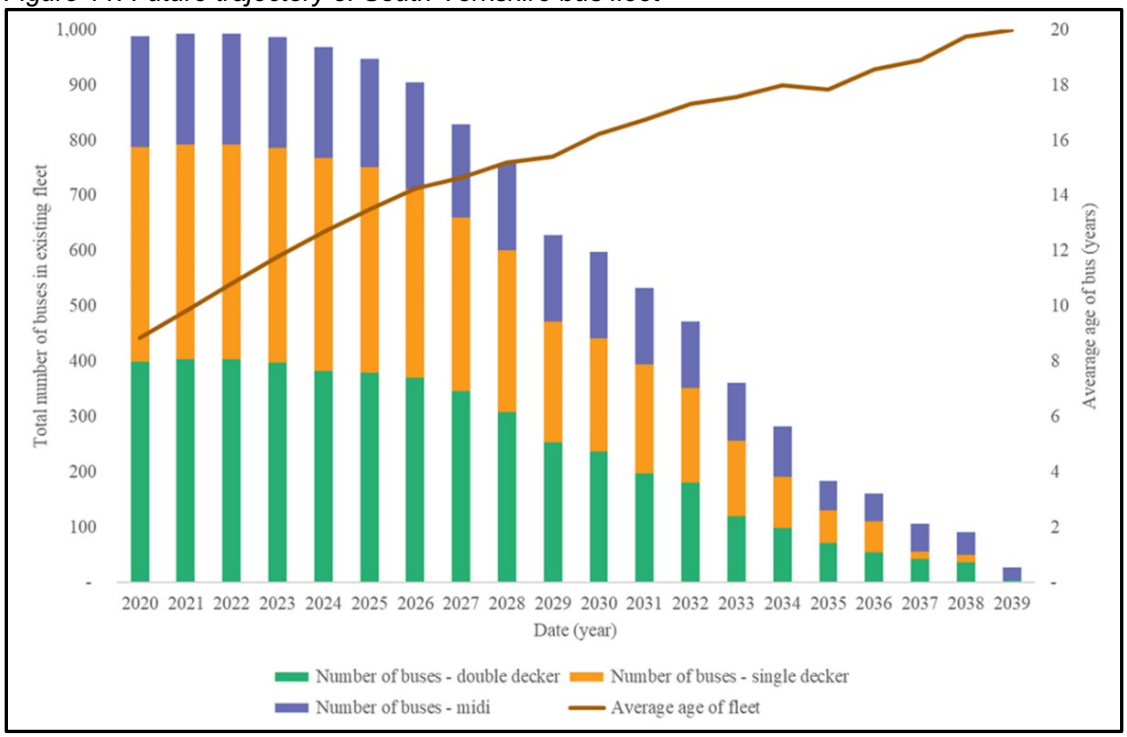
With such a low starting point, even with the ZEBRA proposals, this would only result in a zero-emission fleet of around 3.5% for the defined area of South Yorkshire. Investment in ZEBs is urgently needed based on air quality need and to meet our ZEB fleet target.

It should be noted that the 3.5% ZEB projection is based on the South Yorkshire region as a whole. When looking specifically at the Rotherham to Doncaster and Rotherham to Barnsley bus corridors (services 221 and 22x), the ZEBs on these specific corridors would account for 32% of the fleet. Further details on why the 221 and 22x were chosen for ZEBRA, is provided in **Section 3.2.5**. With regards to the electric City Centre shuttle bus proposal, this would be a brand-new route through the city, which no other service currently operates.

Future trajectory for the South Yorkshire bus fleet

Figure 11 shows the future year trajectory for the South Yorkshire bus fleet, broken down by vehicle type. The average age of the fleet in South Yorkshire is currently 10 years (see **Table 3-3** of **Section 3.1.5**), compared to the national average of 8 years. This underlines the urgency of investment which is needed in South Yorkshire to upgrade our vehicles to zero emission.

Figure 11: Future trajectory of South Yorkshire bus fleet



Climate Emergency

Alongside air quality, there is a wider issue of responding to the climate emergency. Most of the energy that is consumed in the region is produced from fossil fuels with petrol and diesel dominating the transport sector. Transport across the region is responsible for approximately 2,770t CO2, equating to the total footprint and representing a significant area which needs to be tackled to meet our net zero target.

The SYMCA declared a Climate Emergency in November 2019 and published an Energy Strategy in 2020 that sets out the goals and policies required to meet net-zero by 2040. This includes transitioning to a zero-emission public transport fleet by 2035 and securing a 10% reduction in car miles by 2030, rising to a 25% reduction in 2040. The Energy Strategy made clear the role of transport in supporting the region's transition to a low carbon economy, including the investment needed in zero emission vehicles.

Impact of the ZEBRA proposal on CO2 emissions

221 bus service

Analysis of the current buses used on the 221 route, as well as the distance travelled by the buses, has shown that there would be an annual saving of around 1070 tonnes of CO2 emitted into the atmosphere, as a result of our ZEB proposal for the 221 bus service.

22x bus service

Analysis of the current buses used on the 22x route, as well as the distance travelled by the buses, has shown that there would be an annual saving of around 1000 tonnes per year in CO2 emitted into the atmosphere, as a result of our ZEB proposal for the 22x. As mentioned earlier in the chapter, Euro 6 buses used on the 22x route will be cascaded to other routes within South Yorkshire. This will mean a knock-on effect of CO2 reduction through the cascading of vehicles.

Enhanced Partnership

In June 2021, the SYMCA committed to develop an Enhanced Partnership. The Enhanced Partnership will form the basis of delivery of the region's Bus Services Improvement Plan (BSIP). The Enhanced Partnership Plan is currently out to public consultation and if approved will be in place from April 2022.

https://southyorkshire-ca.gov.uk/SheffieldCityRegion/media/PDF-library/Transport%20pdfs/37770_Bus-Service-Improvement-Plan_FINAL.pdf

The BSIP makes reference to the ZEBRA bid, as well as a pledge to introduce a new zero emission bus fleet. The Enhanced Partnership approach in the short-term, will build on existing bus partnerships in South Yorkshire. Voluntary bus partnerships between the constituent local authorities and bus operators were introduced progressively in each of our four local authority areas between 2012 and 2017 and are currently overseen by SYPTE. This model means that some operational decisions (for example, route changes) are taken in consultation between operators, local authorities, SYPTE, as well as the public where appropriate. The Enhanced Partnership will be supported by new governance arrangements that include wider passenger representation and a legally binding commitment to hold parties accountable for delivery.

Alignment with DfT's objectives / priorities

The information provided in this chapter has demonstrated a strong case for ZEBRA investment in South Yorkshire. The following tables, taken from **Section 3.3.2** of this business case, shows the alignment of our proposals to DfT's ZEBRA objectives (**Table 3-1**) and strategic priorities (**Table 3-2**).

Table 3-1: ZEBRA scheme alignment with DfT's ZEBRA objectives

DfT ZEBRA Objectives	Alignment with South Yorkshire proposal
1. To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO2 emissions.	Our ZEBRA proposal will support this objective by reducing the transport sector's contribution to CO2 emissions, by the introducing the first ZEBs across South Yorkshire. There would be an annual CO2 saving of around 1,070 tonnes per year on the 221 service, and around 1,000 tonnes of CO2 saving annually on the 22x. The existing 22x Euro 6 buses would be cascaded to other South Yorkshire bus routes, which would therefore have an additional air quality knock on benefit in our region, by replacing the dirtiest buses with the cascaded Euro 6 vehicles. There isn't a diesel electric city centre shuttle bus currently in operation, so direct comparisons on air quality / CO2 benefits cannot be made in the same way that they have been for the 221 and 22x.
2. To support the roll-out of the 4,000 Zero Emission	Our ZEBRA proposal would contribute to this roll-out by delivering 27 ZEBs by September 2023. This would be a first phase of the

Buses that the government committed to in February 2020.	transition to zero emission buses in South Yorkshire, to help meet the target of a fully zero emission public transport fleet by 2035.
3. To support bus manufacturers in the development of zero emission bus technology.	SYMCA would help support manufacturers in the development of zero emission bus technology. This would be through the provision of quarterly monitoring information to DfT, as part of the monitoring and evaluation requirements of ZEBRA. Information captured via telematics would be collated through the South Yorkshire ZEBRA scheme and will help DfT and bus manufacturers to better understand how the technology works in real world situations. Due to the more challenging nature of the 22x and 221 services (long route lengths), this would provide a good opportunity for operators to understand battery range in a challenging real-world situation, alongside implications on battery degradation. In addition, due to the hilly nature of Sheffield, this adds further opportunities for learning and testing the vehicles on more challenging topography in the UK.
4. To support partnership working between Local Transport Authorities, bus operators, and other local stakeholders as set out in the National Bus Strategy.	South Yorkshire already has a voluntary bus partnership, that has fostered a close working relationship between SYPTE, the local bus operators and the four local authorities, in developing and implementing bus priority improvements. We will be transitioning into the BSIP arrangements, as set out in the National Bus Strategy. Partnership working will be at the forefront of the ZEBRA proposals, ensuring a successful project for the public, the SYMCA and bus operators.
5. To understand better the challenges of introducing zero emission buses and supporting infrastructure to inform future government support for Zero Emission Buses.	The project will document any lessons learnt throughout the life of the project to ensure DfT better understands the challenges of introducing ZEBs and supporting infrastructure. In addition, a well thought out monitoring and evaluation plan will also help inform the government in terms of best practice for similar schemes moving forward.

Table 3-2: ZEBRA scheme alignment with DfT's strategic priorities

DfT's Strategic Priorities	Alignment with South Yorkshire ZEBRA proposal
1. Grow and level up the economy	The Government's Levelling Up Fund priority list of local authority areas has the following classification for the districts of South Yorkshire. • Barnsley (priority 2) • Doncaster (priority 1) • Rotherham (priority 1) • Sheffield (priority 2) It should be noted that over 30% of neighbourhoods in South Yorkshire are in the most deprived neighbourhoods in England. The ZEBRA project would: • help with the transition to a zero-emission public transport network. • help stimulate the local economy by upskilling the local bus drivers to drive electric buses as well as upskill the local engineering workforce through the servicing and maintaining of the electric buses and infrastructure. • improve the local public transport service through the addition of brand new, clean buses, with enhanced accessibility specifications.

	This should improve the passenger usage on the network, helping to provide good access to jobs across South Yorkshire. • help to grow and level up the economy with greater access to jobs and opportunities, in particular with the inclusion of a new electric city centre shuttle bus service, which would improve public transport connectivity and boost patronage.
2. Reduce environmental impacts	The ZEBRA proposal will deal with the priority areas directly, through improving the local air quality, targeting local CAZs and AQMAs. It would also help to tackle the climate emergency.
3. Improve Transport for the user	The ZEBRA proposal would improve transport for the user, by providing a cleaner, modern and more appealing mode of transport, compared to the aging fleet of South Yorkshire. Alongside other proposed schemes in South Yorkshire, funded through TCF, LUF and CRSTS, it would be a package of improvements to improve the overall offering to the user. With specific regards to the proposed new city centre shuttle bus, this would improve transport for the user by offering something different to what is there currently, helping to provide improved public transport accessibility and connectivity in the city centre.

3.1.5 Vehicles and Operators in South Yorkshire

The list of commercial bus services in South Yorkshire is shown in **Table 3-3** below. [redacted] are by far the largest operators in the region in terms of fleet size, and between them operate [redacted] of the annual bus mileage across the region.

Other smaller operators include [redacted]

Table 3-3 shows the fleet sizes of the operators in South Yorkshire, alongside the vehicle ages and their Euro engine status. There are no ZEBs in operation in any of the fleets within South Yorkshire. The table also shows the number of bus trips per week by operator. This is more useful than the number of routes per operator, as it could be one trip or a hundred trips per route. This all provides good context for the fleet operations in South Yorkshire.

Table 3-3: Age / Euro category of vehicles operating within South Yorkshire (September 2021)

Main Operator	Euro I	Euro II	Euro III	Euro IV	Euro V	Euro VI	EEV*	ZEB	No Buses	Avg. age (yrs)	Trips per week
[redacted]	-	-	32 (8.8%)	6 (1.7%)	78 (21.5%)	247 (68%)	0	0	363	9.9	29,448
	-	-	26 (8.6%)	60 (19.9%)	115 (38.2%)	64 (21.3%)	36 (12.0%)	0	301	9.3	19,635
	-	2 (5.1%)	16 (41%)	15 (38.5%)	6 (15.4%)	0	0	0	39	12.3	1,422
	-	-	1 (6.7%)	5 (33.3%)	5 (33.3%)	4 (26.7%)	0	0	15	9.8	715
	-	-	6 (25%)	6 (25%)	11 (45.8%)	1 (4.2%)	0	0	24	11.7	298
	-	-	9 (25%)	3 (8.3%)	20 (55.6%)	4 (11.1%)	0	0	36	11.3	2,474
	-	-	3 (60%)	0	0	2 (40%)	0	0	5	11.3	210
	-	-	5 (55.6%)	2 (22.2%)	2 (22.2%)	0	0	0	9	16.0	282
South Yorkshire Total Number	**-**	**2**	**98**	**97**	**237**	**322**	**36**	**0**	**792**	**10**	**-**
South Yorkshire %	**0%**	**0.3%**	**15.6%**	**15.4%**	**37.7%**	**51.2%**	**5.7%**	**0%**	**-**	**-**	**-**

**Enhanced environmental vehicle standard.*

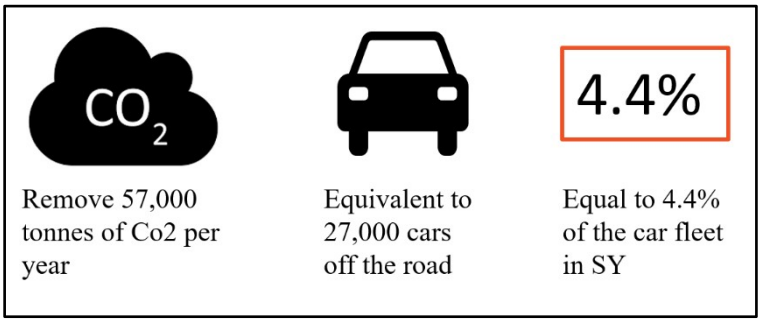
Through close working with SYPTE and bus operators, SCC was awarded £1.947 million from the Government's Clean Bus Technology Fund in Spring 2018. 117 non-Euro 6 diesel buses operating in Sheffield (93 First buses and 24 Stagecoach buses) were retrofitted with technology which improved their engine performance and reduced emissions to a compliant Euro 6 standard. These upgrades are reflected in **Table 3-3.**

CO2 and Air Quality impact of the existing fleet

Carbon Impact

Figure 12 below illustrates that by upgrading the whole South Yorkshire bus fleet to zero emission would have considerable carbon benefits. It would have the equivalent effect of removing 4.4% of the 600,000 cars in South Yorkshire.

Figure 12: Impact of converting the existing South Yorkshire bus fleet to Zero Emission



Air Quality Impact

Table 3-4 below shows the considerable air quality pollutants emitted from buses in South Yorkshire over the course of a year.

Table 3-4: Pollutants emitted by bus operators in South Yorkshire

	NOX (kg/year)	CO (kg/year)	HC (kg/year)	PM (kg/year)
South Yorkshire Buses (all operators)	201694	184942	39795	2042

South Yorkshire Bus Type

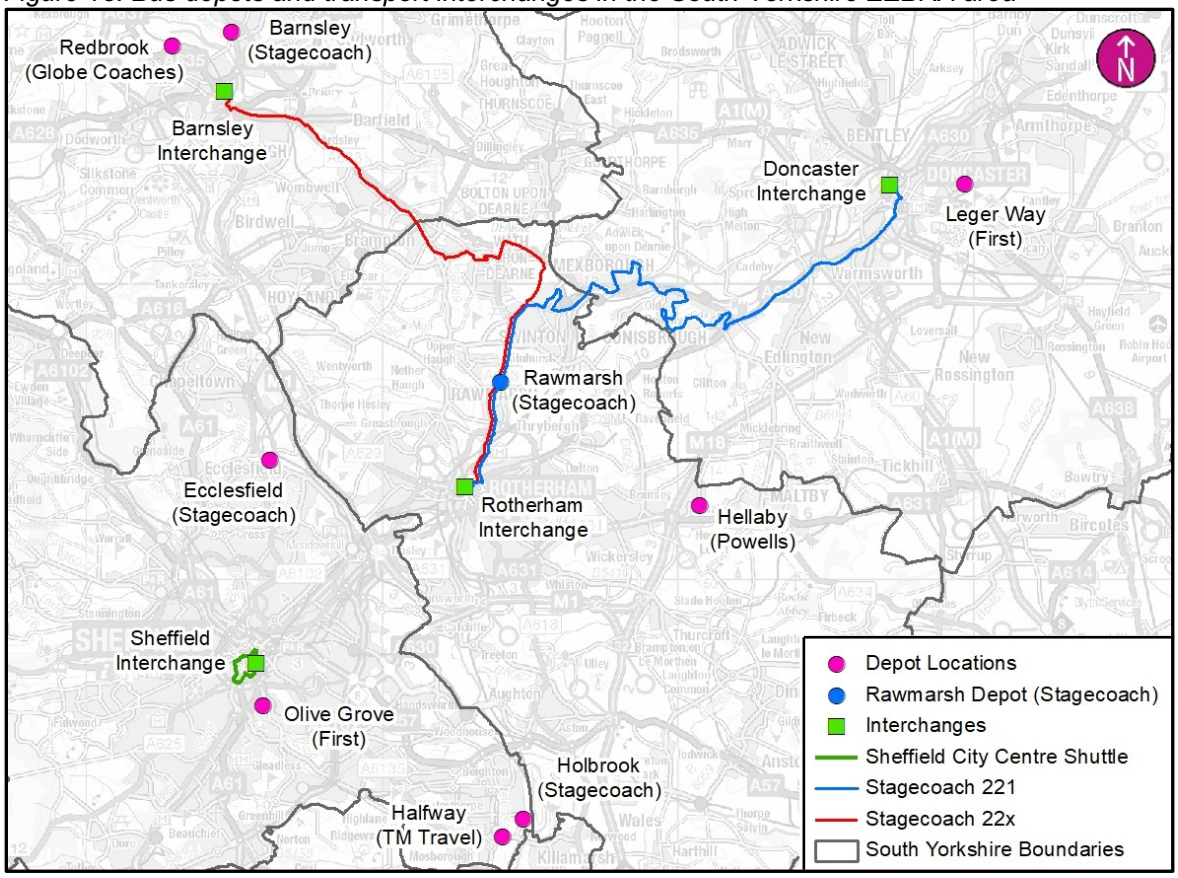
Table 3-5 shows the bus type by operator in terms of midi, single and double decker buses. Just over half of the buses in South Yorkshire are single decker vehicles (55%), with double decker vehicles making up 38%, followed by midi buses at 7%.

Table 3-5 – Midi / Single / Double Decker buses in South Yorkshire

Operator	Midi	Single	Double	Total buses
[redacted]	2	172	189	363
	12	199	90	301
	10	21	8	39
	2	13	0	15
	7	15	2	24
	17	5	14	36
	3	2	0	5
	1	8	0	9
Total S Yorks	**54**	**435**	**303**	**792**
%	**6.8%**	**54.9%**	**38.3%**	

Figure 13 below shows the area of South Yorkshire in relation to the bus operator depots and transport interchanges. This helps to provide some context to the geographical location of the ZEBRA proposal, and the different operators in the region.

Figure 13: Bus depots and transport interchanges in the South Yorkshire ZEBRA area



3.1.6 Proposed Funding Sources

The table below provides an overview of the proposed funding sources to deliver the project.

A - Total Scheme Cost (£)	£15,588,978
B - Total Private Investment (£):	£4,554,206
C - Total Other Public Sector Investment (Non-ZEBRA Funding) (£):	£2,683,051
D - Total ZEBRA Funding Sought (£):	£8,351,721
E - ZEBRA as % of Total Scheme Investment:	54%

[redacted] funding will be required to support the City Centre Shuttle Bus service over the 5-year period. The source of this funding has yet to be confirmed. [redacted]

3.2 PART 2 – SCHEME RATIONALE

3.2.1 - What opportunities or barriers will this scheme unlock? Why is this scheme important for the South Yorkshire?

Becoming a zero-carbon public transport network by 2035

This proposition, if successful, would secure the first zero-emission buses for South Yorkshire, and would be a key stepping-stone towards our goal of a zero-carbon public transport network by 2035.

Our Transport Strategy (Local Transport Plan agreed in 2018), set out plans for a zero-carbon public transport system by 2040. However, since then, the declaration of the climate emergency by South Yorkshire Leaders, and the creation of an Energy Strategy to help address these challenges, highlights the need for urgent action. The result of this urgency is the acceleration of our target date for a zero-emission bus fleet operating in the region, bringing this forward by five years to 2035.

Delivery of the SYMCA's environmental aims

Our region includes two CAZs (Sheffield and part of Rotherham) and SYMCA announced a Climate Emergency in November 2019. The introduction of the first ZEBs across South Yorkshire will be a demonstrable and visible step in us delivering our strategic environmental aims. **Figure 10,** previously shown, illustrates the ZEBRA proposals in relation to the CAZ and AQMAs across the region, which the ZEBRA scheme will address.

Integration of Zero Emission Public Transport modes

The ZEBs would perfectly complement our tram and pioneering Tram-Train system, which is already zero-emission, as well as making a significant contribution towards South Yorkshire's aim of an integrated transport system that is fully zero-carbon.

Relevant lessons learnt will be applied from SYMCA's award winning Tram-Train pilot project in South Yorkshire, including:

1) *The scheme was initiated as a limited trial of new technology and over time the focus changed to operating a trial service and more recently as an ongoing operational service. This has brought into focus some competing imperatives between the original objective and operational reality.* This is of relevance to our ZEBRA project due to the need to deliver on the objectives set out in this business case, but also ensure lessons are learnt for future roll out of electric bus schemes – as this would be our first Zero Emission Bus scheme in South Yorkshire.
2) *Effective early engagement between SYPTE and the operator is essential, and the overall programme should be developed in an integrated manner. For example, the work should be phased such that the vehicle specifications are known prior to the Design Stage of the infrastructure work.* For ZEBRA we have been working closely and in an integrated manner with Stagecoach in developing the proposals, including a joined-up approach to market engagement. The lesson on vehicle specifications are also of relevance to ZEBRA.
3) *Other key operating constraints, such as the traction power solution, should be specified from the outset and remain unchanged. The scope must be absolutely fixed before contracting.* For ZEBRA this has relevance for what is needed prior to contracting.

4) *Client Requirements and Concept of Operations should be clearly set out at the outset and Governance arrangements sufficiently robust to ensure both are met.* For ZEBRA, this governance clarity is set out in the Management Case, but the requirements of the ZEBRA operation will be clearly set out in the legal agreement between the SYMCA and Stagecoach for the 221 and 22x.
5) *Driver/staff training took longer than was originally envisaged.* In the case of ZEBRA, the driver/staff training would be simpler than training the tram drivers to operate on the railway network. That said, sufficient time will be allowed in the programme to ensure sufficient training.
6) *For any future vehicle procurement, a longer period of testing and commissioning of vehicles should be allowed.* For ZEBRA, the vehicle procurement (buses) is different to that of Tram-Trains. That said, close engagement with bus manufacturers during December 2021 has ensured robust timescale estimates for vehicle (and infrastructure) procurement.

A current project, discussed in **Section 3.2.2** of the business case, includes the upgrade of the South Yorkshire Community Transport fleet from diesel to electric. This will ensure that zero emission transport is possible for those with reduced mobility that are not able to access the standard public transport provision.

Closer working with partners

The ZEBRA proposal will stimulate closer working with all four local authorities and at least one of our South Yorkshire bus operators. The 221 / 22x project will involve close working with Stagecoach. There will also be close working with whichever operator wins the new tender for the city centre shuttle bus service. Closer working with all operators and local authority partners will take place through the implementation of the BSIP.

Increase public transport accessibility and mode shift

The introduction of a new zero emission shuttle bus service in Sheffield, would improve public transport accessibility and connectivity in the city centre. It would increase bus patronage as well as help to achieve a mode shift away from the private car into more sustainable modes. This would be done through the creation of a new service which would improve public transport accessibility across the City Centre – helping to better integrate bus services across the city, but also integrate with other public transport modes including tram, tram-train and rail. Our ZEBRA project would therefore help to address the decline in public transport usage post-Covid.

Provide a package of public transport improvements

The proposed ZEBRA scheme shouldn't be seen as an isolated project around air quality, but rather as a part of a package of measures to improve the quality of transport for the user. This will be done through various ambitious proposals including:

- TCF projects currently being delivered.
- CAZ proposals.
- Levelling up Fund (LUF) projects.
- BSIP.
- City Region Sustainable Transport Settlement (CRSTS) projects.

3.2.2 – Complementary proposals / projects

CAZ proposals include highway improvements on the A633 at Rawmarsh High Street and bus priority including 450m of bus lane reallocated from traffic lanes. Both the 221 and 22x travel along the A622 at Rawmarsh hill, so these ZEBRA services would benefit from the CAZ improvements, leading to more bus journey time reliability along these routes, maximising the benefit to the passengers.

The current Sheffield City Centre TCF project helps to provide some wider strategic context for the proposed electric city centre shuttle bus, as included in this business case. Sheffield City Council's Transport Strategy (2019-2035) emphasised a growing role for public transport to enable development and growth in the city centre. To create headroom for additional jobs and housing, requires a more intelligible, integrated and competitive bus network as an alternative to growing private car usage that would result in choking the potential for Sheffield city centre as the key economic driver of the wider city region. The Strategy proposed a streamlined, more direct series of bus routes, including a city centre bus "box" to enable journey time savings both to and through the city centre in order to connect it better to residential areas and for cross city journeys particularly to the Lower Don Valley and Meadowhall (shopping complex). The TCF city centre project (also known locally as Connecting Sheffield) would be a step toward implementing this. [redacted] The ZEBRA fund provides an excellent opportunity to trial this as an electric shuttle bus service, and even more so in view of the upcoming Clean Air Zone (CAZ).

A further project currently being developed, funded through a combination of ITB, SYMCA Gainshare, and potentially the City Region Sustainable Transport Settlement (CRSTS) involves the upgrade of up to 42 diesel Community Transport (CT) minibuses to electric. This will include the necessary charging infrastructure at the four CT depots across South Yorkshire (Barnsley, Doncaster, Rotherham and Sheffield [redacted] This project is currently at the final business case stage.

A selection of our proposed CRSTS and/or BSIP 'journey improvement' projects across South Yorkshire includes:

- Modernisation of shelters.
- Passenger Information Displays (PIDs) at bus and tram stops.
- Making contactless payment available across all buses.
- Providing community-based off vehicle ticket vending machines.

These improvements, throughout the South Yorkshire bus network, would improve the offering for bus users, helping to maximise the benefits of the ZEBRA scheme.

A related 'travel corridor enhancement' project, is included in the South Yorkshire BSIP:

- Travel corridor enhancements including the **A633 at Warren Vale**. This proposal, currently at feasibility stage, would involve a new southbound bus lane on the A633 southbound towards Rotherham. The ambition of the bus lane is for it to be 24 hours, although this is still to be determined. The A633 at Warren Vale is the route of the 22x and 221 bus

services. As such, the bus journey times, reliability and punctuality would be improved for the ZEBRA services, helping to maximise the benefits of the ZEBRA scheme.

CRSTS:

Our region's CRSTS submission focussed on achieving three key objectives:

1. Growing the economy through better connectivity.
2. Levelling up our public transport.
3. Accelerating the decarbonisation of our transport system.

It is objective three that clearly sets out our ambition with regards to decarbonisation. In October 2021, the Government announced the allocation of £570m to SYMCA as part of the CRSTS fund over five years. The following schemes, to be delivered through CRSTS funding, will be complementary to our ZEBRA proposals:

- **A630 St Anne's Roundabout** – bus priority. Replacement of the roundabout with subways, with a new junction and bus priority. This roundabout is a key 'hot spot' for bus journey time and reliability for the 221 and 22x bus services through Rotherham. This roundabout scheme will therefore improve journey times and reliability for both of our ZEBRA services through Rotherham, helping to improve the bus offering to members of the public, and therefore maximising the benefits of the ZEBRA scheme.

- **Bus customer experience improvements** – delivery of the capital elements of BSIP.

- **Bus route priority improvements** – including new bus lanes, lengthening and widening existing bus lanes, and changes to bus lane hours of operation.

- **Sheffield Supertram renewal** – funding secured for the upgrade of the zero emission tram vehicles, which will complement the ZEBRA proposals.

3.2.3 – What are the key economic, social and environmental impacts of delivering the scheme?

Economic – positive impacts

Analysis by bus manufacturers and Arup, through the market engagement process during December 2021, analysed the Total Cost of Ownership (TCO) for electric buses compared to diesel equivalent. Based on 15 or 17 years of ownership, including DfT's intention to increase BSOG incentive to 22p/km, there are significant savings when comparing the cost of running diesel buses to electric. When factoring in bus battery replacements, these savings are reduced, but overall there would be a positive economic saving by transitioning to electric buses compared to diesel buses in the longer term.

The delivery of the ZEBRA scheme would help facilitate a boost to the local economy. This would be in the form of upskilling of local engineers in the servicing and maintenance of the electric buses. In addition, there would be upskilling of the local bus drivers with increased knowledge for driving electric buses.

The feasibility of second lives of the bus batteries will also be determined as part of the bus procurement process. This will ensure the batteries don't end up in landfill and could provide an economic boost through second lives in energy storage.

Social – positive impacts

Updating the bus fleets to ZEBs will replace the use of fossil fuels, reducing greenhouse gas emissions that contribute to climate change and improve local-air quality. The proposed scheme will have a positive impact on improving air quality providing health benefits, especially in built-up areas which are typically more polluted. It would be of importance for groups more vulnerable to the health-effects of poor air quality, such as children or older people, and those with existing health conditions.

The ZEBs will be legally required to install additional measures to meet enhanced accessibility standards, including on-board audio and visual route and next stop information. It is considered that these measures will provide an easy-to-understand service that improves legibility and understanding for older people, leading to subsequent confidence when using the public transport system.

The proposed minimum legal requirements for accessibility measures on ZEBs will benefit disabled people, improve passenger confidence and those additional measures will ensure users feel safe and comfortable using the bus network.

Upgrading to ZEBs will have positive health impacts for older people, young people, children, pregnant and post-partum women, and those with existing health conditions, by improving the air quality. Additionally, the installation of enhanced accessibility measures will improve passenger experience and confidence for people with disabilities and older people.

The proposed electric city centre shuttle bus service would have the added benefit of increasing accessibility for public transport users within and across Sheffield City Centre.

Environmental – positive impacts

The environmental benefits have been set out extensively within this business case. The ZEBRA proposals will directly improve the CAZ and AQMAs across South Yorkshire. The proposals will also directly improve the climate emergency.

The ZEBRA proposals for the 221 would provide savings of around 1,070 tonnes of CO2 and savings of around 8.5 tonnes of NOx emissions per year. The ZEBRA proposals for the 22x would provide savings of around 1,000 tonnes of CO2 and savings of around 0.9 tonnes of NOx emissions per year. In addition, the cascading of Euro 6 diesel buses on the 22x service, replacing dirty older buses in South Yorkshire, would also have an additional knock on benefit for the environment.

The proposed city centre shuttle bus isn't currently in operation – therefore direct comparisons for CO2 and NOx savings haven't be made. However, the city centre shuttle would operate within the heart of the Clean Air Zone in Sheffield, within the proposed Clean Air Charging Zone. The ZEBRA fund would mean the aspiration of a shuttle bus in the city centre can be zero emission. As such, there would be air quality and CO2 savings compared to running this as a diesel service.

Further details on the Equality Impact Assessment for our ZEBRA scheme can be found in **Chapter 8** of this business case.

3.2.4 Why the number of buses proposed? What will happen to the existing vehicles?

221 and 22x

Discussions were held between the SYMCA bus services team, Stagecoach (who currently operate these services) as well as Arup (modelling the electric bus services) to establish the number of buses required to operate the services. This was based on knowledge of the current number of vehicles required to run the service, any requirements due to vehicle charging, as well as ensuring there is sufficient contingency vehicles across the two services.

[redacted] It is considered that 23 in total is appropriate to run the services as electric, which includes three contingency vehicles across the 221 and 22x. These additional buses are necessary for in-service operation, out of service mileage, vehicle scheduling/positioning, maintenance and testing. [redacted]

Vehicles currently used are [redacted] on the 22x and [redacted] on the 221. The [redacted] buses would be withdrawn, and the [redacted] buses would be cascaded to other routes within South Yorkshire to replace more buses for withdrawal. The cascading of these [redacted] buses in place of other more polluting buses elsewhere, would therefore have a positive knock-on effect of improving air quality in other areas. The electric buses on the 221 and 22x would be a like for like replacement in terms of vehicle numbers, compared to the current diesel operation.

City Centre Shuttle Bus

Discussions were held internally within the SYMCA bus services team to determine the number of vehicles required to run the shuttle bus service. The assumptions were, in part, based on a previous city centre shuttle bus known as the “FreeBee” which operated in Sheffield city centre between 2007 and 2014.

In order to operate the shuttle bus service at a [redacted], it is considered that four vehicles would be needed, which includes one contingency vehicle. The shuttle bus project is being designed to allow some flexibility, so that there could be an evening variation to the shuttle bus route in the future, which could serve the night-time economy.

Currently, there isn’t a city centre shuttle bus operating in Sheffield City Centre. As such, based on the existing situation, no existing diesel buses will be directly replaced. However, SCC is committed to reintroducing a city centre shuttle bus service, to improve air quality, improve public transport accessibility and connectivity. The ZEBRA proposal would therefore enable the vehicles to be Zero Emission rather than diesel.

3.2.5 Why the routes proposed?

Following the Government announcement of the ZEBRA scheme, workshops were held with the bus operators in our region. The intention of the workshops was to gauge the level of operator interest for a ZEB scheme.

All operators were asked whether they wanted to progress with a ZEBRA scheme, in collaboration with SYMCA. From these discussions, it was clear that the only viable ZEBRA proposal was with Stagecoach. Other operators did not want to be considered as a partner for this particular fund in South Yorkshire. Stagecoach made it clear that they would be interested in working in partnership through the ZEBRA scheme.

Following the agreement to progress a ZEBRA proposal in collaboration with Stagecoach, a separate workshop was arranged with all four local authorities in South Yorkshire, SYMCA, and Stagecoach, to discuss place options for the ZEBRA scheme. The decision on the ZEBRA location was based on the following principles:

- Areas/routes where Stagecoach services currently run.
- Areas of greatest air quality need.
- Busy well used bus services.
- Routes that serve areas of employment.
- Areas which would be most viable from a technology perspective (flatter areas).
- Trying to include as many parts of South Yorkshire as possible, to help facilitate a joined up, region-wide first phase of ZEB roll-out.
- Scalable and deliverable within the ZEBRA timeframe.

From these discussions, one proposal was clearly the preferred option, as it met all the above criteria and more. This option included three out of the four local authority areas (Barnsley, Rotherham and Doncaster). This proposal is to electrify the 22x and 221 bus services, which run out of Stagecoach's Rawmarsh (Rotherham) depot, but which also go through Barnsley and Doncaster, in addition to Rotherham. The advantages of this proposal include:

- Existing Stagecoach services which can be converted to electric.
- A 23-bus scheme is considered a good size for an initial phase of electric bus roll out in South Yorkshire.
- The project is scalable and deliverable within the ZEBRA timeframe.
- The routes are busy, important, interurban routes, providing many useful links.
- The routes provide access to key areas of employment e.g. Manvers (industrial estate).
- The routes go through a CAZ as well as AQMAs – with demonstrable air quality need. This includes 'Rawmarsh Hill' which is a key area of air quality concern.
- Operationally, both the 22x and 221 run out of the same depot (Rawmarsh).
- Operationally, both the 22x and 221 could use the same opportunity charging (at Rotherham Interchange).
- Although there are some hilly areas within the 221 and 22x routes, on the whole they are relatively flat and therefore better suited to the electric bus technology.

Other Stagecoach routes were also discussed, including potential options in Sheffield. However, Stagecoach had reservations over a scheme in Sheffield due to the much hillier topography across the city, and uncertainties over whether the current electric bus battery technology is viable for routes in Sheffield. The 221 and 22x proposal has the benefit of covering three local authority areas (no other existing routes could do more) and go through areas of great air quality concern. It should also be noted that Stagecoach's Rawmarsh depot, which the 22x and 221 operate from, does not run services through to Sheffield.

The vehicle range reservation in Sheffield, as well no buses running to Sheffield from the Rawmarsh depot, meant that an additional Sheffield proposal was needed for ZEBRA, to help address the air quality problems in Sheffield, in particular given the CAZ.

As discussed in **Section 3.2.2**, through discussions with Sheffield City Council (SCC) it was clear that there was [redacted] an aspiration [redacted] for a city centre shuttle bus within the city centre. This would help improve public transport connectivity and accessibility in the city centre. With the introduction of a clean air charging zone in the city centre during 2022, the requirement for this service to be electric is even more vital. A second part of our ZEBRA proposal therefore includes an electric city centre shuttle bus service, which would better connect the city and address the objectives of the CAZ. The ZEBRA fund would support the aspiration for the city centre shuttle bus to be electric. The service would be tendered, and any operator would have the opportunity to bid for running these city centre buses.

Alignment with DfT objectives/strategic priorities

The route selections outlined above were reviewed against the DfT objectives and strategic priorities, to ensure the best routes possible were selected for ZEBRA. The reasoning provided in **Tables 3-6** and **3-7** below, confirmed that the 221, 22x and city centre shuttle bus services align to DfT's ZEBRA objectives and strategic priorities.

Table 3-6: Route selection alignment with DfT ZEBRA objectives

1. To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO2 emissions.	The chosen routes would provide a significant contribution to this objective. It should be noted that this would also be the first ZEB scheme in South Yorkshire.
2. To support the roll-out of the 4,000 Zero Emission Buses that the government committed to in February 2020.	The chosen routes would provide a significant contribution to this objective. It should be noted that this would also be the first ZEB scheme in South Yorkshire.
3. To support bus manufacturers in the development of zero emission bus technology.	The chosen routes would be challenging in the context of the electric bus technology – which could help bus manufacturers better understand the charging requirements and battery degradation. This is due to the long route lengths on the 22x and 221. The city centre shuttle buses would also provide opportunities for testing the electric buses on the challenging hilly topography in Sheffield – which could provide valuable learning.
4. To support partnership working between Local Transport Authorities, bus operators, and other local stakeholders as set out in the National Bus Strategy.	Our ZEBRA proposals would include all four local authority areas of South Yorkshire. As such, it would maximise the local partnership working between all Transport Operators, as well as Stagecoach (221 / 22x). It would also provide opportunities for any other operator to run the city centre shuttle bus, due to the tendered nature of the service. Our proposals would therefore maximise the partnership working in our region.
5. To understand better the challenges of introducing zero emission buses and supporting infrastructure to inform future government support for Zero Emission Buses.	The chosen routes would be challenging in the context of the electric bus technology. This is due to the long route lengths on the 22x and 221. The city centre shuttle buses would also provide opportunities for testing the electric buses on the challenging hilly topography in Sheffield – which could provide valuable learning.

Table 3-7: Route selection alignment with DfT Strategic Priorities.

1. Grow and level up the economy	The routes selected would help to grow and level up the economy by investing in public transport across the whole of South Yorkshire, some areas of which are classified as the highest priority in the Government's Levelling Up fund priority list at the local authority level. Local engineers and drivers would be upskilled through the introduction of the electric buses and charging infrastructure.
2. Reduce environmental impacts	The chosen routes across the whole of South Yorkshire would directly address this strategic priority area. The chosen areas include the CAZ and multiple AQMAs across the region. As such, our ZEBRA proposals would greatly reduce environmental impacts. It would also help to facilitate future ZEB projects following this initial roll out.
3. Improve Transport for the user	Our ZEBRA project would help to improve transport for the user across the whole of South Yorkshire, ensuring everyone can benefit from the transition to electric buses. The chosen routes would help to facilitate an integrated zero emission public transport offering, with the Sheffield City Centre electric shuttle bus linking up with the zero emission Tram and Tram-Train through to Rotherham, which would link up with the 22x and 221 zero emission buses to Barnsley and Doncaster. This would greatly improve transport for the user across South Yorkshire.

Section 3.3.4 of this business case provides a summary of the key strengths and weaknesses of the key options considered for this ZEBRA proposal.

3.2.6 Why the technology type?

SYPTE has undertaken feasibility work over a number of years looking into ultra-low and ZEBs, both with electric and hydrogen buses. The different types of technology were discussed with the operators in South Yorkshire, as part of the ZEBRA EoI process. Whilst one smaller operator felt that hydrogen was the way to go in South Yorkshire due to the longer range of the vehicles, the larger operators preferred electric at this moment in time. The key reasons were as follows:

- Greater confidence in the electric bus technology due to the large number of roll outs across the country.
- Electric buses currently being cheaper than the hydrogen bus alternatives.
- Some lessons learnt with hydrogen bus roll outs in other regions. This includes experiences from both [redacted] in their hydrogen bus trial in Aberdeen, which wasn't very positive. Both [redacted] had some hydrogen single decker buses as part of this scheme which were new in 2014 but are no longer in operation (as of 2020).

When discussing the technology type with Stagecoach, who we are collaborating with for ZEBRA, it was agreed that electric buses would be most appropriate for our ZEBRA proposal in South Yorkshire, in particular given the reasons set out above.

South Yorkshire also has the use of an 'electric bus toolkit' – further details provided in **Section 3.2.7,** which we are able to use to determine whether existing bus routes and services are capable of being run as electric, based on various different parameters including topography, bus battery, route length etc. By selecting electric as the technology type, we can therefore make use of this tool, to help determine the specifications of vehicles and chargers.

Although electric is the proposed technology type for the ZEBRA submission, it could be the case that the future transition to ZEBs in South Yorkshire is through a combination of both

electric and hydrogen. A piece of work taking place currently is titled 'environmental analysis – setting out the pathway to a zero-emission bus fleet for South Yorkshire'. This commission forms part of a trio of workstreams in response to the South Yorkshire bus review report in 2020.

The Bus Review identified that buses have not been used to their full potential to reduce emissions in the region and that the average age of the bus fleet in South Yorkshire is older than the national average. Since the publication of the Bus Review (*Bus Review Report June 2020*), the pandemic has continued to impact public transport, highlighting concerns around poor air quality and exacerbating existing issues with the system.

The ongoing environmental analysis commission will set out the pathway to a zero-emission bus fleet for South Yorkshire. The work covers the technical, legal, contractual, and financial elements of delivering a zero-emission fleet, resulting in a roll out plan, underpinned by high level modelling. This process will identify the barriers to delivery, conditions for success, delivery mechanisms, costs for transitioning to ZEB fleet and the investment profile required to meet the regions net zero commitments. The commission will present the region with scenarios for consideration by leaders, that show how progress could be accelerated under different parameters to assist with decision making. Our ZEBRA proposal will feed into this Environmental Analysis workstream for the region. It could be the case that the future transition to zero emission involves different technology types, but this ZEBRA proposal is for electric, primarily due to:

- Greater value for money (currently).
- Greater levels of confidence in the technology – due to the extensive roll outs across the country.
- Operator technology preference.

3.2.7 Why the infrastructure / charging method?

Methodology

We used South Yorkshire's Electric Bus Toolkit (EBT) to determine the charging and infrastructure requirements. This meant the choice of infrastructure was evidence based to provide greater confidence that the operational assumptions are accurate, as well as ensuring the proposals aren't over or under engineered.

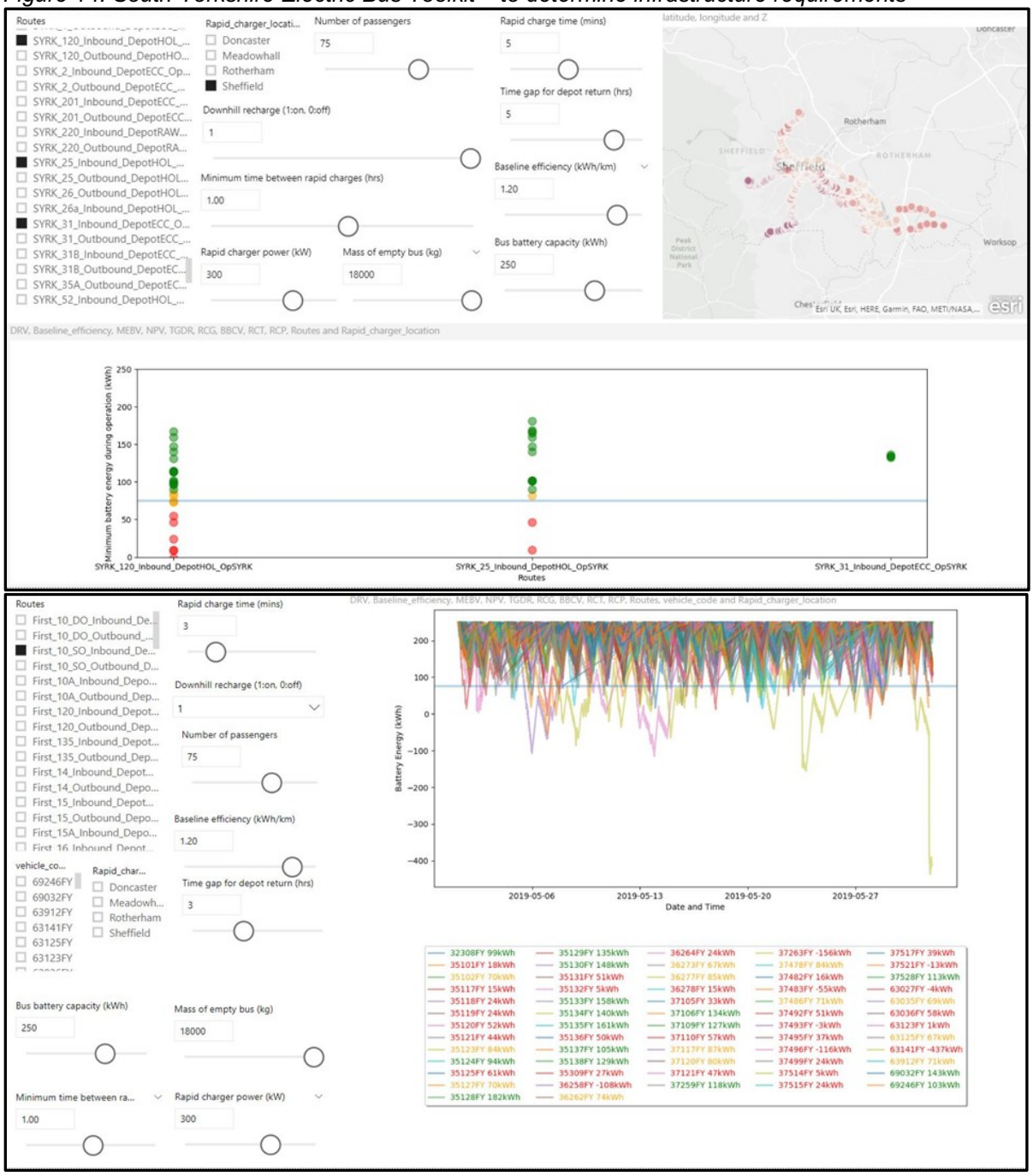
The EBT can be used to perform 'what if' analysis and see what it would take to make a particular route transition from diesel to electric, given different criteria including:

- Available charging.
- Charge times allowed.
- Bus weight.
- Bus battery.
- Downhill recharge.
- Route length.
- Topography of route.

The EBT factors in all the relevant information that will impact on the battery life, within the algorithms, to help determine the charging requirements.

Figure 14 includes a screenshot of the EBT dashboard, which helps to illustrate the parameters included in the toolkit analysis. SYMCA would be more than happy to meet with DfT to talk through the toolkit to demonstrate how it works and ensure greater understanding.

Figure 14: South Yorkshire Electric Bus Toolkit – to determine infrastructure requirements



The toolkit was originally developed in response to operator hesitancy over the bus battery technology, in areas such as Sheffield, with the hilly nature and greater demand on the bus battery. However, the toolkit was used in ZEBRA to help determine whether the 221, 22x and the city centre shuttle bus could be run based on depot charging, or whether rapid charging would be needed through the day – and if so, how often and for how long. It was also used to quantify the air quality improvements and CO2 reductions, as a result of introducing zero emission buses on specified routes.

Results of the EBT analysis and the proposed way forward

The toolkit was used to model the 22x and 221 and the new city centre shuttle bus route. The findings outlined below, formed the basis of the charging infrastructure requirements, as part of the ZEBRA project.

221 & 22x

The EBT analysis for the 221 and 22x routes has shown it would be marginal with regards to whether the buses could operate with depot charging alone, based on the currently available electric buses – without the need for pantograph chargers. It depends, to an extent, on the level of charge allowed for at the end of the day in reserve. We have followed up the EBT analysis by undertaking market engagement with seven electric bus manufacturers and five charging infrastructure suppliers. Although different suppliers had differing views of what could be possible due to the different product ranges and different levels of optimism, it was evident that even if the 221 and 22x buses might work without pantograph chargers in the early years of roll out, this is unlikely to be the case over time with the battery degradation. It was felt that two pantograph chargers would be needed for ZEBRA at Rotherham Interchange to ensure both routes are viable and for reasons of contingency. It is considered that two pantograph chargers would be needed rather than one, to reduce the risk operationally with having both the 221 and 22x using the same pantograph chargers. This would mean that there won't be a risk of buses being delayed waiting for a rapid charger. It also means that one pantograph charger can be serviced whilst the other is operational. It also means that if there is a fault with one pantograph charger, there is some contingency with another available to use. It also provides opportunities for other services to be charged at Rotherham Interchange in the future.

City Centre Shuttle Bus

Due to the short and repetitive nature of the city centre route, modelling has confirmed that pantograph chargers would not be needed at Sheffield Transport Interchange. As such, our proposal involves the new service running from overnight 'depot style' charging alone.

3.3 PART 3 – SCHEME OBJECTIVES

3.3.1 - How will your scheme contribute to the achievement of SYMCA's strategic objectives?

SCR Transport Strategy

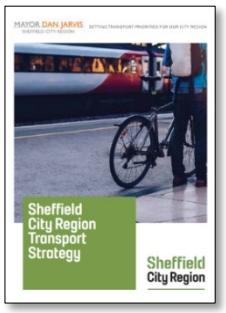


Table 3.8 shows the alignment of the ZEBRA scheme with the Sheffield City Region (SCR) transport strategy goals, mayoral commitments, transport strategy policies and DfT objectives.

SCR Transport Strategy
SCR Mayoral Commitments

Table 3.8: ZEBRA scheme alignment with SYMCA goals and commitments

Transport Strategy Goals	Mayoral Commitments	Transport Strategy Policies	Alignment with South Yorkshire ZEBRA proposal
1. Residents and businesses connected to economic opportunity	I will invest in tram, tram-train, bus rapid transit, bus networks, active travel and tackle our congestion hotspots.	1. Improve the existing transport network to enhance access to jobs, markets, skills and supply chains adopting technology solutions to support this	1. Enabling people to access opportunities through choosing greener and healthier forms of transport, by investment in high quality public transport infrastructure (both for existing journeys (221 and 22X) and new journeys stemming from the new city centre shuttle bus.

		2. Enhance productivity by making our transport system faster, more reliable and more resilient, considering the role of new technologies to achieve this	2. Targeted investment in the ZEBRA scheme, in public transport charging infrastructure on the key corridors, will make the public transport offering more reliable and resilient.
		3. Invest in integrated packages of infrastructure to unlock future economic growth and support Local Plans, including new housing provision	3. The scheme will invest in an integrated package of charging infrastructure for public transport, which will unlock future sustainable economic growth, as we transition to net zero as a region.
2. A cleaner and greener Sheffield City Region	I will work with partners to deliver a zero-emissions public transport network and we will eliminate the need for AQMAs	4. Improve air quality across our City Region to meet legal thresholds, supporting improved health and activity for all, especially in designated AQMAs and CAZs	4. The replacement of diesel buses with zero emission across South Yorkshire would provide targeted air quality improvements to address the designated AQMAs and CAZs.
		5. Lead the way towards a low carbon transport network, including a zero-carbon public transport network	5. The scheme would help facilitate the transition to a low (zero) carbon transport network, by transitioning from diesel buses to zero emission, as well as creating a modal shift away from the private car.
		6. Work in tandem with the planning and development community to create attractive places	6. Planning requirements for the pantograph chargers are being worked through with the local authority. We will work in tandem with the planning authority to ensure the infrastructure is in keeping with the surrounding public area.
7. **Safe, reliable, and accessible transport network**	I will invest in services to ensure that residents with disabilities, young people, the elderly and those who are isolated economically and geographically are able to travel easily, confidently and affordably.	7. Ensure people feel safe when they travel and invest in our streets to make them more attractive places.	7. The scheme will be designed to ensure people feel safe when they travel by bus (e.g. appropriate lighting and bus stop infrastructure) ensuring a safe and attractive environment to travel.
		8. Enhance our multi-modal transport system which encourages sustainable travel choices and is embedded in the assessment of transport requirements for new development, particularly for active travel.	8. Encouraging people to choose greener and healthier forms of transport both for existing bus services (221 and 22x) and new bus services (city centre shuttle bus).

		9. Ensure our transport network offers sustainable and inclusive access for all to local services, employment opportunities and our green and recreational spaces	9. Investing over a sustained period in high quality public transport infrastructure that better connects key destinations 10. The scheme will ensure sustainable and inclusive access to employment opportunities. For example, the city centre shuttle bus will provide greater accessibility and connectivity across the city centre.

South Yorkshire Bus Review

Table 3.9 shows the alignment of the ZEBRA scheme with some key aspects of the South Yorkshire bus review

Bus Review Report

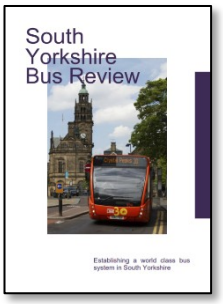


Table 3.9: ZEBRA scheme alignment with South Yorkshire Bus Review

South Yorkshire Bus Review – Findings & Recommendations	Alignment with South Yorkshire ZEBRA proposal
Finding 3: Climate change Buses need to play a bigger role in reducing local transport emissions and tackling climate change.	The ZEBRA proposal will result in buses playing a much bigger role in reducing local transport emissions and tacking climate change. This will be due to directly replacing diesel buses from CAZs and AQMAs with zero emission buses.
Finding 5: Connectivity There is poor connectivity between parts of the South Yorkshire bus network and with other modes of transport.	The proposed electric city centre shuttle bus will help better connect the city centre by public transport, as well as improve connectivity with other modes.
Recommendation 14: We recommend an increased and longer-term role of buses in tackling climate change. Road transport produces 36% of CO2 in South Yorkshire.	The ZEBRA proposal will directly address climate change, by reducing CO2 emissions in South Yorkshire, as quantified in Section 3.1.5.

SCR Energy Strategy

The region's ambition is set out in various strategies, including the Sheffield City Region Energy Strategy [SCR Energy Strategy]

The specific goal relating to our ZEBRA ambition is outlined below:

Goal 4 (Transport):

- Deliver a clean transport network. Work with partners to ensure South Yorkshire moves to a zero-carbon transport network.
- Fully zero-emission public transport network by 2035.

Active Travel Implementation Plan

The region's Active Travel Implementation Plan [Active Travel Implementation Plan] states that active travel can form a small part of a longer distance journey. Most longer distance journeys start with a shorter journey, mainly to a bus stop, interchange, or rail station. The Plan will deliver infrastructure and support the increased activity levels for the next generation. The ZEBRA proposals align well to the wider ambitions, with better integration of zero emission public transport with active travel provision.

The proposed electric city centre shuttle bus would increase public transport usage within the city centre, as the new service would increase and improve passenger connectivity, maximising the benefits of the significant TCF transformational changes. Furthermore, the Doncaster, Rotherham and Barnsley elements of the scheme, whilst part of existing bus services, would link up to various active travel projects across South Yorkshire.

3.3.2 - How does the scheme fit with other relevant national and local policies?

DfT's ZEBRA objectives

Table 3.10 shows the alignment of the ZEBRA scheme with DfT's ZEBRA objectives.

Table 3.10: ZEBRA scheme alignment with DfT's ZEBRA objectives

DfT ZEBRA Objectives	Alignment with South Yorkshire proposal
1. To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO2 emissions.	Our ZEBRA proposal will support this objective by reducing the transport sector's contribution to CO2 emissions, by the introducing the first ZEBs across South Yorkshire. There would be an annual CO2 saving of around 1,070 tonnes per year on the 221 service, and around 1,000 tonnes of CO2 saving annually on the 22x. The existing 22x Euro 6 buses would be cascaded to other South Yorkshire bus routes, which would therefore have an additional air quality knock on benefit in our region, by replacing the dirtiest buses with the cascaded Euro 6 vehicles. There isn't a diesel electric city centre shuttle bus currently in operation, so direct comparisons on air quality / CO2 benefits cannot be made in the same way that they have been for the 221 and 22x.

2. To support the roll-out of the 4,000 Zero Emission Buses that the government committed to in February 2020.	Our ZEBRA proposal would contribute to this roll-out by delivering 27 ZEBs by September 2023. This would be a first phase of the transition to zero emission buses in South Yorkshire, to help meet the target of a fully zero emission public transport fleet by 2035.
3. To support bus manufacturers in the development of zero emission bus technology.	SYMCA would help support manufacturers in the development of zero emission bus technology. This would be through the provision of quarterly monitoring information to DfT, as part of the monitoring and evaluation requirements of ZEBRA. Information captured via telematics would be collated through the South Yorkshire ZEBRA scheme and will help DfT and bus manufacturers to better understand how the technology works in real world situations. Due to the more challenging nature of the 22x and 221 services (long route lengths), this would provide a good opportunity for operators to understand battery range in a challenging real-world situation, alongside implications on battery degradation. In addition, due to the hilly nature of Sheffield, this adds further opportunities for learning and testing the vehicles on more challenging topography in the UK.
4. To support partnership working between Local Transport Authorities, bus operators, and other local stakeholders as set out in the National Bus Strategy.	South Yorkshire already has a voluntary bus partnership, that has fostered a close working relationship between SYPTE, the local bus operators and the four local authorities, in developing and implementing bus priority improvements. We will be transitioning into the BSIP arrangements, as set out in the National Bus Strategy. Partnership working will be at the forefront of the ZEBRA proposals, ensuring a successful project for the public, the SYMCA and bus operators.
5. To understand better the challenges of introducing zero emission buses and supporting infrastructure to inform future government support for Zero Emission Buses.	The project will document any lessons learnt throughout the life of the project to ensure DfT better understands the challenges of introducing ZEBs and supporting infrastructure. In addition, a well thought out monitoring and evaluation plan will also help inform the government in terms of best practice for similar schemes moving forward. SYMCA would be happy to talk through the Electric Bus Toolkit with DfT.

National Bus Strategy (NBS)

Table 3.11 shows the alignment of the ZEBRA scheme with the National Bus Strategy (NBS).

Table 3.11: ZEBRA scheme alignment with NBS

National Bus Strategy	Alignment with South Yorkshire ZEBRA proposal
Chapter 2: The buses we want • Better integrated with other modes and each other. • Greener – we will support the introduction of at least 4,000 more zero emission buses. • Accessible and inclusive by design.	- The proposed city centre shuttle bus would facilitate better integration with other modes. - The South Yorkshire ZEBRA proposal would contribute to this roll out through 27 initial ZEBs. - In addition to the accessible design of the buses, the new city centre shuttle element of the proposal will increase public transport accessibility across the city. - The scheme design would meet the DfT requirements for ZEBRA.
Chapter 3: Delivering better bus services • Building back better – recovering from the pandemic. • Bus Service Improvement Plans. • Investment on key corridors. • Make sure that future local transport is joined up.	- The proposal will help to build back better – as well as greener. - The proposal, including the transition to zero emission, will form a key part of the South Yorkshire BSIP. One of the BSIP objectives is 'greener – increase the number of zero emission buses on our transport network'. Our ZEBRA proposal will help achieve this BSIP objective. - The ZEBRA proposal, in particular with the new city centre shuttle bus, will help to better connect / join up the city by public transport. This will help 'join up' the public transport in the city centre alongside the Supertram and Active Travel improvements through TCF. The 22x and 221 routes are key corridors through Rotherham, Doncaster and Barnsley. This proposal will therefore ensure investment is on key employment and residential corridors across the region.
Chapter 5: A green bus revolution • We will ensure our plans for buses lead to overall carbon reductions. • Place based approach to investment. • Both operators and LTAs must play their part.	- The ZEBRA proposal will lead to overall carbon reductions. - The ZEBRA proposal is a South Yorkshire based approach to investment. - Stagecoach, the four LTAs, and the SYMCA are all committed to the project.

DfT's Strategic Priorities

Table 3.12 shows the alignment of the ZEBRA scheme with DfT's strategic priorities.

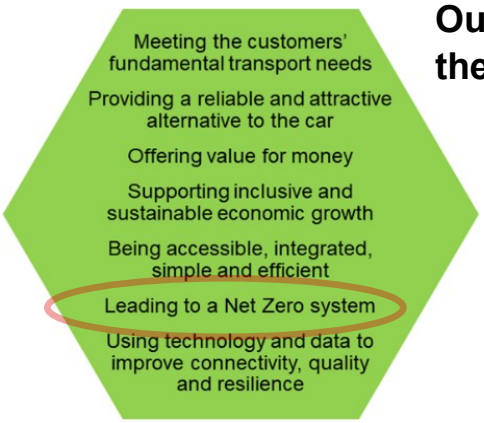
Table 3.12: ZEBRA scheme alignment with DfT's strategic priorities

DfT's Strategic Priorities	Alignment with South Yorkshire ZEBRA proposal
1. Grow and level up the economy	The Government's Levelling Up Fund priority list of local authority areas has the following classification for the districts of South Yorkshire. - Barnsley (priority 2) - Doncaster (priority 1) - Rotherham (priority 1) - Sheffield (priority 2) The ZEBRA project would: • help with the transition to a zero-emission public transport network. • help stimulate the local economy by upskilling the local bus drivers to drive electric buses as well as upskill the local engineering workforce through the servicing and maintaining of the electric buses and infrastructure. • improve the local public transport service through the addition of brand new, clean buses, with enhanced accessibility specifications. This should improve the passenger usage on the network, helping to provide good access to jobs across South Yorkshire. • help to grow and level up the economy with greater access to jobs and opportunities, in particular with the inclusion of a new electric city centre shuttle bus service, which would improve public transport connectivity.
2. Reduce environmental impacts	The ZEBRA proposal will deal with the priority areas directly, through improving the local air quality, targeting local CAZs and AQMAs. It would also help to tackle the climate emergency.
3. Improve Transport for the user	The ZEBRA proposal would improve transport for the user, by providing a cleaner, modern and more appealing mode of transport, compared to the aging fleet of South Yorkshire. Alongside other proposed schemes in South Yorkshire, funded through TCF, LUF and CRSTS, it would be a package of improvements to improve the overall offering to the user. With specific regards to the proposed new city centre shuttle bus, this would improve transport for the user by offering something different to what is there currently, helping to provide improved public transport accessibility and connectivity in the city centre.

South Yorkshire - Bus Services Improvement Plan (BSIP) - 2021

At the outset of the BSIP process, the SYMCA, local authorities and bus operators agreed a vision for the South Yorkshire bus network. This is illustrated in **Figure 15** below.

Figure 15: Our vision for the bus



The Government envisages that BSIPs will include a range of policies and interventions that deliver a number of headline outputs, including:

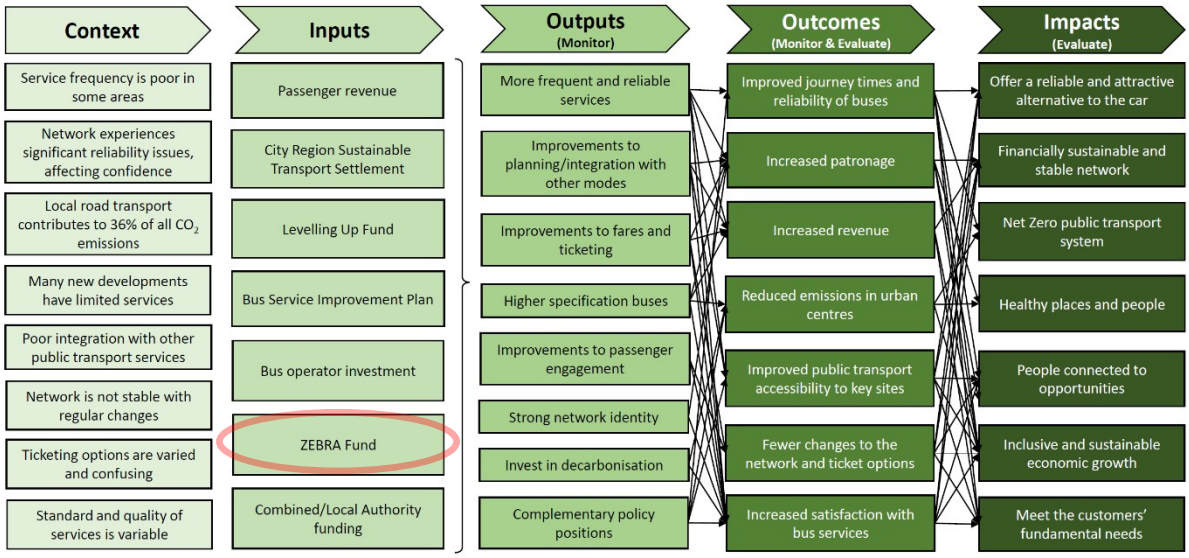
- More frequent and reliable services
- Improvements to planning/integration with other modes
- Improvements to fares and ticketing
- Higher specification buses
- Improvements to passenger engagement.

Given the history of bus services in South Yorkshire, the strength of local feeling that was evident during the development of the Bus Review, and the emphasis placed on achieving ambitious carbon reduction targets, two other headline outputs were considered to be important to shape the Plan:

- Strong network identity
- **Invest in decarbonisation**

The draft BSIP logic map, shown in **Figure 16**, includes ZEBRA as one of the potential inputs into BSIP, to help deliver the outcomes of reduced emissions in urban centres, increased satisfaction with bus services, which would lead to impacts of a Net Zero public transport system, as well as healthy places and people.

Figure 16: Draft BSIP logic map:



BSIP targets

Two key targets of the BSIP, related to our ZEBRA proposals, are shown below. The South Yorkshire ZEBRA proposal is fundamental to these BSIP targets:

- Eliminate AQMAs in our City Region and comply with legal thresholds to achieve compliance in the shortest possible time.
- Reduce tailpipe carbon emissions in line with targets for the UK and have a zero-carbon public transport network by 2040.

BSIP delivery

The intention is that the prioritised activities, interventions, and policies described in this initial BSIP, should be seen as collective response to the Bus Review and the impact of the COVID-19 pandemic, and the means by which the bus network that South Yorkshire wants and needs to be delivered. **Table 3.13** below includes the prioritised BSIP activities, in relation to the headline and transport specific zero emission Strategic Economic Plan (SEP) objective of Greener – increase the number of zero emission buses on our transport network.

Table 3.13: Prioritised BSIP activities

SEP Objective (Headline and Transport Specific)	City Region Sustainable Transport Settlements (CRSTS) fund objective and activity	South Yorkshire BSIP			Transport Strategy success criteria
		Vision	Prioritised activities	Headline output	
Greener – **increase the number of zero emission buses on our transport network**	Accelerating the decarbonisation of our transport system – offer greater modal choice over private vehicles and invest in the transition to a zero carbon bus fleet	**Leading to a net zero system**	• Ensure active travel proposals provide good links to key interchanges and public transport hubs • Consider new types of service as part of review of tendered services, using electric vehicles • Review bus park and ride locations and improve the offer • Ensure new and amended infrastructure takes account of urban realm to promote a better street environment • **Fleet replacement and retrofitting to achieve a net zero fleet** • Positively change attitudes towards the bus and lead by example.	• More frequent and reliable services • Improvements to planning/integration with other modes • Higher specification buses • Invest in decarbonisation • Complementary policy positions	• **Have a zero-carbon public transport network by 2040** • **Eliminate AQMAs in our city region**

3.3.3 - What are the scheme's objectives?

The **overarching ZEBRA objectives**, as set out in the DfT ZEBRA guidance document, are as follows:

1. To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO2 emissions.
2. To support the roll-out of the 4,000 Zero Emission Buses that the government committed to in February 2020.
3. To support bus manufacturers in the development of zero emission bus technology.
4. To support partnership working between Local Transport Authorities, bus operators, and other stakeholders as set out in the National Bus Strategy.
5. To understand better the challenges of introducing zero emission buses and supporting infrastructure to inform future government support for Zero Emission buses.

DfT's **strategic priorities** are as follows:

1. Grow and level up the economy
2. Reduce environmental impacts
3. Improve transport for the user

Tables 3.10 and **3.12** shown previously, outlined the alignment of our ZEBRA proposals to the overarching ZEBRA objectives and DfT priorities. Our **scheme specific South Yorkshire ZEBRA objectives** are set out below:

1. To support the government's commitment to decarbonisation and ZEB delivery.
2. To improve the local air quality in South Yorkshire and help address the climate emergency.
3. To provide a zero-emission public transport shuttle bus service in Sheffield City Centre.
4. To increase bus patronage within South Yorkshire, on the ZEBRA funded services.
5. To increase the proportion of Zero Emission Buses on the South Yorkshire network.
6. To help DfT to better understand the challenges of introducing ZEBs and supporting infrastructure.

3.3.4 - Please outline the options which have been considered, setting out the strengths / weaknesses for each option.

	Strength/ Weaknesses compared to Do Min	Expected Outcomes compared to Do Min
Option A (Do Minimum)		
Option B *Electrification of the 221 (Rotherham to Doncaster) and 22x (Rotherham to Barnsley) bus services.*	***Strengths*** - The proposal would involve the electrification of 22x (Rotherham to Barnsley) and the 221 (Rotherham to Doncaster. The environmental benefits would therefore be spread across three local authority areas. - Both bus services would run from the same depot (Rawmarsh) meaning a joined-up project from the depot charging infrastructure perspective. - Pantograph charging infrastructure at Rotherham Interchange could also open up the opportunity to electrify additional routes in the future. - Support from bus operator Stagecoach, which runs these services out of the Rawmarsh depot. - Directly addresses known air quality issues along the proposed routes, including the CAZ and AQMAs. - The option aligns well with associated projects including the	- Replacement of 24 diesel single decker buses with electric buses. - Reduction in carbon emissions across Barnsley, Rotherham and Doncaster, along the 221 and 22x bus corridors, resulting from the replacement of diesel buses with ZEBs. - Improvement in local air quality across Barnsley, Rotherham and Doncaster, across the 221 and 22x bus corridors, resulting from the replacement of diesel buses with ZEBs. - A first zero emission bus project in South Yorkshire.

	upgrade of Community Transport vehicles from diesel to electric. - Aligns very well with proposed bus priority schemes where the 22x and 221 operate – which will improve bus journey times and reliability for the ZEBRA funded electric buses. This includes the A633 Warren Vale proposed new bus lane (ambition for 24 hours) as well as the A630 St Anne's Roundabout bus priority scheme. ***Weaknesses*** - The project includes 3 of the 4 local authority areas within South Yorkshire, but it does not include Sheffield, which has a city centre CAZ – with some of the worst air quality in South Yorkshire. - It could be argued that upgrading 23 buses to electric is not ambitious enough. However, with no ZEBs in operation in South Yorkshire currently, it could be the key steppingstone needed on the road to a zero-emission bus fleet.	
Option C *Electrification of the 22x bus service only (Rotherham to Barnsley)*	***Strengths*** - The proposal would involve the electrification of the 22x (Rotherham to Barnsley) only. As such, the environmental benefits would be spread across two local authority areas, compared to three in option B and four in option E. - Would be a cheaper scheme compared to Option B, due to a lower number of electric buses. - This could be a scalable option if a lower funding amount was available. - Directly addresses known air quality issues along the proposed routes, including the CAZ in Rotherham and AQMAs in both districts. - The option aligns well with associated projects including the upgrade of Community Transport vehicles from diesel to electric.	- Replacement of 12 diesel buses with electric buses. - Reduction in carbon emissions and improvement in local air quality, across Rotherham and Barnsley, based on the replacement of diesel buses with ZEBs. - Continuation of a lack of ZEB investment in Doncaster and Sheffield.

	- Aligns very well with proposed bus priority schemes where the 22x operates – which will improve bus journey times and reliability for the ZEBRA funded electric buses. This includes the A633 Warren Vale proposed new bus lane (ambition for 24 hours) as well as the A630 St Anne's Roundabout bus priority scheme. ***Weaknesses*** - Lower amount of air quality and carbon reduction benefits compared to Options B and E. - A missed opportunity to electrify the 221 Rotherham to Doncaster corridor, as well as the 22x corridor, as these buses would use the same depot. - Continuation of no ZEBs in Sheffield or Doncaster. - Only provides air quality benefit across the Rotherham to Barnsley 22x bus corridor. - Lacks ambition in scale with the target of South Yorkshire to have a zero-emission public transport network by 2035.	
Option D *Electrification of the 221 bus service only (Rotherham to Doncaster)*	***Strengths*** - The proposal would involve the electrification of the 221 (Rotherham to Doncaster) bus service only. As such, the environmental benefits would be spread across two local authority areas, compared to three in option B and four in option E. - Cheaper scheme compared to Option B, due to a lower number of electric buses. - Could be a scalable option if a lower funding amount was available. - Directly addresses known air quality issues along the proposed routes, including the CAZ in Rotherham and AQMAs in both districts. - The option aligns well with associated projects including the upgrade of Community Transport vehicles from diesel to electric.	- Replacement of 12 diesel buses with electric buses. - Reduction in carbon emissions and improvement in local air across Doncaster and Rotherham, due to the replacement of diesel buses with ZEBs. - A continuation of lack of investment in ZEBs in Barnsley and Sheffield.

	- Aligns very well with proposed bus priority schemes where the 221 operates – which will improve bus journey times and reliability for the ZEBRA funded electric buses. This includes the A633 Warren Vale proposed new bus lane (ambition for 24 hours) as well as the A630 St Anne's Roundabout bus priority scheme. ***Weaknesses*** - Lower amount of air quality and carbon reduction benefits compared to Options B and E. - This option could be seen as a missed opportunity to electrify the 22x Rotherham to Barnsley corridor, as well as the 221 corridor, as these buses would use the same depot. - Continuation of no ZEBs in Sheffield or Barnsley. - Lacks ambition in scale with the target of South Yorkshire to have a zero-emission public transport network by 2035.	
Option E (Preferred) *Electrification of the 221, 22x and a new electric city centre shuttle bus.*	***Strengths*** - A joined-up ZEB project across the whole of South Yorkshire, facilitating a first phase of ZEB roll out. - ZEBs introduced in all four local authority areas across South Yorkshire, creating greater public awareness of ZEBs across the region. - The most ambitious option. - Scalable option. - The proposal would involve the electrification of the 22x, 221 (Rotherham, Barnsley and Doncaster bus corridors) and a new Sheffield city centre shuttle bus. As such, the environmental benefits would be spread across all of South Yorkshire, directly addressing air quality issues. - Directly addresses known air quality issues including the CAZ in Sheffield and Rotherham, and	- Replacement of 27 diesel single decker buses with electric buses (assuming four existing diesel shuttle buses in Sheffield). - Reduction in carbon emissions and improvements in local air quality across Barnsley, Rotherham, Doncaster and Sheffield. - Increased accessibility and connectivity in Sheffield city centre. - SCC is committed to a city centre shuttle bus, to improve public transport accessibility and connectivity. The ZEBRA proposal would help to bridge the cost

	the AQMAs across South Yorkshire. - The 221 and 22x bus services run from the same depot (Rawmarsh) meaning a joined-up project from the depot charging infrastructure perspective. The city centre shuttle bus would be a tendered service, so it is currently unknown which operator would run the new service. - Pantograph charging infrastructure at Rotherham Interchange could open up the opportunity to electrify additional routes in the future. - Support by bus operator for converting existing 221 and 22x services to electric. - Improves public transport accessibility and connectivity in Sheffield city centre. - Increases bus patronage in Sheffield city centre. - The option aligns well with associated projects including the upgrade of Community Transport vehicles from diesel to electric. - Aligns very well with proposed bus priority schemes where the 22x and 221 operate – which will improve bus journey times and reliability for the ZEBRA funded electric buses. This includes the A633 Warren Vale proposed new bus lane (ambition for 24 hours) as well as the A630 St Anne's Roundabout bus priority scheme. ***Weaknesses*** - Greater project ambition and scope brings greater scheme complexity and programme risk. - Most expensive option. - The city centre shuttle bus project requires [redacted] to be identified and confirmed for the minimum 5-year period. It is currently unknown what will happen to the service after this 5-year period. - Even with the introduction of 27 new electric buses in South Yorkshire, this only equates to 3.5% of the total fleet in South Yorkshire. As such, whilst a key stepping-stone in ZEB roll out	difference to help make the shuttle bus electric rather than diesel.

	across the region, there is still a long way to go for a fully zero emission fleet.	

3.3.5 Why is the solution identified (preferred option) the best / most suitable for meeting the objectives set out?

Option E – the electrification of the 221, 22x and a new electric city centre shuttle bus is the preferred option in this business case. The reasons and justification are set out in **Section 3.3.4** above. However, in addition, Option E is the best for addressing the scheme specific ZEBRA objectives:

1. **To support the government's commitment to decarbonisation and ZEB delivery.**

   The preferred option is the most ambitious and would deliver the most ZEBs, to help support the government's 4,000 ZEB delivery target.

2. **To improve the local air quality in South Yorkshire and help address the climate emergency.**

   The preferred option is the best option for improving local air quality across all of South Yorkshire, including the AQMAs and two CAZs. It is also the option that creates the greatest contribution to carbon emission reduction.

3. **To provide a zero-emission public transport shuttle bus service in Sheffield City Centre.**

   The preferred option facilitates a zero-emission shuttle bus service in Sheffield City Centre.

4. **To increase bus patronage within South Yorkshire, on the ZEBRA funded services.**

   Whilst previous evidence has suggested that by improving vehicles has a marginal impact on patronage, it is considered that the city centre shuttle bus would have a significant impact. This is based on data from the previous city centre shuttle bus which operated from 2007 to 2014. The last year of operation had annual patronage of around [redacted]. It is noted that the landscape will have changed since then due to the pandemic and new ways of working. However, this provides an indication of the sort of patronage that could be expected. The impact of decisions regarding payment at point of use on forecasted patronage will need to be considered.

5. **To increase the proportion of Zero Emission Buses on the South Yorkshire network.**

   The preferred option will provide the greatest proportion of ZEBs on the South Yorkshire network.

6. **To help DfT to better understand the challenges of introducing ZEBs and supporting infrastructure.**

   The monitoring and evaluation plan, as outlined in **Section 7.14** sets out how the project will be monitored and evaluated, including any lessons learnt through the process. Option

E is the most ambitious of the options and will therefore provide the greatest opportunity for learning across South Yorkshire.

3.3.6 How the impact of the scheme will be measured

The process by which the scheme impact will be measured is set out within **Section 7.14** (Monitoring and Evaluation). Full details on the how the impact of the scheme will be measured are contained in 7.14.

To provide a summary of the approach, the SYMCA would be responsible for the scheme monitoring, but the evaluation would be undertaken by the evaluation contractor appointed by DfT (at the ZEBRA programme level). This is as per the DfT Monitoring and Evaluation (M&E) guidance. SYMCA will therefore engage with the evaluation contractor, but our focus will be on the monitoring requirements for the South Yorkshire scheme.

The proposed frequency of the data monitoring will be as follows:

1. Data provided to DfT following implementation of the scheme (e.g. number of electric buses purchased, number and type of diesel buses being replaced). This data would be provided to DfT once following implementation, as this data would not change post implementation.

2. As per DfT's guidance document, most other data would be provided to DfT on a quarterly basis (collated by DfT's programme level evaluator) up to five years post implementation. This would include data that would change over time such as the average daily vehicle mileage and the average daily energy consumption.

3. Some data will be collected and issued to DfT annually (such as on board attitudinal / perception surveys).

The scheme M&E will help DfT and SYMCA determine the extent to which the project objectives have been realised, providing key lessons towards future projects, as well as support manufacturers in the development of ZEB technology, by providing monitoring data from real world situations.

The scheme-specific objectives, outcomes and outputs will form the basis of the monitoring requirements for our M&E plan. Our monitoring approach seeks to check progress against the scheme outputs and outcomes, which will mean we will be able to see whether our scheme has achieved what it intended to do, and how the success metrics change over time.

For further details, including specific methods of data collection, please see **Section 7.14.**

3.3.7 Changes since the EoI

The key changes since the submission of the EoI are outlined below:

General changes

- Allowance for infrastructure maintenance has been removed from the capital estimate, reducing the capital cost by [redacted]

- The proposed charging infrastructure has been refined based on the route analysis and feedback from vehicle and infrastructure suppliers so that:
  - The pantograph chargers at Rotherham Interchange are now 300kW rather than 450kW, resulting in a saving of
  - The fast chargers at Sheffield Interchange are now 100kW chargers rather than 150kW chargers, resulting in a saving of
- Contingency / optimism bias has been included.
- Forecast inflation has been accounted for.
- The costs for the proposed electric vehicles have been revised based on supplier quotes that respond to clearer specification and route requirements, from to a blended average of per vehicle.
- The costs for the diesel equivalent vehicles have been revised based on supplier quotes that respond to clearer specification and route requirements, from to per vehicle.
- The allowance for upgrading the electrical connection to the point of connection at Rotherham Interchange, Rawmarsh Depot and Sheffield Interchange has been revised based on quotes from the DNO online tool. This has led to a saving of
- Battery replacement has been included at a unit cost of per battery in year 8.

Additional costs have been provided (although not included in the funding profile) as this will be covered by SYMCA:

- A allowance for marketing.
- A allowance for professional fees has been included to support procurement.
- A management allowance has been included to ensure the SYMCA can deliver and oversee the scheme.

City Centre Shuttle Bus

Through the analysis, it was determined that pantograph charging would not be required for the electric city centre shuttle bus. As such, the infrastructure costs have decreased (now allowing for depot fast chargers only). This reduces the capital cost by

The removal of the need for pantograph charging at Sheffield will also reduce some delivery risk, with a key element of the Sheffield proposal no longer required. There would be a slight downside with not having the pantograph chargers at Sheffield Interchange, as there won't be pantograph chargers for other commercial buses to use in the future – which might have helped speed up the transition of diesel commercial buses to electric in Sheffield. However, on balance, as the pantograph chargers are not critical for the running of the shuttle bus operation, its inclusion in this bid does not represent value for money.

The shuttle bus is subject to being confirmed to run the service for a minimum of 5 years. as a risk mitigation measure, in the event that cannot be secured, we have included an alternative route for these same buses and same infrastructure, which would be used on an existing tendered bus service, which also aligns very well with the ZEBRA objectives.

22x / 221

For the 22x and 221 services, Stagecoach will own the electric buses rather than the previous proposal of SYMCA owning the vehicles and leasing them to Stagecoach.

4 - ECONOMIC CASE

4.1 – Economic Case Overview

Electric buses provide a wide range of benefits to users and the wider community alike. With the transport sector being the lead cause of noise and air pollution in the UK and producing 27% of the nation's total emissions in 2019, it is particularly pertinent to move towards less polluting forms of travel *(DEFRA noise pollution: economic analysis, Environmental Protection UK)*. Electric buses are a key tool in reducing emissions that cause climate change, as well as reducing air pollution levels that curtail the lives of numerous urban residents.

As part of the standard ZEBRA process, the South Yorkshire Mayoral Combined Authority (SYMCA) ZEBRA proposal includes the first roll out of ZEBs across this region, which is a vital first step in achieving an ambition for a fully zero emission bus fleet by 2035. The South Yorkshire proposal involves all four local authorities and crosses two Clean Air Zones (CAZs).

The economic case assesses the full impacts of this project by determining value for money for the taxpayer. These impacts include those costs and benefits which accrue to the environment, society, businesses and government. This economic evaluation assesses the value for money arising from the investment in 27 new electric buses in South Yorkshire, through electrification of routes 221 and 22x and the introduction of a new electric shuttle in Sheffield City Centre. The Department for Transport's Greener Bus Model ('GBM') is used to model the quantifiable costs and benefits of replacing the existing fleet with an electric one. The Do-Minimum scenario assumes replacement of the current fleet against an equivalent fleet of Euro VI diesel buses.

The additional non-monetised benefits that may arise from this scheme, including reductions in preventable early deaths linked to air quality and the effect of reductions in noise pollution are considered in the latter part of this analysis.

A Net Zero emission bus fleet also forms a key part of South Yorkshire's Bus Service Improvement Plan programme. Upgrading the existing buses to electric is a minimum requirement for achieving a highly efficient public transport network, which responds to the needs of existing and future users. An electric fleet can contribute to raising the profile and resilience of the network, and increase the patronage on all types of journeys, which currently stands at just 9% of all trips to work (*South Yorkshire Bus Service Improvement Plan 2021).* The environmental benefits of this shift will be felt throughout the community, benefiting a group wider than simply those who use the bus for travel.

GREENER BUS MODEL

4.2 – Key inputs to the model, including evidence / sources / assumptions

The Greener Bus Model (GBM) has been provided by the Department for Transport (DfT) to ensure consistency of default values and methodology between all ZEBRA funding applicants. It allows applicants to input a set of user-defined parameters as well as form a choice between different pre-set parameter options. These can be broadly grouped into project parameters, a description of the bus fleet, and emission parameters. The way in which these inputs form the basis of the evaluation have been established and applied is detailed below.

Project parameters

It is expected that this scheme's bus service will be fully operational by Financial Year 2023-2024. As the GBM tool is in calendar years, the first year of infrastructure delivery is assumed to be 2022 while buses are assumed to be operational by 2023.

A VAT of 0% is applied as VAT is treated as a transfer payment in this instance and resources are valued equal to their net-of-tax prices in this part of the economic evaluation.

A standard Optimism Bias of 3% is applied to all cost items, except to the supporting infrastructure CAPEX. The 3% rate reflects the fact that estimates were tested in the market by speaking with known suppliers for vehicle and infrastructure costs. This testing helped estimate costs with a high degree of confidence, as required for economic appraisal at the Full Business Case stage. This justifies the application of an Optimism Bias of 3% for most cost items, except the supporting infrastructure civils work. Civil works are often subject to cost over-run and may incur extra expenditures along the way. To reflect this uncertainty, a 24.55% factor was applied to the supporting infrastructure items instead. This represents a weighted factor with 44% being applied to the iDNO quotes for the civils work and 3% applied to the remaining infrastructure costs, such as charge posts. A weighted factor is applied as it more accurately describes the uncertainty around the design of the civil engineering work. Even though this project is at an advanced FBC stage, there are no civils drawings or preliminary layouts available, therefore a 44% optimism bias has been applied to selected items. This comparatively high level of optimism bias is justified because the civil work is an instance of a Standard Civil Engineering/Building project. For an FBC stage, the latest TAG guidance recommends a 44% uplift for this project or project component (TAG Unit A1.2, par. 3.5.8, Table 8). The same recommendation can be found in the *Supplementary Green Book Guidance – Optimism Bias*.

Funding sources are essential to establish whether an item is a benefit or disbenefit. Most cost items are paid for through a mix of public and private funding. A sizeable amount of the vehicle costs and the supporting infrastructure costs for this project will be incurred by the public sector and through the ZEBRA grant. The GBM does not allow for ongoing costs, such as operational or maintenance, to be split between public and private funds. Therefore, these have been marked as 'Private' in all the GB models, since the private sector pays more than the public sector. As they are not eligible for grant funding, marketing and management costs have not been included in the GBM.

The diesel equivalent CAPEX for each route is used to work out 75% of the vehicle premium that will be covered by ZEBRA funding. The battery cost is subsumed within the price paid for the vehicles.

The operator's investment is the cost of the equivalent diesel fleet and 25% of the capital cost of the infrastructure at Rawmarsh depot.

The battery replacement costs for the 23 buses on the 221 and 22x route are covered by private investment, whereas the battery replacement costs for the 4 CCS buses will be covered by public funds via SYMCA. The SYMCA contribution is the remaining cost, after all the items above have been subtracted from the total vehicle CAPEX figure, along with the infrastructure costs.

A similar approach is used when calculating the funding for the supporting infrastructure, which follows the financial case approach. The ZEBRA grant is simply 75% of the supporting infrastructure cost, the operator's investment is 25% of the ZEBRA grant above, the iDNO contribution is fixed at [redacted] and the local funding is therefore what remains after all these are

subtracted from the total supporting infrastructure CAPEX. These are all summarised in the below table:

CAPEX Section	Funding source	Description
Vehicle CAPEX	ZEBRA grant	75% of the premium funded by ZEBRA.
	Investment from operators	The operator's investment is the cost of the equivalent diesel fleet for the 221 and 22x route.
	SYMCA	The SYMCA contribution covers the diesel equivalent for the City Centre shuttle and 25% of the premium for all vehicles.
	Battery replacement - private investment	The battery replacement costs for the 23 buses on the 221 and 22x route are covered by private investment (the operator).
	Battery replacement - Public investment (SYMCA)	The battery replacement costs for the 4 CCS buses will be covered by public funds via SYMCA.
Supporting infrastructure CAPEX	ZEBRA grant	This is 75% of the total supporting infrastructure cost.
	Operator investment	This represents 25% of the infrastructure cost at Rawmarsh Depot, which is 72% of the total infrastructure cost.
	iDNO Contribution	[redacted]
	Local government funding (SYMCA)	This is 25% of the infrastructure cost at Sheffield Interchange and Rotherham Interchange, which is 28% of the total supporting infrastructure cost, minus the iDNO contribution.

The Bus Service Operators Grant (BSOG) was set to *Basic BSOG rate + LCEB, AVL and Smartcard Uplifts* for the existing fleet, and to 22p for the new electric buses, reflecting the expected change to the fuel (or electricity) rebate. The BSOG is paid by HMRC to selected bus operators, to assist with the payment of fuel, or, in the case of the upcoming fleet, electricity costs.

All costs are in real 2021 prices, which are then converted to a standard appraisal 2010 baseline using the GBM.

Fleet description

This project aims to transition to a pure electric bus, single-decker fleet for all routes under examination.

The number of buses to be delivered is 23 for routes 221 and 22x (combined), and 4 for the City Centre shuttle. These numbers include contingency buses (3 for routes 221,22x and 1 for the shuttle). It is essential to note the contingency buses are not earmarked as being so, and they will not be idle by default – they are part of the fleet and fully functional, to be called on as needed for daily operations. They are necessary for in-service operation, out of service mileage, vehicle scheduling/positioning, maintenance, and testing. The average mileage of these contingency buses is therefore assumed to be the same as for the rest of the fleet.

The electric buses will replace Euro VI standard buses for route 22x, and Euro IV standard for route 221. Regarding the buses these are replacing, they are assumed to be [redacted] years old for the 221 and 22x routes and half a year old for the shuttle. This is based on averaging of the fleet ages on each route, using information provided by the operator, Stagecoach. For the City Centre bus, the current fleet age is assumed to be one year old. This assumption is intended

to circumvent the fact that the tool only calculates benefits as if a fleet replacement occurs, whereas the city centre route represents a new route.

Mileage and speed

Mileage was obtained by calculating a simple average of the annual vehicle-kilometres, as part of the route analysis exercise. The total kms were divided by the number of buses. This is a simplification, nonetheless it does not affect the reliability of the results. The average mileage is 38,731 kms per vehicle per year for the City Centre shuttle and 76,506 kms per vehicle per year for the 221/22x routes. The average annual km per vehicle, which is a unique input to the Greener Bus Model, is a weighted average of this. This was done to represent the full extent of kilometres travelled. The alternative of using a plain average was discarded as it is factually inaccurate, effectively reducing the number of miles travelled by each bus on route 221,22x.

These mileage assumptions are based on pre-Covid data, and they reflect the service as it is at the time of submission, with 15-minute intervals between buses.

Average velocity rates were obtained from the route analysis exercise, although this data does not appear to influence the overall results. The average velocity for routes 221 and 22x is 21.3 km/h, and for the City Centre shuttle it was assumed to be 8.3 km/h. These values were obtained from Arup's energy modelling analysis exercise.

No patronage assumptions were made as they are not required for the GBM.

Emission parameters

Regarding carbon emissions, the model was set to calculate them for the 'Road Transport Urban Big' area, which is the best suited to the South Yorkshire study area, given there are more than half a million residents living within the SY boundaries. The cost of carbon was set to 'Central' for our central calculation, and to 'Low' or 'High' for the sensitivity tests. The year-on-year growth in damage costs was set to 2%, as recommended by the latest DEFRA guidance.

The PM and NO_X parameters were also set to 'Central' for the central case appraisal.

No alterations were made to the 'percentage of DataBook emission' figures, as these are the industry standard.

Costs

A comprehensive list of cost items was calculated through the market analysis exercise, the route analysis and information from the operator. The capital costs are split into the cost of the vehicles and the supporting infrastructure cost. The model automatically calculates the operational cost of running the vehicles, using standard mileage, electricity and fuel consumption values. The model also inflates and deflates values where needed, and applies all other standard TAG calculations, such as discounting. The costs shown below are therefore not inclusive of inflation.

Supplier engagement sessions with a selection of bus manufacturers and infrastructure suppliers were conducted as part of the market analysis exercise. The suppliers provided responses through dedicated sessions, based on a route analysis provided by Arup, to help them identify the best solutions for each route. These sessions informed our understanding of vehicle, battery and charging specifications. The supplier engagement process was supported by both technical and operational staff from Stagecoach. The information gathered through the market engagement exercise served to confirm the feasibility of converting the chosen bus

routes to electric operation and was used when calculating anticipated overall scheme costs and delivery timescales.

All vehicle-related costs were included within the vehicle cost CAPEX, which includes the cost of the batteries and one round of battery replacement costs in year 7/8 of the scheme. Marketing, management and professional fees do not affect the BCR because they are not eligible for grant funding, and therefore not included in the CAPEX within the GBM. Contingency is the equivalent of optimism bias and is left out of the economic cost breakdown because it is calculated within the GBM tool, using the level of optimism bias provided by the user. The vehicle CAPEX costs are assumed to be incurred in the year of the vehicle delivery (2023).

The supporting infrastructure costs reflect charger installation; the cost of the chargers themselves and the electrical network within the depot/interchange. This cost category also includes allowance for an upgrade to the power network by the DNO. The infrastructure delivery costs are assumed to be incurred in the year of the infrastructure delivery (2022).

Ongoing costs, such as the infrastructure maintenance costs, vehicle maintenance costs and vehicle operating costs are calculated using the GBM tool. The assumption that infrastructure maintenance is capitalised, used for previous draft submissions, is no longer valid and has been removed from the CAPEX costs. It is now comprised within the infrastructure maintenance item.

The distribution of funding sources for all these costs was prepared in line with the financial case assumptions. The resulting proportions of public and private funding, split by the different stakeholders involved, are very similar to those recorded in the financial case and were derived using identical formulas, for example ZEBRA funding is 75% of the premium of the vehicle capital costs. The differences between the approach to costing in the economics and financial case have been reconciled as much as possible. However, it is worth noting vehicle and supporting infrastructure CAPEX costs in the GBM are exclusive of contingency, other management and marketing costs, inclusive of all battery costs, and comprising of GBM's own inflation assumptions.

A detailed breakdown of how the cost items were developed for the purposes of the economic modelling is detailed below, split between Vehicle CAPEX and Supporting Infrastructure CAPEX. For a full discussion of starting point costs, in conjunction with the specification of each item, please see the market engagement section.

Table 4.1: Capital expenditure costs for the scheme (inflation & OB uplift not included)

Vehicle Replacement	
221,22x	***Cost***
Vehicle CAPEX	[redacted]
Battery replacement	
Subtotal	11,095,000
City Centre	***Cost***
Vehicle CAPEX	[redacted]
Battery replacement	
Subtotal	1,864,000
Total cost of vehicle replacement*	**£12,959,000**
Supporting Infrastructure	
221,22x	***Cost***
Point of Connection / Offsite Works CAPEX	[redacted]
Opportunity charging (Rapid charging)	
Depot charging (Fast charging)	
Subtotal	2,462,674

City Centre	***Cost***
Point of Connection / Offsite Works CAPEX	[redacted]
Opportunity charging (Rapid charging)	
Depot charging (Fast charging)	
Subtotal	
Total cost of supporting infrastructure	**£2,847,170**
Management (not eligible for grant funding)	***Cost***
221 and 22x	[redacted]
City Centre	
Total cost of Management	

To summarise, the central case cost per vehicle is [redacted] for a single decker, once the items paid for by the private sector or the operators are excluded, such as marketing. This represents the economic case CAPEX, divided by the number of buses. This not only includes the price of the vehicles themselves but also one round of battery replacement in year 7/8. The battery costs represent the number of batteries needed for each route (23 for 221,22x and 4 for the shuttle), multiplied by [redacted] the price of one battery. [redacted] will cover the 221,22x battery costs [redacted] and SYMCA funding will cover the City Centre Shuttle battery costs [redacted]

This cost per bus will be different from those in the financial case, as the financial case distinguishes between cost per bus for the 221,22x route and cost per bus for the CCS route.

The relatively high cost is a function of the specification, which must respond to the South Yorkshire topography and route requirements. The routes travel through areas of higher elevation than the average bus routes in England, passing through densely populated urban areas, sub-urban and rural areas. In general, the South Yorkshire area is particularly geographically diverse, with a wide range of altitudes. The driving style needed to adapt to different section of the route and power required for the vehicle to maintain its usual capacity are therefore onerous and require buses of a superior capacity, and therefore increased price. The 221 and 22x specifically are challenging routes to electrify.

As there is a difference in charging requirements between the two routes, these have been calculated differently. The disaggregation is detailed in the two tables below.

Table 4.2: Routes 221 &22x - Supporting infrastructure CAPEX - Electrical infrastructure line items

Item	Cost (£)	Detail
Electrical connection (Rawmarsh Depot) capex	[redacted]	
Electrical connection (Rotherham Interchange) capex		
Electrical infrastructure - capex		
Rapid chargers (inc. civils) (Rotherham Interchange) capex	[redacted]	£ per charger
Number of rapid chargers	**2**	
Opportunity charging - capex	[redacted]	
Fast chargers (inc. civils) (Rawmarsh Depot) capex	[redacted]	£ per charger
Number of fast chargers	**23**	
Depot charging - capex	[redacted]	

Table 4.3: City Centre Shuttle: Supporting infrastructure CAPEX - Electrical infrastructure line items

Item	Cost (£)	Detail
Electrical connection (Sheffield Interchange) capex	[redacted]	
Electrical connection (not used) capex		
Electrical infrastructure - capex		
Rapid chargers (inc. civils) (Not used) capex	[redacted]	£ per charger
Number of rapid chargers	-	
Opportunity charging - capex	-	
Fast chargers (inc. civils) (Sheffield Interchange) capex	[redacted]	£ per charger
Number of fast chargers	4	
Depot charging - capex	[redacted]	

The route analysis indicates that these will be the appropriate chargers for these routes. The supplier engagement process further supports the type and specification of the chargers below because they represent minimum requirements for the route specifics and topography.

In the same way as vehicle and infrastructure maintenance costs, vehicle operating costs are independently calculated by the GBM. We initially supplied the tool with local electricity prices, for the entire appraisal period, but since we could not obtain written support in favour of these prices, we reverted to average GBM ones. [redacted]

As mentioned in the Project Parameters section, battery usage-related maintenance costs are now included in the capital costs.

Combined appraisal parameters

A combined appraisal has been developed for the three routes which form the complete scheme. The following assumptions were used in aggregating values so that they could be inputted into the GBM.

The model inputs calculated through a weighted average method are:

- Speed: the weighted average is 19.3 km/h
- Age of fleet to be replaced (DM fleet): the weighted average for the two routes (City Centre and 221/22x) is 8.2 years
- Mileage: the average annual mileage per bus is 115,237 km; this figured is weighted to reflect that the 23 buses on the 221 & 22x lines have higher annual mileage than the 4 City Centre shuttle buses.

Parameters such as fleet life expectancy, delivery year, damage costs and emissions are assumed to be consistent across all routes.

4.3 – Describe any deviation from DfT base case assumptions

Annual average mileage has been provided as a reliable estimate from the route analysis exercise undertaken by Arup, hence it is sensible to replace the existing DfT assumption of 56,531 kms per annum from within the GBM tool. As shown in the planned service map, routes 221 and 22x are long inter-urban routes, serving a variety of areas and communities within the

four districts of South Yorkshire. Such cross-boundary routes run consistently longer mileages than intra-urban services do, hence justifying our replacement of the standard DfT assumption.

The other parameters describing the fleet are retained as they are in the model, these being the fuel/electricity consumption, vehicle life expectancy and standard emission parameters per each fuel type.

4.4 – Key outputs from the model

The outputs of the tool, from the BCR & Dashboard tab, can be found below. A brief interpretation of the results is also provided. A short explanation is supplied next to each row, to help clarify whether the line item is being treated as a benefit or a disbenefit.

One of the main benefits to users may arise through a decrease in Greenhouse Gas emissions. Benefits for operators may realise if they run through reduced operating costs or through increases in operator grants received. Benefits to the public sector can occur if they pay less for capital or ongoing expenditures. Costs or disbenefits occur if the public sector as a whole pays more per mile, or in capital costs, to help fund the scheme, than it would pay for the counterfactual case.

Table 4.4: Routes 221, 22x and the City Centre shuttle – Combined Appraisal Summary Table

Impacts	**Value (£)**	**Interpretation**
Carbon Impact	[redacted]	Positive impact, reduction in CO2 emissions
NOx Impact	[redacted]	Positive impact, reduction in NOx emissions
PM Impact	[redacted]	Positive impact, reduction in PM emissions
Indirect Tax Impact (Fuel/Electric Duty)	[redacted]	Reduction in indirect tax receipts
BSOG	[redacted]	Increase in grant received by operator
Vehicle Maintenance Cost	[redacted]	Savings incurred by private sector
Operating Cost (Resource)	[redacted]	Savings incurred by private sector
Operating Cost (Duty)	[redacted]	Savings incurred by private sector
Costs (Broad Transport Budget)	**Value (£)**	**Interpretation**
Vehicle CapEx	[redacted]	Cost of new vehicles
DM Fleet Replacement CapEx	[redacted]	A negative capital replacement cost means the public sector is saving money by using new fleet
Infra CapEx	[redacted]	Cost of new infrastructure
BSOG	[redacted]	Increase in grant received by operator represents a cost to government
Summary	**Value (£)**	**Interpretation**
Present Value of Benefits	[redacted]	The value of all the benefits, to users, operators and the public sector, once timescales, inflation and optimism bias have been accounted for
Present Value of Costs	[redacted]	The value of all the costs to users, operators and the public sector, once timescales, inflation and optimism bias have been accounted for
Net Present Value	[redacted]	PVB - PVC. If positive the scheme brings more benefits than it costs and it represents value for money
Benefit Cost Ratio	[redacted]	[redacted]
CEI	[redacted]	

**Items shown above are discounted values. All other standard TAG transformations also applied by the GB model.*

[redacted] The scheme brings large environmental benefits, and a substantial reduction in funds spent by the public sector on a new fleet. The operators also benefit from large grant increases and maintenance cost savings. Nonetheless the vehicle capital costs are high, and as a portion of those must be incurred by the private sector, [redacted] The additional infrastructure required to render the routes operational, for instance at depots and interchanges, is also a substantial cost which contributes to the reduction in BCR. Moreover, as the GBM tool does not cover longer-term benefits to the community, such as improvements in the image of public transport, increase in patronage or reduction in noise, the current BCR is an understatement of the benefits the project will bring during its lifecycle.

4.5 – Sensitivity testing

The following sensitivities were undertaken:

- DS Fleet mileage +10%
- DS Fleet mileage -10%
- BSOG for DS Fleet set to 6p
- Low Carbon Value
- High Carbon Value
- CAPEX +10%
- CAPEX – 10%

The BCR has the strongest response to changes in carbon pricing and in Bus Subsidy Operator Grant. The impact is otherwise moderate across the rest of the sensitivities. That is in line with our expectations, as carbon prices moderate the environmental benefits, which are a key impact of this scheme whereas subsidies impact the finances of both public and private operators, the central agents in this analysis.
[redacted] The second most critical parameter is the BSOG level for the DS fleet. Reverting to the 6p BSOG for the electric fleet substantially increases the BCR, due to the public sector having to pay less for each mile travelled by the new electric buses. The impact of these two parameters reflect just how much the project contributes to putting South Yorkshire on the path to Net Zero carbon.

Table 4.5: Sensitivity tests and BCR variation summary tables

Parameter	Lower	Main	Higher
Mileage	[redacted]	[redacted]	[redacted]
Carbon	[redacted]	[redacted]	[redacted]
CAPEX	[redacted]	[redacted]	[redacted]

Parameter	6p	22p (current)
DS Fleet BSOG	[redacted]	[redacted]

To better illustrate the impact these parameters have on the scheme BCR, the following table shows variation from the main case:

NON-MONETISED BENEFITS

4.6 – Detail of non-monetised benefits expected to be generated by the scheme

In addition to the monetised benefits identified by the GBM Tools, other non-monetised benefits have been identified which this scheme will enable. These non-monetised benefits are outlined below and when considered in addition to the monetised benefits calculated above, provide a robust argument for our proposed scheme representing a low to moderate value for money investment.

Reduction in preventable early deaths from respiratory problems linked to poor air quality

Poor air quality has a real and significant effect on people's lives, contributing to bronchitis, asthma and other respiratory illness, as well as cardio-vascular problems and cancer. The main pollutants of concern in the UK are oxides of nitrogen, principally nitrogen dioxide (NO_2), and particulates (PM). Long-term exposure to air pollution is understood to be a contributory factor in deaths from respiratory and cardio-vascular disease.

South Yorkshire has well established air quality issues as evidenced by the declaration of 22 Air Quality Management Areas (AQMAs) for excessive amounts of pollutant NO_2. The entire urban area of Sheffield has been identified as an AQMA, in addition to 6 locations in Barnsley, 7 in Rotherham and 8 in Doncaster. Each of these AQMAs has an Air Quality Action Plan (AQAP), setting out measures which will reduce emission levels.

The reduction in air pollution anticipated following the investment in the electric bus network in South Yorkshire via the ZEBRA – South Yorkshire scheme will support the mitigation efforts aimed at reducing the adverse health impacts air pollution has on local communities along these chosen bus routes. The same level of reduction in harmful pollutants would not be achieved by simply replacing the existing fleet with a newer diesel fleet so the scheme is key to South Yorkshire's ambitions for a healthier urban environment.

Reduction in Noise Pollution

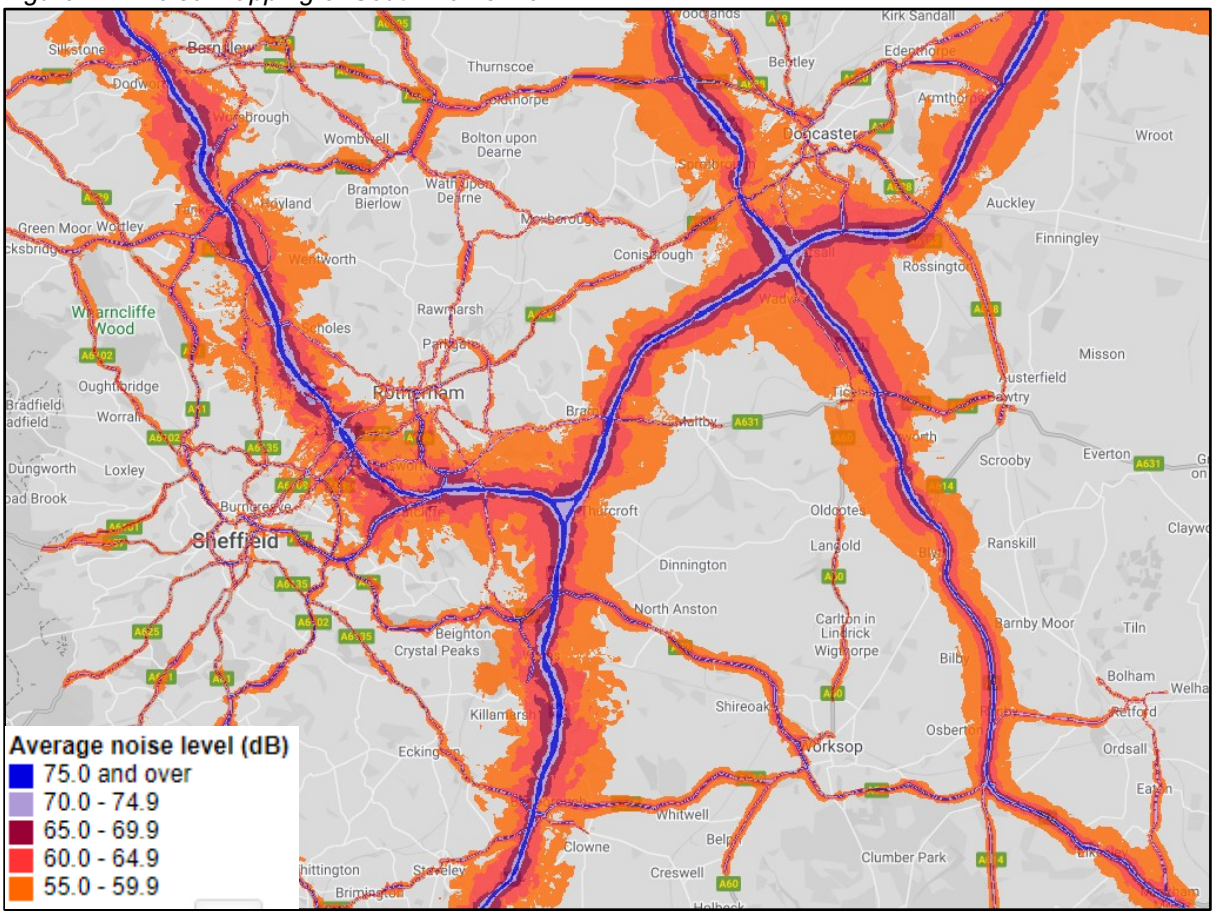
Lower levels of noise pollutions are standard features of electric fleets of any kind. The proposed buses will help achieve a marked reduction in noise on the corridors they are travelling on, when boarding and alighting passengers at a stop, as well as when stopped at a junction. According to the World Health Organization (WHO) noise is the second largest environmental cause of health problems, just after the impact of air quality (particulate matter). In 2018 the WHO published the Environmental Noise Guidelines for the European Region

report which made specific recommendations for reducing road traffic noise to mitigate adverse health effects that included:[1]

- For average noise exposure, the GDG (EU Guidelines Development Group) strongly recommends reducing noise levels produced by road traffic below 53 decibels (dB) L_{den}, as road traffic noise above this level is associated with adverse health effects.
- For night noise exposure, the GDG strongly recommends reducing noise levels produced by road traffic during night-time below 45 dB L_{night}, as night-time road traffic noise above this level is associated with adverse effects on sleep.

Noise mapping has been carried out in England by DEFRA and the map shown in **Figure 4.1** uses road data gathered from 2017. The map shows 24-hour annual average noise level in decibels with weightings applied for the evening and night periods.

Figure 4.1: Noise mapping of South Yorkshire



Source: England Noise and Air Quality Viewer

From the evidence provided by the 2017 road noise map of South Yorkshire (shown in **Figure 4.1**) it is clear that the average noise level recorded along the majority of the major road network in the region exceeds the recommended noise pollution limits set out by the WHO.

[1] noise-guidelines-exec-sum-eng.pdf (who.int)

This prevalence of noise pollution along these routes will impact a large amount of urban communities along the road network and contribute towards adverse impacts on the health of the local population.

A reduction in vibration along the relevant routes is another expected non-monetised benefit of the project. The impact of vibrations could be proxied using the TAG Noise Workbook, however as that would require an estimate of the number of households affected it would not be possible within the project's timeframe. A recent urban study in Germany (*Laib et al. 2019 Modelling noise reductions using electric buses in urban traffic.*) confirms that electric buses can bring up to 14 dB(A) reductions in noise, when using lower speeds, compared to combustion engine buses. There is also good potential for noise and vibration reduction while moving, and at bus stops, in the case whereby electric buses have a high share of the total traffic.

The delivery of this scheme in terms of electrifying the 22x and 221 bus services and the introduction of a new electric city centre shuttle bus service in Sheffield will support the mitigation of noise pollution along these routes thereby reducing the adverse health impacts on the local population.

Improved perception of public transport system

As outlined in the Strategic Case the current bus fleet serving communities across South Yorkshire has received no major investment in terms of vehicle upgrades in recent years with the average age of vehicles being approximately 9.5 years old. Consequently, the current bus fleet, particularly in Doncaster and Rotherham, includes a high proportion of high polluting buses. Doncaster also has the lowest proportion of less polluting vehicles, with only 9.4% of buses meeting the Euro 6 standard.

The proposed investment in new electric vehicles operating along the 22x and 221 bus services and the introduction of a new electric city centre shuttle bus service in Sheffield will revitalise the perception of the public transport network. Newer vehicles will likely improve perceptions of efficiency and safety of these services whilst the environmentally friendly element of these services is also expected to appeal to local communities given the current focus on climate change on the national and global agenda. These buses are also likely to be of a higher specification, thus enhancing the passenger experience and further contributing to a level of increase in bus patronage.

Other potential benefits to the economy

Beneficial economic effects are also likely to ripple through the local economy, although we would need further in-depth market studies to confirm their scale. Bringing ZEBs into South Yorkshire provides a kick-start to the electric bus and infrastructure maintenance sectors and will gradually result in up-skilling of staff, an increase in number of specialised technical roles, as well as potential earnings growth that would feed back into the local economy. Electric buses require specialised maintenance, and despite having fewer moving parts than traditionally fuelled buses, would nonetheless bring additional jobs and skills to the region. As we expect the number of ZEBs to increase post this scheme, due to network effects and economies of scale, we would also expect to see a multiplier effect from this project, which effectively amounts to stimulus to local businesses that provide or support the delivery of zero emission-related goods and services.

4.7 – Value for Money Summary
There is a good case for South Yorkshire's ZEBRA bus scheme which demonstrates that there is a large benefit associated with the reductions in Carbon, NO_X and PM. This is particularly important given the issues with air quality in South Yorkshire. As the non-monetised benefits indicate this reduction in emissions is particularly instrumental in reducing some of the effects linked to poor air, such as preventable early deaths from respiratory problems. [redacted] based on the cost benefit analysis. This is partially driven by the costs involved but does not fully reflect the range of benefits the project would bring, particularly the non-quantified environmental benefits.
4.8 - Detail any uncertainties that could impact delivery of benefits or costs
Economic risk assessment In terms of cost-side risk, the largest risk with respect to the GBM economic analysis results is the CAPEX of vehicles and supporting infrastructure. A sensitivity analysis of 10% upwards and downwards variation is conducted to test the effect of any change. However, if the costs vary by more than 10% compared to the baseline this may negatively impact the BCR further. We have mitigated for it by applying a generic OB rate of 3%, recommended for FBC schemes by the DfT, and a 44% optimism bias rate to certain items in the supporting infrastructure costs. An increase of more than 44% in those cost items is highly unlikely, based on our existing supplier information and quotes. Regarding the other main component of CAPEX, that is the vehicles themselves, Arup has chosen a price point that allows for variation in final pricing, and which is also very close to the maximum price available on all bus models being considered, based on information from the detailed engagement exercise with the suppliers. Therefore, the risk with respect to CAPEX increases, not covered in the existing approach to optimism bias and in the existing sensitivity, has been largely mitigated. Another key risk with respect to the scheme's BCR is an increase in electricity prices. This is less of a risk and more of a short-term certainty, given current affairs and trends in the electricity market. Nonetheless we have provided a good level of mitigation by using the default GBM electricity values, which are lower than the prices we obtained from our partner Stagecoach, by approximately 30% across the appraisal period. Vehicle mileage has been derived by Arup's route analysis team, and has been input into the GBM with a degree of averaging across the routes considered (221, 22x and CCS). The risk that routes 221,22x change to the extent that the mileage is lower or higher by more than 10% (the scenarios covered by our sensitivity tests) is very low. These services are important in South Yorkshire, and they are not ancillary services that can be easily cancelled or amended for large sections of the route. Moreover, such a change would effectively mean excluding between 5% and 25% of the current patrons, which is an undesirable scenario for both the public sector and the operator. In the event of route alterations, due to large highway projects in the area for example, the overall itinerary for those services shall be arranged to the best interest of the operator and the local communities served by the operator. [redacted] In general, all costs which have been used as inputs in the GBM have a degree of risk compensation applied to them, individually or as part of a group of costs.

Sections 5.1 Commercial Case Overview and 5.2 Commercial Strategy discuss the risks related to the information that underpins our cost input data in the GBM, and respectively the risks for the costs arising from the procurement plan.
4.9 – Sensitivity analysis of uncertainties
This has been discussed above and conducted with the main sensitivity runs for the model.

5 - COMMERCIAL CASE

5.1 – Commercial Case Overview

Overview

The proposed Commercial approach has been designed to ensure that the project obtains value for money both in terms of the buses and charging infrastructure procured by SYMCA and those which will be secured by Stagecoach as the operating partner for routes 221 and 22x.

Market engagement undertaken during December 2021 has provided confidence that the proposed operating and technical solutions, including the need for opportunity charging on routes 221 and 22x, are correct for the project. The supplier engagement process has also ensured that robust cost assumptions have been fed into final business case.

A summary of the funding requirements are as follows:

- DfT (ZEBRA): £8,351,721
- SYMCA: £2,683,051
- Stagecoach: [redacted]
- Other private (iDNO)

Total: £15,588,978

Whilst it is recognised that the SYMCA project team will require some additional resources, especially to support the technical aspects of the project, it is also envisaged that the project will draw on the existing resources and experience of Stagecoach from their delivery of other electric bus projects in the UK. The most relevant being the recent introduction of opportunity charging buses into Kilmarnock. It might also be possible to draw on any relevant experience of the operator awarded the City Centre Shuttle (CCS) operating contract.

Commercial Strategy

The commercial case is based on securing assets owned by either SYMCA or Stagecoach supported by a procurement strategy which aims to ensure value for money in the purchase of both the buses and supporting charging infrastructure. The proposed agreement between SYMCA and Stagecoach for routes 221 and 22x will ensure the long-term use of the assets within the Combined Authority area maximising the local benefits of the scheme over the medium to long term.

The buses for the Sheffield City Centre shuttle will be owned by SYMCA allowing them to be used on other tendered services in the future if necessary. It is not proposed to charge the CCS operator for the four electric buses as these costs would only be recovered by the operator through the operating contract price. However, it is proposed to put a lease agreement in place which will cover the operator's maintenance and repair obligations and return conditions.

The reasons for selecting routes 221 and 22x are discussed in **Section 3.2.5** of the **Strategic Case**. Stagecoach was chosen following a selection process where all operators in the region were offered the opportunity to collaborate with SYMCA in the ZEBRA scheme. From these discussions, it was clear that the only viable operator at that time was Stagecoach. Other operators did not want to be considered as a partner for this particular fund in South Yorkshire.

On routes 221 and 22x, both of which are commercial services, Stagecoach have offered to procure both buses and the charging infrastructure for Rawmarsh depot. The benefits of this approach are examined within the commercial case. The opportunity charging infrastructure to support the operation at Rotherham Interchange will be owned and operated by SYMCA to allow the potential use by other services in the future.

Procurement Strategy & Preferred Option

The preferred procurement option is to undertake separate tendering processes for both vehicles and infrastructure to maximise competition and ensure value for money across all elements of the procurement.

The assets required and the proposed procurement approaches are summarised as follows:

- 4 x 9.5-10 m single electric deck buses for Sheffield City Centre shuttle procured by SYMCA through a separate tender using an existing public sector framework agreement.
- 4 x 100kW DC chargers plus installation at Sheffield Interchange through a separate tender possibly using an existing public sector framework agreement.
- 23 x 12m single deck electric buses for use on routes 221 and 22x purchased by Stagecoach using their existing bus purchase framework agreements
- 23 x 150kW depot chargers for Stagecoach Rawmarsh depot purchased by Stagecoach through a separate tender.
- 2 x 300kW opportunity charging units for routes 221 and 22x located at Rotherham Interchange and owned and purchased by SYMCA.

The tender specifications for the buses and chargers will be output based with suppliers having to demonstrate the ability of the products to meet the operating and performance requirements of the routes.

It is anticipated that the chargers for Sheffield and Rotherham Interchanges will be combined into one tender to reduce the resources required to run this tender process.

Market Engagement

Early supplier engagement sessions with a selection of bus manufacturers and infrastructure suppliers took place during December 2021. The supplier engagement process was supported by both technical and operating managers from Stagecoach.

Through this exercise, a pre-meeting briefing pack was shared with a number of vehicle and infrastructure suppliers, who were invited to provide responses through dedicated sessions. The briefing pack included a route analysis for each of the three routes so bus manufacturers could offer the most suitable product in their range to match the operating requirements. It is important to note that this was not an official procurement exercise, and other suppliers may have an opportunity to respond to the tender(s) when any formal Invitation to Tender is issued.

The aim of the early market engagement exercise was as follows:

- Gather market insight on the appropriate parameters of the scheme e.g. suitable vehicle specification, charging regime and charging infrastructure, etc.
- Understand supplier views on the various opportunity charging regimes
- Clarify the likely timescales for delivery, including understanding of dependencies and risks
- Seek feedback on the proposed approach to procurement
- Understand technology roadmaps and developments which will impact on product availability offering during 2022/23
- Seek feedback on the route analysis document and their feedback on the potential technology and operational approach to support the conversion of these routes
- Understand their experience of delivering similar projects through presentation of case studies

In summary the market engagement process has:

- Informed the proposed procurement approach
- Provided assurance on the charging regime for each of the routes
- Validated the indicative costs being used in the business case; and
- Confirmed the likely timescales for the supply of buses and infrastructure including the installation and commissioning process which has been fed into the procurement programme shown in section 5.4

Detailed feedback from the market engagement exercise is summarised in **Section 5.5**.

Since the supplier engagement sessions in December 2021 the following activities have also taken place:

- [redacted] attended a site visit to Rotherham Interchange on the 11 January 2021, on a no fee no obligation basis, to undertake a high-level initial assessment of the feasibility of installing opportunity charging masts at the interchange.

- [redacted] have agreed to undertake a route test of routes 221 and 22x using one of their existing electric buses to verify their energy consumption forecasts for these routes. This exercise will help verify assumptions as the project progresses.

5.2 – Commercial Strategy

The project will deliver 27 zero-emission electric buses for route 221 (Rotherham to Doncaster), route 22x (Rotherham to Barnsley) and a new city centre shuttle (CCS) service within Sheffield. Routes 221 and 22x will be delivered in conjunction with Stagecoach Yorkshire whilst the CCS service will be a new tendered service.

[redacted] Analysis has been undertaken to ensure that the proposed buses for the CCS service would also be suitable for routes [redacted] if this option was necessary.

These three routes have been selected as, given their geographical spread, they will allow electric buses to be introduced across a number of regions within the Combined Authority Region.

In addition to overnight charging at Stagecoach's Rawmarsh Depot, the 221 and 22x buses will be supported by opportunity charging infrastructure at Rotherham Interchange. The CCS buses will be overnight charged at Sheffield Transport Interchange.

The project is intended to kick-start zero-emission bus usage across South Yorkshire and the proposed infrastructure will support this wider aim.

Route 22x uses 12m single deck Euro VI low emission diesel buses which are eligible for the 6p per km incentive whilst route 221 uses older 12m Euro IV diesel buses. It has been agreed with Stagecoach that the Euro VI buses on route 22x will be reallocated to other routes allowing older buses to be withdrawn thus leading to an overall improvement in air quality. Discussions are currently taking place with Stagecoach to seek to retain these buses within the South Yorkshire operating area and it is proposed that this will be included in the Heads of Terms between SYMCA and Stagecoach.

The new City Centre shuttle will be tendered. The operator who would run the new service is currently unknown. Currently, South Yorkshire has [redacted] local bus contracts with operators. [redacted] all have operating contracts with South Yorkshire Passenger Transport Executive (SYPTE), within Sheffield, that includes full daytime bus workings, similar to the proposed electric city centre shuttle bus. These operators continue to bid for work and have confirmed interest in future contracts including the proposed electric city centre shuttle bus. Contracts for April 2022 are currently out for bids with [redacted] potential bidders already interested in various work across the county. There is a very low risk that contracted services do not receive bids, and full daytime work within Sheffield is the most popular contract work for bidders. As such, we anticipate that at [redacted] bids, would be received for operating the city centre electric shuttle if the ZEBRA project goes ahead.

In terms of timelines for the tendering of the CCS operating contract the current aim would be to award the contract during the summer of 2022 so that the successful operator can be involved in the project delivery phase. Contract award during the summer of 2022 will also allow a final decision on the location of the charging infrastructure (Sheffield Interchange or Operators depot) to be made and for this to be fed into the infrastructure procurement.

An analysis of all three routes was undertaken to determine the operational requirements. This showed an operating range requirement of between 120 miles and 239 miles per day for the 23 buses operating across routes 221 and 22x and an operating range requirement of around 70 miles per bus per day for the CCS service. Routes 221 and 22x are particularly challenging with 10 of the 20 Monday-Friday vehicle workings having mileages greater than 160 miles, which is seen as the current benchmark maximum range for overnight depot charged buses. The route analysis is included within **Appendix A**.

Data from the route analysis, which was undertaken by Arup, supported by the supplier engagement process, has determined that the operating range requirement means that battery electric buses supported by opportunity charging masts at Rotherham Interchange is the preferred solution for the conversion of routes 221 and 22x. The analysis indicated that overnight depot charging for the CCS service would suffice and no opportunity charging would be required for this service.

Having opportunity charging infrastructure in place at Rotherham Interchange is also seen as a catalyst to encourage more operators to operate electric buses across South Yorkshire. A report produced by Arup for SYMCA in 2021 “Environmental analysis – setting out the pathway to a zero-emission bus fleet for South Yorkshire” showed that due to the hilly topography across the region pantograph charging is likely to be a requirement on several routes in the future. The 221 and 22x project therefore becomes an important project in terms of informing and supporting this future strategy.

The use of opportunity charging at Rotherham Interchange will allow all buses to complete their required daily duties without the need for buses to return to the depot during the daytime to swap over with a fully charged bus, a practice which will lead to an overall increase in the fleet size required and driver costs. Analysis undertaken during the preparation of the route analysis suggested that route 221 and 22x would require extra vehicles if buses only capable of being depot charged were used. This conclusion was also supported by the supplier engagement sessions.

The opportunity charging infrastructure at Rotherham Interchange will be specified to meet inter-operability standards to allow future access to buses from other manufacturers.

Following consultation with Stagecoach it was agreed that routes 221 and 22x should continue to be operated by 12m single deck buses with a seated capacity of 42 passengers and an overall capacity of 70.

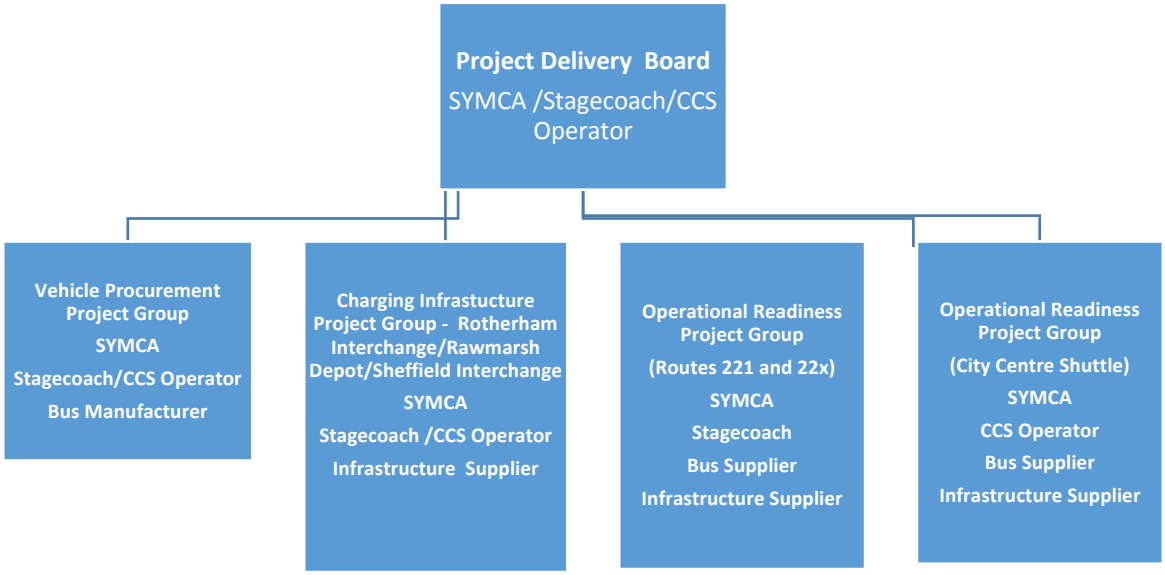
The CCS service will be operated with smaller buses (9m - 10.5 m) with an overall passenger capacity of around 60*. The size of bus for the CCS service have been chosen as being a suitable length for operation on the city centre roads and providing adequate capacity for the expected demand.*

The project will be delivered by SYMCA in partnership with the appropriate bus operator in conjunction with the chosen bus and infrastructure suppliers. For routes 221 and 22x the partnership with Stagecoach will allow SYMCA to draw on the operator's knowledge and experience including the procurement of buses and experience from other electric bus projects elsewhere in the UK. Stagecoach has already introduced depot charged electric buses into a number of UK cities including London and Manchester. Also, it has recently launched opportunity charged single deck buses in Kilmarnock, Scotland, and the operator's experience from delivering these buses should provide valuable input into the 221/22x project.

For the CCS route, the SYMCA intend to secure an operator in parallel with procuring vehicles and infrastructure to allow them to form part of the project delivery team. It is envisaged that the infrastructure supplier will provide a turnkey solution for the design and installation of the infrastructure.

In terms of project delivery, a Project Delivery Board will be established consisting of representatives from SYMCA and the appropriate operator who will oversee delivery of the project. Individual project working groups will sit below the Project Delivery Board to oversee elements of the project including vehicle procurement, infrastructure installation and operational implementation. The working groups will include external suppliers as appropriate.

Figure 5.1: Delivery Structure – Buses and Infrastructure



As discussed in **Section 5.3**, it is envisaged that the SYMCA will lead on the procurement of both the buses and charging infrastructure for the CCS, including the installation of the opportunity charging infrastructure at Rotherham Interchange. Stagecoach will purchase the buses and depot charging infrastructure for routes 221 and 22x although through the delivery structure detailed above SYMCA will be involved in the selection process for these assets.

Stagecoach and the contracted operator for the Sheffield City Centre shuttle service will act as delivery partners supporting both the vehicle and infrastructure delivery groups. The operators will also be responsible for managing the implementation and ongoing operation, including vehicle acceptance, driver & engineering training and maintenance of the buses including arranging for warranty work to be undertaken.

The delivery structure above fits into a wider Project Management Structure as detailed in the Management Case (see **Figure 7.3** within **Section 7.6.2**).

The proposed commercial model between SYMCA and Stagecoach is an Agreement covering the initial period of operation of the buses and the terms on which the capital funding has been supplied. It is proposed that the initial agreement period will be for a minimum of 5 years with a commitment to operate on routes within South Yorkshire for a minimum of 10 years. Stagecoach are proposing a straight line repayment of the both the ZEBRA and SYMCA grants for each year less than 10 years. The agreement will also cover Stagecoach's access to the charging infrastructure at Rotherham Interchange.

Prior to the formal agreement being agreed between SYMCA and Stagecoach, Heads of Terms have been agreed. Key issues covered by the Heads of Terms are as follows:

- obligations of each party on terms of delivery of various aspects of the project.
- length of commitment to operate the buses on routes 221 and 22x (5 years) including obligation for the continued use of the buses in the SY region beyond the initial agreement period (10 years).
- responsibilities for costs including energy costs, maintenance of buses and infrastructure at Rawmarsh depot and future mid-life battery replacement costs.
- agreement on the redeployment of the Euro VI buses currently used on route 22x to other routes within the SY region thus securing additional environmental benefits from the early withdrawal of older Euro standard buses.
- payment profiles for ZEBRA and SYMCA support.
- clarity regarding risk of future changes to operating costs (for example energy costs, changes to BSOG etc). This will rest with Stagecoach.

A letter of support from Stagecoach indicating their support for the project is included in **Appendix D.**

Given the Sheffield City Centre shuttle service will be a tendered service it is not proposed to charge a lease payment for these buses as they will be free issued as part of the Invitation to Tender document for this service. Operators will then be expected to reflect the savings of vehicle ownership and any operating costs savings from operating electric buses in their route tender bid.

Access to the ZEBRA funding scheme supported by additional funding from the City Region Sustainable Transport Settlement (CRSTS) will allow SYMCA to purchase both the buses and infrastructure for the CCS service outright. Due to the availability of capital funding to purchase the buses for the CCS service, the option of leasing the assets has therefore been discounted. Outright purchase as opposed to leasing will ensure that the long-term use of these assets in the SYMCA region can be assured for their full operational life.

PROCUREMENT STRATEGY

5.3 - Detail of intended procurement routes for the project's key outputs and activities

Objectives of Procurement Process
The proposed procurement process is intended to ensure the project, DfT and SYMCA obtains value for money but also secure suppliers who have the technical understanding and skills to successfully deliver the buses and infrastructure within the timescales required by the ZEBRA funding requirements.

The objectives can be summarised as follows:

- Ensuring value for money for the DfT and SYMCA
- Securing buses with attractive Total Cost of Ownership (TCO) over their operational life
- Reducing risk where appropriate, for example through extended warranties to cover battery life
- Securing buses offering maximum emissions reduction in terms of well to wheel
- Develop local opportunities and social value including training and apprenticeships to support future deployment of zero-emission technology

Commercial Options Considered

Several options were considered for the purchase of the buses and supporting infrastructure for routes 221, 22x and the CCS service. It is proposed that the opportunity charging infrastructure for Rotherham Interchange and the overnight charging infrastructure for Sheffield Interchange will be owned by SYMCA given this equipment will be located on SYMCA's facilities and there is an objective to make it available to other operators in the future.

In light of the offer from Stagecoach to purchase the buses for routes 221 and 22x, consideration of the purchase options for these buses and those required for the CCS are considered separately in the following two tables.

Commercial Options – Routes 221 and 22x

Commercial Option	Financial Arrangement	Pros	Cons
Option 1 SYMCA buys both buses and charging infrastructure through a combination of ZEBRA and SYMCA match funding	**Vehicles** • Diesel equivalent cost funded by SYMCA via the CRSTS • 25% of the premium funded by SYMCA via the CRSTS • 75% of the premium funded by ZEBRA **Infrastructure** • 75% funded by ZEBRA	Maintains long term ownership/use of assets within SYMCA region. Creates an ongoing revenue stream from lease payments for SYMCA to invest in other public transport projects.	Agreeing acceptable lease price could be challenging – depreciation versus commercial lease costs. Requires SYMCA to secure funding for the diesel equivalent cost.

	• Potential private contribution from IDNO • Remainder funded by SYMCA via the CRSTS **Operating costs** • Savings accrued to operator are recouped by SYMCA through the vehicle lease, based on total cost of ownership assessment (diesel equivalent)		
<u>Option 2</u> Stagecoach buys the buses with 75% premium support by ZEBRA and 25% by SYMCA	**Vehicles** • Diesel equivalent cost funded by Stagecoach • 25% of the premium funded by SYMCA via the CRSTS • 75% of the premium funded by ZEBRA **Infrastructure** • 75% funded by ZEBRA • Potential private contribution from IDNO • Remaining 25% funded by SYMCA via the CRSTS for Rotherham Interchange and by Stagecoach for Rawmarsh Depot. **Operating costs** • Operational savings (and future cost risks) accrue to operator	Allows some of the CRSTS funding to be used for other projects within the region as base diesel cost doesn't need SYMCA funding. SYMCA can benefit from operators' technical expertise and resources in procuring buses, reducing project resources needed by SYMCA. Risk for delivery, availability and performance of the assets is transferred to operators Reduced administrative burden for SYMCA as many procurement responsibilities delegated to the bus operator	Model potentially more challenging from a State Aid/subsidy control perspective. Operator would benefit from operational savings and BSOG incentive under this model. Long term use of the buses in the region is not guaranteed.
<u>Option 3</u> Stagecoach (221/22x) buys buses with 75% cost premium funded by ZEBRA with Stagecoach match funding	**Vehicles** • Diesel equivalent cost funded by Stagecoach • 25% of the premium funded by Stagecoach • 75% of the premium funded by ZEBRA	Operator expected to use operational savings and BSOG incentive payments to fund the 25% cost premium over the operational life of the buses	Model potentially more challenging from a State Aid/subsidy control perspective. Long term use of the buses in the region is not guaranteed.

	Infrastructure • 75% funded by ZEBRA • Potential private contribution from iDNO • Remainder funded by SYMCA via the CRSTS for Rotherham Interchange and Stagecoach for Rawmarsh depot. **Operating costs** Savings accrued to operator	Allows CRSTS funding to be used for other projects within the region. Some of the risks for delivery, availability and performance of the assets is transferred to operators Reduced administrative burden for SYMCA as many of procurement responsibilities delegated to the bus operator	Requires greater up-front capital investment from Stagecoach.

In summary, given Stagecoach's willingness to purchase the buses and provide capital funding to cover the equivalent cost of a diesel bus then options 2 & 3 are preferred over option 1. Option 2 assumes SYMCA fund the 25% bus premium but Stagecoach fund the 25% cost for the Rawmarsh depot infrastructure, whilst Option 3 assumes that Stagecoach would be required to pay 25% of the bus premium and 25% of the Rawmarsh Depot infrastructure costs. Both options 2 & 3 would reduce the financial commitment required from SYMCA creating better value for money for the public sector.

As indicated in the economic case, the operating costs of the electric bus fleet proposed for routes 221 and 22x will reduce mainly as a result of reduced energy costs and the 22p/km BSOG incentive scheme. In terms of the final agreement between SYMCA and Stagecoach the operator will be expected to use these savings to cover battery replacement at years 7/8 and potentially years 14/15 and to give a commitment to use their best endeavours to ensure the long-term use of these buses in the South Yorkshire region. Stagecoach will also be expected to provide technical expertise to help support delivery of the project including covering all project management costs associated with the delivery of the charging infrastructure at Rawmarsh depot. In terms of the agreement, Stagecoach will be expected to take responsibility for all future risks in terms of changes to operating costs, for example variations in the cost of electricity and the zero-emission incentive scheme.

Based on the above option 3 is therefore discounted and it is intended to proceed with option 2 with ZEBRA covering 75% and SYMCA covering 25% of the capital premium of the buses and Stagecoach covering 25% of the cost of the Rawmarsh infrastructure. In return for Stagecoach taking the future operating cost risks thus eliminating any future exposure to SYMCA in terms of operating costs. This approach should also help secure the long-term use of these buses in the South Yorkshire region.

Sheffield City Centre Shuttle Service

Commercial Option	Financial Arrangement	Pros	Cons
<u>Option 1</u> SYMCA buys both buses and charging infrastructure through a combination of ZEBRA and SYMCA match funding	**Vehicles** • Diesel equivalent cost funded by SYMCA via the CRSTS • 25% of the premium funded by SYMCA via the CRSTS • 75% of the premium funded by ZEBRA **Infrastructure** • 75% funded by ZEBRA • Potential private contribution from IDNO • Remainder funded by SYMCA via the CRSTS **Operating costs** Buses free issued to the tendered operator and therefore operating cost savings accrue to SYMCA through reduced tender price for the operating contract	Maintains long term ownership/use of assets within SYMCA region. Reduces the operating contract price of CCS as operators don't need to recover capital costs through contract payments.	Requires SYMCA to fund the base equivalent diesel cost although unlikely operators would be willing to purchase buses for the initial 5 year contract term of the CCS.
<u>Option 2</u> CCS Operator buys the buses with 75% premium support by ZEBRA and 25% by SYMCA	**Vehicles** • Diesel equivalent cost funded by tendered operator • 25% of the premium funded by SYMCA via the CRSTS • 75% of the premium funded by ZEBRA **Infrastructure** • 75% funded by ZEBRA • Potential private contribution from IDNO • Remainder funded by SYMCA via the CRSTS **Operating costs** • Savings accrued to operator although reflected in reduce contract price for operating tender	Allows some of the CRSTS funding to be used for other projects within the region as base diesel cost doesn't need SYMCA funding. SYMCA can benefit from operators' potential technical expertise in procuring buses reducing resource resources needed by SYMCA. Once the operator of the CCS is known it may be possible to draw on their experience of electric buses. Risk for delivery, availability and performance of the assets is transferred to operators	The purchase of buses by the operator of the CCS likely to be unattractive as the short-term nature of the operating contract will make it difficult for operators to justify the capital investment. Model potentially more challenging from a State Aid/subsidy control perspective. Operator would benefit from operational savings and BSOG incentive under this model. Long term use of the buses in the region is not guaranteed. Operator may not have the technical

		Reduced administrative burden for SYMCA as many of procurement responsibilities delegated to the bus operator	knowledge and expertise to procure the buses. Operating costs of the CCS contract would increase as operator needs to recover the diesel equivalent capital costs. Operator potentially has no future use for the buses beyond the initial 5 year contract period.
<u>Option 3</u> CCS Operator buys buses with 75% cost premium funded by ZEBRA	**Vehicles** • Diesel equivalent cost funded by CCS operator • 25% of the premium funded by CCS operator • 75% of the premium funded by ZEBRA **Infrastructure** • 75% funded by ZEBRA • Potential private contribution from IDNO • Remainder funded by SYMCA via the CRSTS **Operating costs** Savings accrued to operator	Operator expected to use operational savings and BSOG incentive payments to fund the base diesel and 25% cost premium over the operational life of the buses Allows CRSTS funding to be used for other projects within the region. Risk for delivery, availability and performance of the assets is transferred to operators Reduced administrative burden for SYMCA as many of procurement responsibilities delegated to the bus operator	The purchase of buses by the operator of the CCS likely to be unattractive as the short-term nature of the operating contract will make it difficult for operators to justify the capital investment. Model potentially more challenging from a State Aid/subsidy control perspective. Long term use of the buses in the region is not guaranteed. Operator may not have the technical knowledge and expertise to procure the buses. Operating costs of the CCS contract would increase as operator needs to recover the diesel equivalent capital costs. Operator potentially has no future use for the buses beyond the initial 5 year contract period.

For the CCS, even though options 2 and 3 are based on the operator buying the buses on the new tendered city centre route, this has been discounted for the reasons described above. It would be difficult for most operators to justify buying new electric buses for a contract of 5 years given operators may have difficulty using the buses elsewhere in the future. The proposal for this element of ZEBRA is that the CCS buses would be owned by SYMCA and the operator would be based on a competitive tender for the operating contract reflecting any vehicle ownership and associated operating cost savings in a reduced tender price, i.e. it is proposed to pursue option 1.

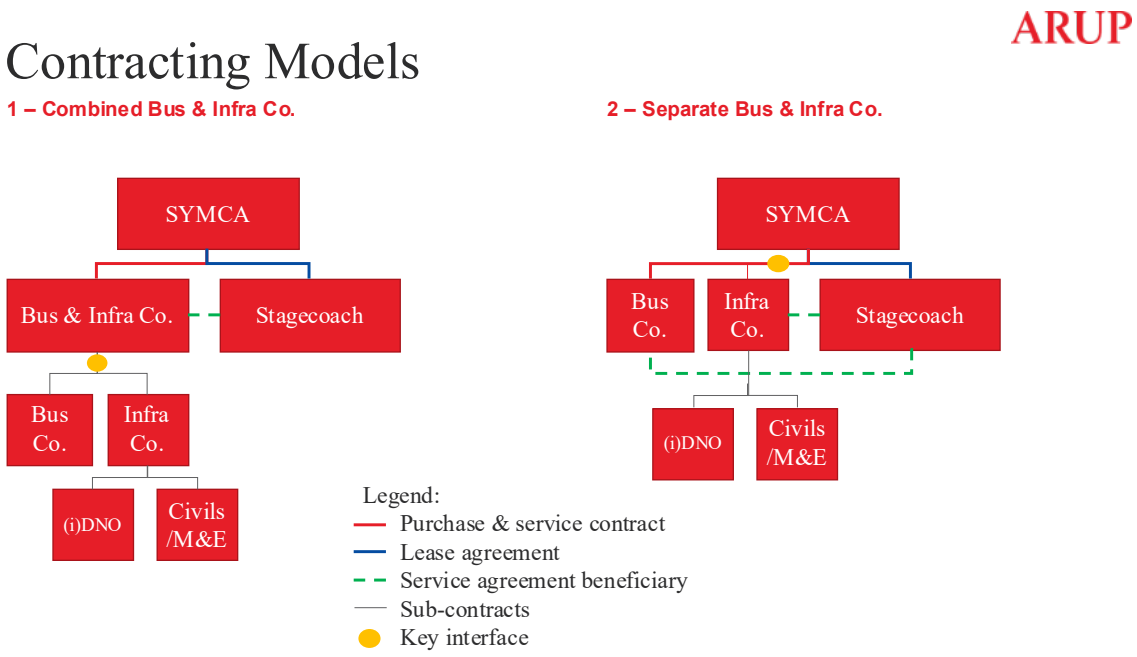
Supplier Engagement Sessions

Supplier engagement sessions with both bus manufacturers and infrastructure suppliers took place during December 2021. Feedback from these sessions is summarised in **Section 5.5**.

5.4 – Procurement plan and timescales

Overall Procurement Plan

Two core contracting models have been considered for the procurement of the buses and infrastructure for the CCS service. This section also details the procurement approach proposed by Stagecoach for routes 221 and 22x and how this will ensure value for money for the public sector.



Whilst model 1 is attractive as it would transfer the interface risk in the delivery of buses and infrastructure to a service provider and ensure that the optimum infrastructure is provided for the chosen buses, this approach does present risks due to the maturity of the market. It also has potential for increased costs due to mark-ups on sub-contracts and the potential to limit competition due to a more limited number of providers and supply chains. It is also clear from the supplier engagement process summarised in **Section 5.5** that this is not an approach currently being promoted or supported by the supply side market.

Adopting the approach in model 2 by tendering the bus and infrastructure requirements separately allows all providers to bid within their specialism potentially leading to lower costs. However, this approach will place a greater obligation on SYMCA in terms of managing the project interfaces between the two main contracts within the project. It may also limit scope for operator innovation or extend programme timescales, as it might not be possible to specify the charging infrastructure requirements until the supplier of the vehicles have been chosen. The programme timelines assume this will be the case.

In summary, the market for the supply of buses is extremely competitive and developing rapidly, in addition the infrastructure supply and installation industry is also becoming increasing competitive. Based on the current direction of the market it is therefore proposed that the supply of buses and infrastructure are treated as separate contracts to ensure SYMCA can select both the best technical solution and best value for both buses and infrastructure.

For both procurement processes, it is envisaged that the tender requirements will be a combination of Pass/Fail questions in terms of technical compliance which bidders must pass to proceed to the technical and commercial evaluation. The next stage of the tender evaluation, which will be subject to scoring by an evaluation panel, will be split into Commercial and Technical Evaluation (currently envisaged on a 40/60 basis). Whilst the commercial evaluation will be undertaken by SYMCA procurement staff it is envisaged that the technical evaluation panel will consist of the SYMCA project manager and bus officers supported by Stagecoach, and the operator of the CCS service once known, who will be able to draw upon specialist staff, if appropriate, who are already involved in the procurement of buses for that company.

The proposed procurement approach envisages using existing public sector framework agreements to purchase both the buses, charging infrastructure and associated works for the CCS service and the Rotherham Interchange infrastructure to reduce both the duration of the procurement process and the amount of document preparation required.

SYMCA does not currently have in place any existing framework agreements for either buses or charging infrastructure that could be used for this procurement exercise. However, SYMCA is currently putting in place a tender under the Crown Commercial Services Dynamic Purchasing System agreement for general vehicle charging infrastructure. The appropriateness of this agreement to support this project is currently being investigated.

For the bus procurement there are a number of appropriate framework agreements which could be used including the TPPL framework in conjunction with Bath and North Somerset Council and the Crown Commercial Service framework. As part of the supplier engagement process it was established that there are several framework agreements which include the major suppliers capable of supporting this project.

In terms of the procurement of the buses for 221 and 22x Stagecoach already have framework agreements in place with several bus manufacturers including those identified as having suitable products as part of the supplier engagement process. Agreements are updated on annual basis with costings for 2022/23 having been submitted in September 2021. Once funding for the 221/22x buses has been confirmed Stagecoach will seek final proposals from the manufacturers on the framework agreement who have suitable opportunity charging products. In conjunction with SYMCA a final assessment of the proposals will be undertaken before recommending the preferred supplier for approval by Stagecoach and SYMCA. The

Stagecoach framework agreements are used UK wide and cover all the group's bus requirements therefore allowing SYMCA and the project to benefit from Stagecoach's purchasing power in terms of unit prices.

In addition to a compliant proposal based on overnight depot charging supplemented by opportunity charging at Rotherham Interchange, based on the route analysis information provided as part of the Invitation to Tender, bidders will be able to submit alternative options based on zero-emission electric buses which, for example, may not require the use of opportunity charging infrastructure at Rotherham Interchange. Suppliers will need to support any alternative bids with a total cost of ownership comparison against their compliant bid to aid the tender evaluation process by SYMCA.

Procurement Programme and Tender Preparation

In terms of the overall programme, the biggest risk is around the DNO works and connections, as these are generally unknown until firm orders are placed. There is more confidence around the delivery programme for buses as the supply chain for electric buses is becoming more established and mature. The programmes below draw on feedback received as part of the supplier engagement process.

It is proposed that the procurement process for the charging infrastructure will commence immediately following the award of the bus contract once the bus supplier and their detailed charging requirements are known. On this basis the award of the bus supply contract is expected during July 2022 and the charging infrastructure supply contract during October 2022 with the target date for commencement of the operation being 2nd September 2023.

Following feedback from the supplier engagement process an infrastructure design phase will be commissioned prior to the infrastructure tender being issued. This process will establish and set out the technical requirements for each site and will form part of the tender specification documents issued as part of the infrastructure tender. It is envisaged that technical consultants will be required to support the drafting of the technical specification for the charger procurement process including undertaking initial site surveys at Rawmarsh Depot, Rotherham and Sheffield Interchanges to determine proposed layouts and sites for charging infrastructure, sub-stations etc. This work will also involve engagement with the local DNO to determine the local grid upgrade requirements, timescales, and costs.

In addition to the base vehicle specification, bus manufacturers will also be asked to supply options or further information covering the following areas:

a) Warranty provision & spare parts including options for warranty extension on key components
b) Repair & Maintenance Options
c) Vehicle Delivery, Acceptance Process/PDI Process
d) Staff Training & Development
e) Purchase Price and Total Cost of Ownership
f) Account Management & After Sales Support
g) Social Value & Environmental Management

Procurement Timescales – Buses

Based on an indicative confirmation date for ZEBRA funding of 20/03/2033 the following procurement programme for the buses required for the CCS service is envisaged. It is expected that Stagecoach will follow a similar programme although some of the tasks and dates will be altered to recognise their own procurement requirements. Since Stagecoach already have bus framework agreements in place it might be possible to accelerate the purchase of the buses for 221 and 22x and potentially deliver this aspect of the project earlier that shown in the programme below. Both procurement exercises will be monitored by Project Delivery Group and the Operational Readiness Project Group as detailed in **Section 5.2**.

Task	***No of working days***	***Start***	***Finish***
Preparation of Final Business Case	*85*	*04/10/2021*	*31/01/2022*
Supplier Engagement	*25*	*12/11/2021*	*17/12/2021*
Confirmation of ZEBRA funding	***0***	***n/a***	***20/03/2022***
SYMCA Board - governance confirmation/approval to proceed	*0*	*n/a*	*21/03/2022*
Preparation of Technical Specification & Purchase Agreement/Contract	*25*	*21/03/2022*	*22/04/2022*
Preparation and approval of Tender Evaluation and Scoring Process (based on price/quality)	*20*	*28/03/2022*	*22/04/2022*
Final Market Engagement Sessions	*5*	*28/03/2022*	*01/04/2022*
Preparation of ITT documents by Framework Procurement Team	*5*	*25/04/2022*	*29/04/2022*
Issue of Invitation to Tender	*0*	*n/a*	*02/05/2022*
Supplier Tender Period	*20*	*02/05/2022*	*27/05/2022*
Tender Clarification Period	*10*	*02/05/2022*	*13/05/2022*
Submission of Tenders	*0*	*n/a*	*27/05/2022*
Evaluation of Tenders (technical & commercial)	*20*	*30/05/2022*	*24/06/2022*
Consensus meetings (technical team)	*5*	*13/06/2022*	*17/06/2022*
Preparation of recommendation and approval paper	*10*	*27/06/2022*	*08/07/2022*
Award of Contract	**0**	**n/a**	**11/07/2022**
Standstill Period	*10*	*11/07/2022*	*22/07/2022*
Contract Signature	*20*	*25/07/2022*	*19/08/2022*
Agreement of Final Specification	*10*	*22/08/2022*	*02/09/2022*
Vehicle Design & Build	*230*	*05/09/2022*	*21/07/2023*
Vehicle Inspection (PDI) and Delivery	*30*	*24/07/2023*	*01/09/2023*
Training and Commissioning	*30*	*24/07/2023*	*01/09/20231*
Marketing and Promotion	*30*	*24/07/2023*	*01/09/2023*
Commencement of Zero-Emission Operation	*0*	*n/a*	*02/09/2023*

Procurement Timescales – Infrastructure

Based on an indicative confirmation date for ZEBRA funding of 20/03/2022 the following procurement programme for the Sheffield and Rotherham Interchange charging infrastructure is envisaged. It is expected that Stagecoach will follow a similar programme for the Rawmarsh

depot infrastructure although some of the tasks and dates will be altered to recognise their own procurement requirements. All the infrastructure procurement exercises will be monitored by Project Delivery Group and the Operational Readiness Project Group as detailed in **Section 5.2.**

Task	***No of working days***	***Start***	***Finish***
Preparation of Final Business Case	*85*	*04/10/2021*	*31/01/2022*
Supplier Engagement	*25*	*12/11/2021*	*17/12/2021*
Confirmation of ZEBRA funding	***0***	***n/a***	***20/03/2022***
SYMCA Board - governance confirmation/approval to proceed	*0*	*n/a*	*21/03/2022*
Technical Site Assessments and design and technical study	*20*	*27/06/2022*	*22/07/2022*
Preparation of Technical Specification & Purchase Agreement/Contract	*20*	*11/07/2022*	*05/08/2022*
Final Market Engagement Sessions	*5*	*18/07/2022*	*22/07/2022*
Preparation and approval of Tender Evaluation and Scoring Process (based on price/quality)	*10*	*11/07/2022*	*22/07/2022*
Preparation of ITT documents by Framework Procurement Team	*10*	*25/07/2022*	*05/08/2022*
Issue of Invitation to Tender	*0*	*n/a*	*08/08/2022*
Supplier Tender Period	*20*	*08/08/2022*	*02/09/2022*
Planning Application (if required)	*65*	*08/08/2022*	*04/11/2022*
Tender Clarification Period including site visits (if required)	*10*	*08/08/2022*	*19/08/2022*
Submission of Tenders	*0*	*n/a*	*02/09/2022*
Evaluation of Tenders (technical & commercial)	*20*	*05/09/2022*	*30/09/2022*
Consensus meetings (technical team)	*5*	*26/09/2022*	*30/09/2022*
Preparation of recommendation and approval paper	*10*	*03/10/2022*	*14/10/2022*
Award of Contract	*0*	*n/a*	*17/10/2022*
Standstill Period	*10*	*17/10/2022*	*28/10/2022*
Contract Signature	*0*	*n/a*	*31/10/2022*
Agreement of Final Specification	*40*	*31/10/2022*	*23/12/2022*
Agreement of layouts Rotherham Interchange, Rawmarsh Depot and the depot for the CCS service	*20*	*28/11/2022*	*23/12/2022*
Manufacturing of Chargers etc	*65*	*02/01/2023*	*31/03/2023*
Charger Installation, civils, grid connections etc	*80*	*03/04/2023*	*21/07/2023*
Commissioning	*20*	*24/07/2023*	*18/08/2023*
Training of Operational Staff	*10*	*21/08/2023*	*01/09/2023*
Commencement of Zero-Emission Operation	*0*	*n/a*	*02/09/2023*

Tender Evaluation – CCS Buses and Charging Infrastructure for Sheffield and Rotherham Interchanges

For both the bus and infrastructure tenders the evaluation will be based on an initial Pass/Fail in terms of compliance with the technical specifications with those passing this compliance check proceeding to the commercial and technical evaluation.

Buses

- Compliance with Technical Specification (Pass/Fail)
- Commercial (40%)
- Technical (60%) broken down as follows:
  - Drive train & battery management system technology (25%)
  - After Sales Support, Account Management & Training (10%)
  - Warranty Provision – added value beyond minimum requirements plus terms & conditions, restriction etc (5%)
  - Proposed programme (10%)
  - Social Value & Environmental Management (10%)

Infrastructure

- Compliance with Technical Specification (Pass/Fail)
- Commercial (40%)
- Technical (60%) broken down as follows:
  - Previous project delivery experience (15%)
  - Proposed project delivery team (15%)
  - Proposed programme (10%)
  - Warranty Provision – added value beyond minimum requirements plus terms & conditions, restriction etc (5%)
  - After Sales Support, Account Management & Training (5%)
  - Social Value & Environmental Management (10%)

An evaluation and scoring document will be prepared setting out to the bidders the requirements under each of the above headings in terms of submission requirements and scoring criteria.

The approach for the evaluation of the Stagecoach buses and infrastructure are detailed in the procurement plan above and make provision for SYMCA to be involved in the final choice of supplier for both buses and infrastructure.

Supplier due diligence is also proposed prior to the final recommendation and award of contracts.

Infrastructure & Associated Installation and Civil Works

For routes 221 and 22X based on the feedback from the supplier engagement process, it is envisaged that in addition to “top up” opportunity chargers at Rotherham Interchange depot, chargers will also be required to ensure that buses are able to start service each day with 100% State of Charge. Undertaking this charge at Rotherham Interchange is not recommended as it will incur additional driver time during the charging process and potentially require more than the two rapid chargers currently recommended.

The CCS service will only require depot chargers for overnight charging.

Contract Management

Both bus and infrastructure contracts will include appropriate KPIs and penalties to incentivise on-time delivery of the project and on-going minimum performance standards once the operation commences. Proposed KPI's and penalties will include vehicle off road (VOR) penalties, late delivery penalties, warranty response times and spare parts delivery and availability. These KPI's and any related penalties will be built into the purchase agreement.

MARKET ENGAGEMENT

5.5 – Details of market engagement taken place to date

SYMCA and Arup, supported by Stagecoach, undertook extensive supplier engagement sessions with both bus manufacturers and charging suppliers during December 2021.

A briefing pack was issued prior to the engagement sessions which detailed an overview of the project requirements project timescales and a route analysis for each of the proposed routes. The route analysis document gave details of the three routes in terms of operating hours and mileages per vehicle. Vehicle suppliers were asked to feedback on the suitability of their product for operation of these routes. In addition to providing an overview of their products including costs, production timescales, extended warranties, and forecast battery life, manufacturers were asked to provide details regarding the total cost of ownership of their product over 17 years and the expected cost of any battery replacement.

Key information provided by bus manufacturers included their recommended product and the suggested charging regime for this. Manufacturers also outlined any potential operational issues caused by operations on routes 221 and 22X in light of the high mileages of the relevant duties.

Charging suppliers were asked to provide an overview of their product range including costs and project case studies.

The information gathered through the market engagement exercise served to confirm the feasibility of converting the chosen bus routes to electric operation and was used when calculating anticipated overall scheme costs and delivery timescales, as reflected in this full business case.

Engagement took place with the following suppliers:

Bus Manufacturer	Infrastructure Supplier
[redacted]	[redacted]

Subsequently, detailed quotations were obtained from four bus manufacturers: [redacted] (see table below), for use in the economic element of the business case.

The feedback from the engagement sessions with each of the bus manufacturers for routes 221 and 22x is summarised in the following table:

Manufacturer name	Recommended Product	Charging Regime	Potential operational issues	Battery replacement / warranty	TCO of buses
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]

[redacted]	[redacted]	[redacted]		[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

In terms of lead-times from placing order to delivery most manufacturers quoted between 9 and 12 months and this has been assumed in the Procurement timescales shown in **Section 5.4** although depending upon the chosen manufacturer there may be the opportunity to improve on this.

The feedback from the manufacturer engagement sessions for the Sheffield City Centre Shuttle service are summarised in the following table:

Manufacturer name	Recommended Product	Charging Regime
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	

The engagement sessions with the infrastructure suppliers are summarised in the following table:

Supplier name	Type of business	Preferred product/s	Lead time	Additional comments
[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

In summary, both the bus manufacturers and the infrastructure suppliers were supportive of the project to convert the 221, 22x and the CCS to electric operation. Whilst the 221 and 22x are challenging routes to convert, it is clear that suitable product and charging regimes exist to successfully convert these routes to electric operation.

Separate analysis of the South Yorkshire bus network suggests there are a number of challenging routes within the region partly driven by topography especially within the Sheffield area. SYPTE believe that the experience gained from converting routes 221 and 22x will be invaluable in developing the future rollout strategy for electric bus within the region.

In terms of next steps, the following key issues were taken away as part of the supplier engagement sessions:

- A number of manufacturers have agreed to undertake further route analysis especially for routes 221 and 22X. These offers are being pursued.
- Several infrastructure suppliers suggested it would be beneficial to commission a fee-based design and technical study prior to the issue of the Invitation to Tender to ensure that SYMCA's requirement are correctly specified as part of the tender documents. This suggestion has been built into the infrastructure programme.
- In terms of lead times for buses and infrastructure, these have been improved since the draft Business Case with the proposed introduction date for all three routes being brought forward from 02 October 2023 to the 02 September 2023.

Following the supplier engagement exercise costs from three suppliers have been used to feed into the Economic Case. The costs below assume buses with the capability to be pantograph charged. Buses for the CCS service which will not have this feature have a lower capital cost and this has been reflected in the average bus costs used in the Economic Case.

Vehicle costs for the 221/22X

Supplier	Vehicle model/ length	Passenger capacity	Battery size	Vehicle cost (excl. VAT)	Battery replacement cost
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[2] Comprised of [redacted] base price per vehicle, plus [redacted] for pantograph and [redacted] for induction loops.

Infrastructure costs were sought from an infrastructure supplier. Costs include the chargers and modem, commissioning and delivery, but exclude connection / civils costs. A supplier estimate suggested a cost of [redacted] per charger to connect the charge-post to the point of connection.

Infrastructure costs

Supplier	Charger capacity	Overnight/ Opportunity	Charger cost (per unit)
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

Budget estimates to upgrade the electricity network to the point of connection were obtained via Northern Powergrid's online tool.

Connection costs

Location	Maximum peak demand	Budget Estimate including VAT (£/kW)	Total costs of connection including VAT
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

5.6 – Details of future market engagement

It is proposed that a further round of market engagement in the form of supplier briefing sessions will occur just prior to the issue of the Invitation to Tender documents which is currently planned for March 2022 for the buses and July 2022 for infrastructure. These sessions are intended to bring potential tenderers up to date with SYMCA tender requirements and ensure that all tender documents reflect any recent industry developments prior to their issue.

SPECIFICATION

5.7 – Bus and infrastructure specification

Overall Requirements

SYMCA will undertake the procurement process for the 27 buses and supporting infrastructure. The broad requirements of the tendering process will be as follows:

- 23 x 12m single deck buses for use routes 221 and 22X. The current 22X buses have [redacted] whilst the buses used on routes 221 have [redacted]. The future specification will require the same capacity for all 23 buses.
- 23 150 kW DC depot chargers for Stagecoach Rawmarsh Depot
- 2 x 300kW fast opportunity chargers for Rotherham Interchange to support routes 221 and 22X
- 4 x 9.5m – 10.5m single deck buses for use on the CCS service with an overall capacity of around 60 passengers depending upon the final choice of vehicle length.
- 4 x 100kW DC depot chargers for the CCS service

The route analysis will be provided as part of the procurement exercise and bus manufacturers will be expected to confirm the suitability of their proposed product to meet the operational requirements of the particular route. Bus manufacturers will also be required to specify the charger requirements to support their product in terms of charge rates, operating standards and to confirm their compliance with interoperability standards. This information will then feed into the tender specification for the charging infrastructure which will commence immediately following the award of the bus manufacturing contract.

Vehicle Specification

The proposed specification of the buses is summarised in **Appendix B**.

In addition to all buses being compliant with the Public Service Vehicles Accessibility Regulations 2000 (PSVAR) it is confirmed that the buses will also include the additional accessibility features required by the ZEBRA funding as follows:

- Incorporate equipment to identify the route, each upcoming stop, and the beginning and end of diversions:
  - Visibly, using at least one screen on any deck, with the lower deck screen visible from all priority seats;
  - Audibly, with announcements audible on any deck, including in the priority seats and wheelchair space; and
  - Using induction loops, in priority seats and the wheelchair space.
- Provide an induction loop to aid direct communication between drivers and passengers who use a hearing aid.
- 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.

The specification for the 221 and 22x will also meet the standard requirements for Stagecoach Group.

The tender specification will also specify minimum warranty terms currently based on the following:

- Body & Chassis Warranty – 3 years
- Structural, Chassis and Body Warranty – 12 years
- Anti-Corrosion Warranty – 12 years

- Chassis/Powertrain warranty (all major components including all driveline and powered system components including batteries and hybrid components) – 5 years.

Extended warranty options will also be requested as part of the bus tendering process which will be considered as part of the tender evaluation process.

For routes 22X and 221 Stagecoach will be responsible for the supply of auxiliary equipment such as radios, AVL and ticketing equipment and their driver telematic system.

5.8 – Plans for marketing strategy

The marketing plans for ZEBRA are shown below, including the associated costs.

Audience Groups

- Business to Consumer (B2C) – new, lapsed, and existing customers travelling on the 221 and 22x services, or in Sheffield City Centre on the shuttle bus service.
- Business to Business (B2B) – businesses in the area who are climate conscious and looking to make changes to reduce their impact on the environment and support more sustainable staff travel.
- Key stakeholders – statutory and non-statutory stakeholders, as detailed in **Table 7-1** of the **Management Case**.

Tactics

- Direct mail to local businesses and potentially households along the routes.
- Promotion on 6 sheets and Alight panels along the routes.
- Vinyl branding installed on all bus stops, depending on relevant permissions from the local authorities.
- Radio.
- Explore options at Barnsley Glassworks, Doncaster Frenchgate, Parkgate Retail, Sheffield Winter Gardens.
- Short animated video content/gifs for social media.
- Potential Tram-train connection to Sheffield 'Go green all the way'.
- Proactive media relations activity selling in ZEBRA and wider zero-emission SYMCA transport ambitions.
- Stakeholder engagement/collaboration to maximise reach of positive messages across local authority areas.

Key Messages
Customers

- Do your bit for the environment, travel clean and green.
- Combat climate change and travel cleaner and greener towards a net-zero future.
- Reducing CO2 across South Yorkshire.
- Improved local air quality and noise pollution (a quieter journey).
- This project is part of our commitment to greener transport in Barnsley, Doncaster, Rotherham and Sheffield, alongside our Tram and Tram-Train services in Sheffield / Rotherham.
- By leaving the car at home, you can reduce congestion and help lower carbon emissions in Barnsley/Doncaster/Rotherham/Sheffield.
- Go green, ditch the car.

- Access to employment and training opportunities.
- Working in partnership to improve local bus services.
- WIFI and USB on bus?
- Go green all the way – connect to Tram-train at Parkgate for a super low-emission journey.

Businesses/Key stakeholders

- Staff saving money on fuel, car maintenance, and parking.
- Healthier, happier and less stressed staff.
- Greater knowledge of public transport links – making it easier for staff customers to get to you.
- Improved use of car parks – reduced need for staff parking spaces, more parking spaces for visitors and customers.
- Help meet environmental targets – positive contribution to a business's environmental 'Green' profile.
- Reduced congestion on the local roads – key concern for manufacturing companies transporting their goods.
- Staff access to links between work, sport, leisure.
- Buses are integral to creating the stronger, greener, and fairer South Yorkshire we all want to see (inward investment/economic growth).

Delivery Plan

Activity	Owner / Status	Budget Estimate
Phase 1 – Pre-Launch		
Finalise promotional plan and resource	SYMCA Marketing / Stagecoach	N / A
▪ Vinyl installations on bus stops –	SYMCA Marketing / Stagecoach / D&P / Projects	[redacted]
▪ If no Alight panels on shelters, can only use an area of 1.5m^2 – artwork must be information, [redacted] ▪ Produce a Covid safe distance-style vinyl and install at each shelter along both routes	SYMCA Marketing / Stagecoach / D&P / Projects	[redacted]
▪ Posters for Static Alight panels - [redacted] per panel, [redacted] static panels available across both 221 and 22x route (spreadsheet attached with locations, panel numbers and SYMCA stop numbers). ▪ Campaign period is two weeks – cost covers that period including courier to deliver to posting company.	SYMCA Marketing / Stagecoach / D&P / Projects	[redacted]
▪ D6 artwork for Alight digital panels ▪ SYMCA benefits from [redacted] of drive time ad space at no cost as part of the Alight Media contract – artwork just needs supplying with panel numbers (spreadsheet attached). ▪ More space can be bought but would need relevant approvals	SYMCA Marketing / Stagecoach / D&P / Projects	N / A
▪ Website landing page set up on TSY.com and stagecoachbus.com	SYMCA Marketing / Stagecoach	N / A
▪ News story live on TSY.com and stagecoachbus.com	SYMCA Marketing / Stagecoach	N / A
▪ News story live on Stagecoach website and stagecoachbus.com	Stagecoach	N / A

▪ Information on SYMCA website about progress of bid	SYMCA Marketing	N / A
▪ Coming soon messages through Social Media and websites	SYMCA Marketing / Stagecoach	N / A
▪ On bus information for 22x, 221 and city centre shuttle bus passengers.	Stagecoach / SCC	TBC
▪ Door Drop to residential households along routes		[redacted]
▪ Potential for introductory ticket offer – to be discussed with Stagecoach	Stagecoach	N/A
▪ Facebook and Instagram Adverts and Messaging	SYMCA Marketing / Stagecoach	[redacted]
▪ Twitter Adverts and Messages	SYMCA Marketing / Stagecoach	[redacted]
▪ LinkedIn Adverts and Messaging	SYMCA Marketing / Stagecoach	[redacted]
▪ TSY news story	SYMCA marketing	N / A
▪ TSY Carousel Adverts	SYMCA Marketing	N / A
▪ Press release re funding bid submission	SYMCA Comms / Stagecoach	N / A
▪ E-bulletin / intranet article re bid submission	SYMCA Comms	N / A
▪ Stakeholder briefing re submission	SYMCA Comms	N / A
▪ Press release re funding award	SYMCA Comms / Stagecoach	N / A
▪ E-bulletin / intranet article re funding award	SYMCA Comms	N / A
▪ Stakeholder briefing re funding award	SYMCA Comms	N / A
▪ Mayoral announcement re funding award	SYMCA Comms / Stagecoach	N / A
▪ Launch event with stakeholders and media	SYMCA Comms / Stagecoach	N / A
▪ Press release/media invitation re launch / unveiling	SYMCA Comms / Stagecoach	N / A
▪ Frontline brief re routes	SYMCA Comms	N / A
▪ Stakeholder briefing re launch	SYMCA Comms	N / A
▪ Email newsletter	SYMCA Marketing	N / A
Phase 2 – Post-Launch		
Activity TBC		
Explore advertising options in and around leisure venues on routes		

Cost Breakdown

- Vinyl ZEBRA identifiers installed on shelters: [redacted]
- Shelter vinyl posters for launch:
- Poster production / Delivery for static Alight panels:
- Door Drop to residential households along routes:
- Facebook and Instagram Adverts and Messaging:
- [redacted]Twitter Adverts and Messages:
- LinkedIn Adverts and Messaging:
- Phase 2 – Post Launch (February/March): TBC

Total estimate: [redacted]

ZEBRA Artwork

To be confirmed once the tactics and key messages are agreed.

Ideas include:

- Focusing on ZEBRA

- Focusing on Green
- Focusing on Electric

Marketing Monitoring and Evaluation

- ZEBRA route patronage
- Visits to campaign landing page
- Sales / use of introductory offer
- Social media engagement (reach/positive sentiment – TSY, Twitter, Facebook, LinkedIn)

Further details on the Monitoring and Evaluation plan can be found within **Section 7.14** of this business case.

5.9 - Procurement, subsidy control and TCA compliance

External legal advice has been provided by DWF Law. Key elements from this advice, for both the 221/22x and the city centre shuttle bus elements are provided below. The full legal advice is provided in **Appendix C**. The full legal advice includes both options of leasing buses to Stagecoach on the 221/22x and Stagecoach owning the buses. However, it should be noted that we will be progressing with the option of Stagecoach owning the buses and not the leasing option. For either approach, there is a clear subsidy and similar considerations apply in order to render the subsidy lawful, in particular with the focus on ensuring the amount of grant was no more than necessary to achieve the relevant objective.

22x/221

DWF law's view is that the DfT grant (and the additional SYMCA funding) may be delivered in compliance with Subsidy Control law, but care will be required in order to achieve this, as set out below.

By supporting Stagecoach with grant funding to enable it to buy zero emission buses to operate the same routes, this would be clear subsidy to the level of grant funding provided. Whilst the starting intention would be to support only the additional costs against conventional diesel buses comparators, this would need to be bolstered with further work to ensure the grant support was no more than necessary to secure the objective (of making Stagecoach do this switch to zero emission buses now). For example, if there were other (perhaps less obvious) benefits to Stagecoach of making the switch as proposed, then this should be factored in to ensure suitable adjustments to the grant funding amount. Subject to due care with the above, the project would be compliant with Subsidy Control law.

City Centre Shuttle Bus

The proposed city centre shuttle bus will be a tendered service operated by a third party through an open competition. This will ensure that there will be no over-compensation and therefore no subsidy to that third party for providing the public service. This arrangement should similarly mean no subsidy to SYMCA accordingly, which in this respect will be doing no more than fulfilling its ordinary role as a State body and public transport authority.

Subsidy Control Bill

For completeness, DWF Law noted that a new *Subsidy Control Bill* was set before the UK Parliament on 30 June 2021 and is currently being scrutinised by the Subsidy Control Bill Select Committee. It is not yet law and would only apply to subsidies which are awarded from

the date of entry into force of resulting legislation, which is anticipated to be in Autumn 2022. The legal advice provided by DWF Law is on the assumption of entering into the relevant arrangements prior to this time, but should this be delayed for any reason then a check should be made as to any potential impact from the future *Subsidy Control Act* (resulting from the Bill).

6 - FINANCIAL CASE

6.1 – Overview of Financial Case

Total capex eligible for ZEBRA funding, with and without inflation, is provided below.

	Without Inflation	With Inflation
Vehicle replacement capex	£ 10,844,116	£ 11,798,398
Infrastructure capex	£ 3,545,912	£ 3,790,580
Total Capex - Eligible for Grant Funding	**£ 14,390,028**	**£ 15,588,978**

These cost items had Optimism Bias (OB) applied already, therefore it is worth noting they will not be an exact match with the draft model input data. The GB model applies OB rates to input values, hence the values in the Greener Bus Model (GBM) are without optimism bias. The GBM also applies discounting.

The diesel bus cost used for the grant calculation is £4,453,350. ZEBRA grant funding is sought for 75% of the premium for electric vehicles, and 75% of the infrastructure cost, as shown below. Total grant funding is £8,351,721.

	Electric	Diesel	Grant funding sought
Vehicle replacement capex	£ 11,798,398	£ 4,453,350	£ 5,508,786
Infrastructure capex	£ 3,790,580	£ -	£ 2,842,935
Total capex	**£ 15,588,978**	**£ 4,453,350**	**£ 8,351,721**

The other funding sources are shown below. This excludes battery replacement costs, operating costs and revenue, and additional costs to the Combined Authority to manage the scheme. Stagecoach (the Operator), will fund [redacted]. A quote of [redacted] private match funding has been offered through an iDNO, with the remainder funded by SYMCA through CRSTS.

	SYMCA	ZEBRA	
Vehicle replacement capex	£ 2,494,612	£ 5,508,786	£
Infrastructure capex	£ 188,439	£ 2,842,935	£
Total capex	**£ 2,683,051**	**£ 8,351,721**	**£**

[redacted]

The majority of costs can be supported by supplier engagement and therefore the level of risk is considered low. Financial risk has been managed through the application of a contingency allowance through an OB rate that is aligned with WebTAG.

The proposed electric services will generate an annual saving to the operator(s) through lower vehicle maintenance and operating costs, mainly as a result of reduced energy costs and the 22p/km BSOG incentive scheme. This saving will ensure long term financial viability. SYMCA will incur an annual cost to maintain the charging infrastructure at Rotherham and Sheffield Interchanges;

[redacted]

The city centre shuttle is not currently in operation and therefore long-term financial viability of the service requires [redacted] to fund the total maintenance and operating costs of the electric service, as well as additional costs to run the service such as driver costs. It is estimated that the city centre shuttle service would require around [redacted], over a minimum of 5 years to cover the cost for the operator to run the electric bus service.

As discussed in the Strategic Case, work is ongoing to identify [redacted] to run the shuttle bus over the minimum five-year period. As such, in mitigation an alternative option has been provided, which would use the same number of electric buses (4) and the same infrastructure in the city centre and be based at the same location (Sheffield Interchange). This alternative would use existing tendered bus service budgets, so it would not need additional funding, as is the case of the city centre shuttle bus. This alternative option, in the event that shuttle bus [redacted] by the DfT ZEBRA funding announcement date, would be to create an electric [redacted] alternative option within the strategic context of Sheffield, the Clean Air Zone (CAZ) and the associated TCF bus priority schemes in Sheffield along the same corridors. This demonstrates that this alternative option uses the same electric buses and infrastructure, in areas with air quality problems, [redacted]

6.2 – COSTS

Provide the full scheme costs. Where appropriate include the risk weighting for line items.

Capital costs (capex)

Total capex eligible for ZEBRA funding, with and without inflation, is provided below.

	Without Inflation	With Inflation
Vehicle replacement capex	£ 10,844,116	£ 11,798,398
Infrastructure capex	£ 3,545,912	£ 3,790,580
Total Capex - Eligible for Grant Funding	**£ 14,390,028**	**£ 15,588,978**

Vehicle replacement costs include 23 new battery electric vehicles at a unit cost of [redacted] per vehicle for the 221/22x services and 4 new battery electric vehicles at a unit cost of [redacted] per vehicle for the City Centre Service. These unit costs are supported by supplier feedback.

The 221 and 22x services require 2 opportunity chargers (300kW pantograph chargers) at Rotherham Interchange. The 221 and 22x services also require 23 fast chargers (150kW chargers) at Rawmarsh depot for overnight charging.

The city centre service requires 4 fast chargers (100kW chargers) at Sheffield Interchange for overnight charging. All charging capex includes the chargers, commissioning and delivery, as well as an allowance for connecting the chargers to the feeder pillar.

Budget estimates have been obtained from Northern Powergrid's online tool for Electric Vehicle connections to upgrade the network to the point of connection, as follows:

Location	Maximum peak demand	Budget Estimate including VAT (£/kW)	Total costs of connection including VAT
Rawmarsh Depot	[redacted]	[redacted]	[redacted]
Rotherham Interchange	[redacted]	[redacted]	[redacted]
Sheffield Interchange	[redacted]	[redacted]	[redacted]

Our approach to risk is to apply a contingency allowance through an OB rate that is aligned with WebTAG. The contingency is a blended OB rate to account for vehicles and infrastructure at 3%, and the civils and upgrade elements at 44%.

There will also be additional costs that are not eligible for ZEBRA funding as shown below.

[redacted]

Other costs include [redacted] for marketing activities that would be required to support the successful roll out of the buses and [redacted] professional fees. A [redacted] allowance for SYMCA management costs has also been applied. It is acknowledged that these additional costs are not eligible for ZEBRA funding and will be funded through SYMCA funds.

We have assumed that all 27 vehicles will need a replacement battery in year 8 of operation, at a unit cost of [redacted] per vehicle. Stagecoach will fund the battery replacements for the 23 buses for the 221/22x. The combined authority will be responsible for the battery replacements for the 4 City Centre Shuttle buses.

Operating costs (opex)

A summary of the annual incremental operating and maintenance costs are provided below. The approach to estimating these are consistent with the economic case; however, exclude discounting and include inflation.

	Without Inflation	With Inflation
Annual infrastructure maintenance costs (opening year)	£ 152,461	£ 165,878
Annual vehicle maintenance costs (opening year)	-£ 302,412	-£ 329,024
Annual vehicle operating costs (opening year)	-£ 729,310	-£ 793,489
Annual Opex (opening year)	**-£ 879,261**	**-£ 956,636**

The costs show that there is an annual saving in both vehicle maintenance and vehicle operating costs of around £1.1m per annum, which is mainly due to the lower cost in maintaining electric vehicles compared to diesel vehicles, the cheaper cost of electricity relative to diesel, and the BSOG incentive. However, the additional infrastructure will add an additional maintenance cost of [redacted] per annum.

Full Business Case

Zero Emission Bus Regional Areas (ZEBRA)

FUNDING

6.3 – Funding Profile

Below is a funding profile for all three services. The funding profile applies inflation to the costs outlined in section 6.2. It excludes the additional costs that would be funded by the SYMCA as they do not fit into either vehicle or infrastructure cost items.

Financial Year	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	Total
CPI	5.1%	1.8%	1.9%	1.9%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
CPI Factor from 2021 prices	1.05	1.07	1.09	1.11	1.13	1.15	1.17	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.37	1.39	
Number of Single Deck buses delivered			27																27
Number of Double Deck buses delivered																			-
Cost of vehicles of proposed schemes																			
Total purchase cost of vehicles (£) (with optimism bias 3%)			[redacted]																
Proposed sources of funding:																			
Cost proposed to be covered by the ZEBRA grant			5,508,786																5,508,786
Funding from local government and any other public sector funding			2,494,612							361,920									2,856,532
Investment from operators			[redacted]																
Other HMG Funding																			
All other private sector contributions																			-
Cost of infrastructure of the proposed scheme																			
Total cost of infrastructure (£) (with optimism bias 13%)		[redacted]																	3,790,580
Proposed sources of funding:																			
Cost proposed to be covered by the ZEBRA grant		2,842,935																	2,842,935
Funding from local government and any other public sector funding		188,439																	188,439
Investment from operators		[redacted]																	
Other HMG Funding																			
All other private sector contributions																			
Total ZEBRA grant funding																			
Total ZEBRA grant funding		2,842,935	5,508,786																8,351,721
Revenue of the proposed scheme																			
Energy supply at Rotherham Interchange			[redacted]																
Total Revenue																			
Operating Expenses of the proposed scheme																			
Cost incurred by LTA (with optimism bias 3%)			46,113	47,997	49,988	52,046	54,171	56,367	58,635	60,977	63,397	65,895	68,475	71,138	73,888	76,726	79,657	82,681	1,008,150
Cost incurred by Operator (with optimism bias 3%)			[redacted]																
Cost incurred by other public sector entity (with optimism bias X%)																			-
Cost incurred by other private sector entity (with optimism bias X%)																			-
Total operating expenses (with optimism bias 3%)	-	-	**(956,636)**	**(979,731)**	**(998,375)**	**(1,027,370)**	**(1,058,066)**	**(1,097,447)**	**(1,133,247)**	**(1,150,887)**	**(1,172,293)**	**(1,193,676)**	**(1,215,034)**	**(1,236,362)**	**(1,257,657)**	**(1,278,911)**	**(1,300,122)**	**(1,321,283)**	**(18,377,097)**

The vehicles would be paid on delivery in 2023-24. The total cost of new battery electric buses has been compared against the diesel equivalent, with ZEBRA funding 75% of the premium. The diesel equivalent capex will be funded by Stagecoach for the 23 vehicles required for the 221 and 22x services. SYMCA would fund the remainder vehicle capex through CRSTS, which includes the diesel equivalent capex for the 4 city centre shuttle vehicles, plus 25% of the premium for all vehicles.

The infrastructure costs would accrue on installation of the infrastructure in 2022-23. ZEBRA funding is sought for 75% of the infrastructure costs. Stagecoach will fund the remaining 25% of the infrastructure cost at their depot at Rotherham Rawmarsh. A quote of [redacted] private match funding has been offered through an iDNO, with the remainder funded by SYMCA through CRSTS.

In terms of infrastructure maintenance costs, SYMCA will fund the annual maintenance of the infrastructure at Rotherham and Sheffield Interchanges. The Rotherham and Sheffield Interchanges account for 28% of the total infrastructure capex. SYMCA will also receive annual revenue by supplying (and charging for) electricity to the operators at these locations. We have assumed that 28% of the total electricity cost of the services will be provided by the chargers at Rotherham and Sheffield Interchanges in line with the infrastructure capex allocation.

The operator(s) would fund the operating and maintenance costs for the vehicles, as well as the maintenance cost for the infrastructure at the Rawmarsh depot. This results in an annual saving to the operator, part of which will be used to fund the battery replacement in year 8.

SYMCA accepts financial responsibility for the project going forward and accepts that cost risk increases will not be met by increased further grant.

6.4 – Evidence of support of stakeholders and customers

Letters of support are provided in **Appendix D**.

6.5 – Statement of long-term financial viability

The ZEBRA grant will not be increased post submission of final business case. The cost estimates have been developed through extensive early market engagement and are therefore considered robust and reliable. Suitable OB allowances ensure an appropriate level of contingency and it is acknowledged that responsibility for estimating and controlling all project costs lies entirely with SYMCA.

The proposed electric services will generate an annual saving to the operator(s) through lower vehicle maintenance and operating costs, mainly as a result of reduced energy costs and the 22p/km BSOG incentive scheme. Although the operators will fund the replacement of the 221/22x vehicle batteries in year 8 at an estimated cost of £2.4m, the cost savings to the operator up to year 8 exceed this by £6m. Therefore, the scheme is considered to be financially viable in the long-term from the operator perspective.

Based on the assumptions in the GBM, SYMCA will incur an annual cost to maintain the charging infrastructure at Rotherham and Sheffield Interchanges

[redacted]

The city centre shuttle is not currently in operation and therefore long-term financial viability of the service requires [redacted] to fund the total maintenance and operating costs of the electric service, as well as additional costs to run the service such as driver costs. It is estimated that the city centre shuttle service would require around [redacted] per year [redacted], over a minimum of 5 years to cover the cost for the operator to run the electric bus service.

[redacted]

6.6 – Risk Management

The majority of costs can be supported by supplier engagement and therefore the level of risk is considered low. A 3% optimism bias has been applied to the elements that have a higher degree of certainty, such as vehicle costs, physical infrastructure and vehicle operating and maintenance costs, although it should be noted that uncertainty around electricity, fuel prices

and the future BSOG rate introduce a risk around ongoing operation and maintenance of the services.

The less-well defined costs relate to any civils work, particularly connection of the charging posts to the feeder pillars at Rawmarsh depot, Rotherham Interchange and Sheffield Interchange. This work has not been designed at this stage, and therefore a 44% optimism bias has been applied. This level of optimism bias was chosen because the civil work is an instance of a '*Building*' project, at Full Business Case stage. The latest TAG guidance recommends a 44% uplift for this type of project or project component (TAG Unit A1.2, par. 3.5.8, Table 8). Although we have obtained budget estimates for the connection costs to the point of connection from Northern Powergrid's online estimation tool, feedback from the supplier engagement process indicated that these costs also have a high degree of uncertainty; therefore, the higher rate of OB has been applied to these costs also.

Inflation also introduces an uncertainty on all costs. This has been mitigated through the application of the forecast CPI in the funding profile; however, inflation is currently very difficult to predict. The duration of delivery is over 2 years until March 2024, therefore this risk is minimised for the capex elements of the scheme given the relatively short and immediate timescales for delivery.

Other risks include matching the desired specification of the vehicles with the quotes provided by the suppliers; however, we have mitigated against this by clarifying the specification matches the quotes provided through the early engagement exercise.

A full risk matrix has been provided in section 7.10 of the FBC.

6.6 – Changes in costs from EoI

Through the route analysis, it was determined that opportunity charging would not be required for the city centre shuttle, and therefore the infrastructure costs have decreased (now allowing for depot fast chargers only). This reduces the capital cost by £359k.

In addition, the following changes have been made:

- Allowance for infrastructure maintenance has been removed from the capital estimate, reducing the capital cost by [redacted]
- The proposed charging infrastructure has been refined based on the route analysis and feedback from vehicle and infrastructure suppliers so that:
  - [redacted]The pantograph chargers at Rotherham Interchange are now 300kW rather than 450kW, resulting in a saving of [redacted]
  - [redacted]The fast chargers at Sheffield Interchange are now 100kW chargers rather than 150kW chargers, resulting in a saving of [redacted]
- The costs for the proposed electric vehicles have been revised based on supplier quotes that respond to clearer specification and route requirements from [redacted] to a blended average of [redacted] per vehicle.

- The costs for the diesel equivalent vehicles have been revised based on supplier quotes that respond to clearer specification and route requirements from [redacted] to [redacted] per vehicle.

- The allowance for upgrading the electrical connection to the point of connection at Rotherham Interchange, Rawmarsh Depot and Sheffield Interchange has been revised based on quotes from the DNO online tool. This has led to a saving of [redacted]

- Contingency/optimism bias has been included.

- Battery replacement has been included at a unit cost of [redacted] per battery in year 8.

- Forecast inflation has been accounted for.

Additional costs have been provided (although not included in the funding profile) as follows:

- A [redacted] allowance for marketing has been included.

- A [redacted] allowance for professional fees has been included to support procurement. A [redacted] management allowance has been included to ensure the SYMCA can deliver and oversee the scheme.

7 - MANAGEMENT CASE

7.1 – Overview of Management Case

The Management Case describes the overall deliverability of our ZEBRA proposal and considers the practical aspects such as implementation timescales and our approach to managing the project risks.

Our proposal will see 27 single decker buses and supporting charging infrastructure being operational and delivering benefits across South Yorkshire as early as September 2023. We have confidence in our ability to do this based on:

- Extensive market engagement during December 2021 and January 2022, helping to provide confidence in the costs provided, the risks which might be encountered, as well as the timescales of the different aspects of delivery.
- Close engagement with Stagecoach during the business case development for the 22x/221 proposals, including involvement in the market engagement process. This strong working relationship will continue during project delivery.
- Letters of support from all four local authorities, the Mayor, and Stagecoach – demonstrating a very high level of support for this scheme, and a willingness on all sides for this project to succeed.
- Our track record on delivering major projects.

Key highlights from this Management Case include:

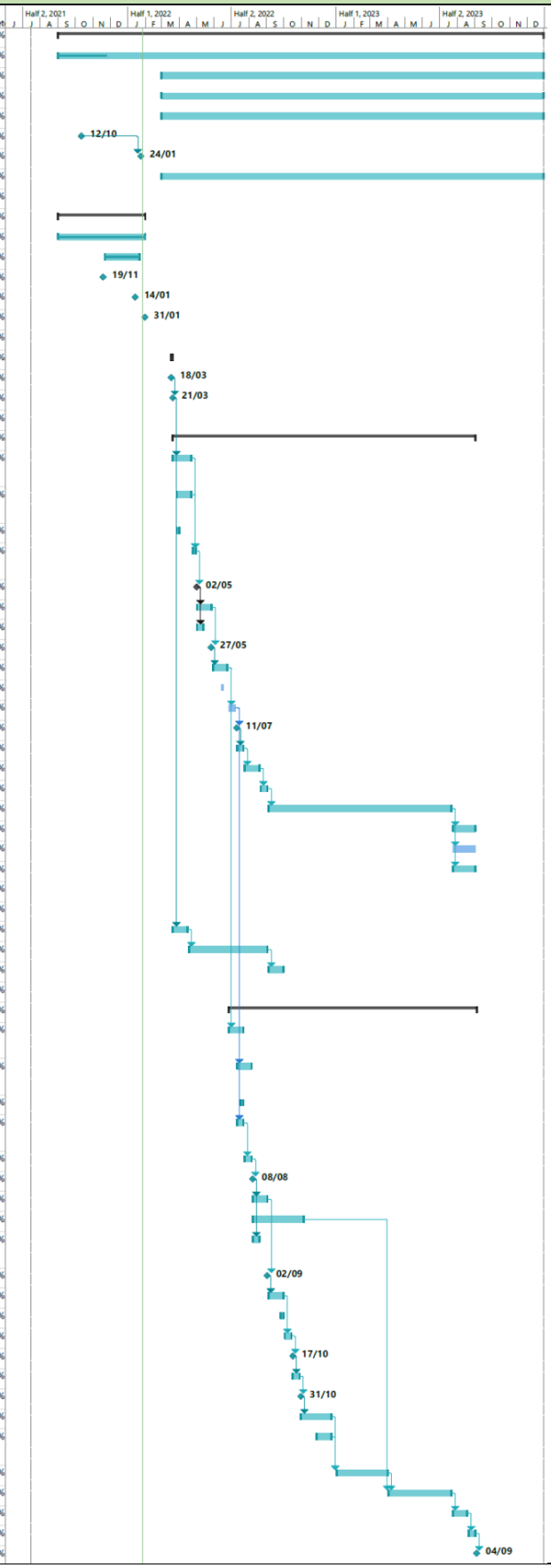
- **Deliverability** – we are confident that we can deliver both the 221/22x and City Centre shuttle bus projects by September 2023. We anticipate the timescales for both projects would be similar, even with separate procurements for the different aspects of the proposal.
- **Governance** – we have effective existing governance procedures which we have used for delivering other major capital schemes in South Yorkshire. These procedures would continue to be used for ZEBRA delivery. The ZEBRA project will be specifically overseen by the Transport and Environment Board and the SYMCA.
- **Delivery team** – we have identified key individuals within a delivery structure for all aspects of our ZEBRA proposals. We will make use of our Engineer's Framework in cases where additional technical resources are needed for delivery. Even though it will be the first ZEB project to be delivered in South Yorkshire, our region has vast amounts of experience in delivering complicated and pioneering projects – a recent example is the award-winning Tram-Train project in Sheffield and Rotherham.
- **State aid** – is applicable for the 221/22x proposals albeit a legitimate one. State aid is not applicable for the City Centre Shuttle. External legal advice was obtained, as part of our business case development.
- **Risk** – our approach to risk management is set out and our ZEBRA risk register has been provided. Our current top risks involve the DNO works and connections (programme and cost implications). We have tried to mitigate this risk by engaging with the local DNO as well as an IDNO, and using the DNO online tool. We have also factored in an appropriate level of risk contingency in case the costs are higher than forecast.
- **Stakeholder management/communications** – our approach has been outlined within the Management Case, including a tailored approach based on the individual stakeholder requirements.
- **Monitoring and Evaluation** – our approach aligns with SYMCA's assurance framework and DfT's ZEBRA requirements.

7.2 - Deliverability
Provide your anticipated timetable for delivery including the key milestones you expect. Please add scheme specific milestones as appropriate. This will form the basis for future progress reporting.

Key Milestones	Any Dependencies	Responsibility	Date
All Funding Secured	ZEBRA DfT funding announcement	DfT	20 March 2022 (assumed)
	CRSTS Match Funding	SYMCA Group Finance Director	24 January 2022
	SYMCA/SCC revenue funding (Sheffield City Shuttle Bus)	SYMCA & SCC Finance Directors	20 March 2022
Approvals	SYMCA Transport and Environment (TEB) board. Progress update on ZEBRA FBC and approval to continue with FBC	ZEBRA SRO	16 Dec 2021 - *approved*
	MCA Board (Approval to submit the FBC to DfT on 31 Jan 2022)	SYMCA Chief Executive	24 Jan 2022 - *approved*
	MCA Board (Approval to accept DfT ZEBRA funding award)	SYMCA Head of Paid Service	21 March 2022
Procurement Complete	Following FBC award	SYMCA ZEBRA Project Manager / Head of Procurement	The award of the bus supply contract is expected during July 2022 and the charging infrastructure supply contract during October 2022.
Scheme Opening		SRO / Project Manager	The target date for commencement of the 221/22x and city centre shuttle bus is the 02 September 2023

7.3 Project Plan

Task Name	Duration	Start	Finish	% Complet
GOVERNANCE	608 days?	Wed 01/09/21	Fri 29/12/23	2%
ZEBRA Project Board Meetings (fortnightly)	608 days	Wed 01/09/21	Fri 29/12/23	10%
ZEBRA Work Package Delivery Meetings (monthly)	479 days	Tue 01/03/22	Fri 29/12/23	0%
ZEBRA Delivery Board - 221/22x (monthly)	479 days	Tue 01/03/22	Fri 29/12/23	0%
ZEBRA Delivery Board - CCS (monthly)	479 days	Tue 01/03/22	Fri 29/12/23	0%
TEB Board Paper - 16th December 2021	0 days	Tue 12/10/21	Tue 12/10/21	100%
MCA FBC submission sign off - 24th January 2022	0 days	Mon 24/01/22	Mon 24/01/22	100%
Interim TEB Progress Updates (frequency tbc)	479 days	Tue 01/03/22	Fri 29/12/23	0%
				0%
FBC COMPLETION	109 days?	Wed 01/09/21	Mon 31/01/22	99%
FBC Development	109 days	Wed 01/09/21	Mon 31/01/22	100%
Supplier Engagement (buses & infrastructure)	45 days	Mon 22/11/21	Fri 21/01/22	100%
1st Draft FBC submission	0 days	Fri 19/11/21	Fri 19/11/21	100%
2nd Draft FBC submission	0 days	Fri 14/01/22	Fri 14/01/22	100%
Final FBC submission	0 days	Mon 31/01/22	Mon 31/01/22	100%
				0%
START IMPLEMENTATION	1 day?	Fri 18/03/22	Mon 21/03/22	0%
Confirmation of ZEBRA funding (date assumed)	0 days	Fri 18/03/22	Fri 18/03/22	0%
SYMCA approval to proceed / accept the award	0 days	Mon 21/03/22	Mon 21/03/22	0%
				0%
VEHICLES (221/22X AND CCS)	380 days?	Mon 21/03/22	Fri 01/09/23	0%
Preparation of Technical Specification & Purchase Agreement/Contract	25 days	Mon 21/03/22	Fri 22/04/22	0%
Preparation and approval of Tender Evaluation and Scoring Process (based on price/quality)	20 days	Mon 28/03/22	Fri 22/04/22	0%
Final Market Engagement Sessions	5 days	Mon 28/03/22	Fri 01/04/22	0%
Preparation of ITT documents by Framework Procurement Team	5 days	Mon 25/04/22	Fri 29/04/22	0%
Issue of Invitation to Tender	0 days	Mon 02/05/22	Mon 02/05/22	0%
Supplier Tender Period	20 days	Mon 02/05/22	Fri 27/05/22	0%
Tender Clarification Period	10 days	Mon 02/05/22	Fri 13/05/22	0%
Submission of Tenders	0 days	Fri 27/05/22	Fri 27/05/22	0%
Evaluation of Tenders (technical & commercial)	20 days	Mon 30/05/22	Fri 24/06/22	0%
Consensus meeting (technical team)	5 days	Mon 13/06/22	Fri 17/06/22	0%
Preparation of recommendation and approval pape	10 days	Mon 27/06/22	Fri 08/07/22	0%
Award of Contract	0 days	Mon 11/07/22	Mon 11/07/22	0%
Standstill Period	10 days	Mon 11/07/22	Fri 22/07/22	0%
Contract Signature	20 days	Mon 25/07/22	Fri 19/08/22	0%
Agree Final Specification	10 days	Mon 22/08/22	Fri 02/09/22	0%
Vehicle Design & Build	230 days	Mon 05/09/22	Fri 21/07/23	0%
Vehicle Inspection (PDI) and Delivery	30 days	Mon 24/07/23	Fri 01/09/23	0%
Training and Commissioning	30 days	Mon 24/07/23	Fri 01/09/23	0%
Marketing & Promotion	30 days	Mon 24/07/23	Fri 01/09/23	0%
				0%
CCS - OPERATOR TENDER				0%
Completion of CCS operator tender documents	1 mon	Mon 21/03/22	Fri 15/04/22	0%
Operator tender process (assumed 5 months)	5 mons	Mon 18/04/22	Fri 02/09/22	0%
CCS operator known	1 mon	Mon 05/09/22	Fri 30/09/22	0%
				0%
INFRASTRUCTURE (221/22X AND CCS)	310 days	Mon 27/06/22	Mon 04/09/23	0%
Technical Site Assessments and design and technical study	20 days	Mon 27/06/22	Fri 22/07/22	0%
Preparation of Technical Specification & Purchase Agreement/Contract	20 days	Mon 11/07/22	Fri 05/08/22	0%
Final Market Engagement Sessions	5 days	Mon 18/07/22	Fri 22/07/22	0%
Preparation and approval of Tender Evaluation and Scoring Process (based on price/quality)	10 days	Mon 11/07/22	Fri 22/07/22	0%
Preparation of ITT documents by Framework Provid	10 days	Mon 25/07/22	Fri 05/08/22	0%
Issue of Invitation to Tender	0 days	Mon 08/08/22	Mon 08/08/22	0%
Supplier Tender Period	20 days	Mon 08/08/22	Fri 02/09/22	0%
Planning applications (if required)	65 days	Mon 08/08/22	Fri 04/11/22	0%
Tender Clarification Period including site visits (if required)	10 days	Mon 08/08/22	Fri 19/08/22	0%
Submission of Tenders	0 days	Fri 02/09/22	Fri 02/09/22	0%
Evaluation of Tenders (technical & commercial)	20 days	Mon 05/09/22	Fri 30/09/22	0%
Consensus meetings (technical team)	5 days	Mon 26/09/22	Fri 30/09/22	0%
Preparation of recommendation and approval pape	10 days	Mon 03/10/22	Fri 14/10/22	0%
Award of Contract	0 days	Mon 17/10/22	Mon 17/10/22	0%
Standstill Period	10 days	Mon 17/10/22	Fri 28/10/22	0%
Contract Signature	0 days	Mon 31/10/22	Mon 31/10/22	0%
Agreement of Final Specification	40 days	Mon 31/10/22	Fri 23/12/22	0%
Agreements of layouts Rotherham Interchange, Rawmarsh Depot and the depot for the CCS service	20 days	Mon 28/11/22	Fri 23/12/22	0%
Manufacturing of chargers etc.	65 days	Mon 02/01/23	Fri 31/03/23	0%
Charger installations, civils, grid connections etc.	80 days	Mon 03/04/23	Fri 21/07/23	0%
Commissioning	20 days	Mon 24/07/23	Fri 18/08/23	0%
Training of Operational Staff	10 days	Mon 21/08/23	Fri 01/09/23	0%
Commencement of Zero-Emission Operation	0 days	Mon 04/09/23	Mon 04/09/23	0%



7.4 - Give a realistic indication of when the scheme should commence

The scheme commencement date, as shown in the project programme, is September 2023. Some contingency has been built into this programme, so the commencement date shown is considered to be realistic. This is well in advance of DfT's delivery deadline of March 2024.

It is anticipated that the delivery timescales for the 221/22x and the City Centre Shuttle (CCS) bus would be similar, which is why both schemes follow the same timescales, as shown in the programme above.

It should be noted, however, that Stagecoach will lead on the procurement of the 221/22x buses through their own framework, whereas the CCS would be procured through a local authority procurement framework. As such, there could be an opportunity to reduce the delivery timescale for the 221/22x compared to the CCS, as by using Stagecoach's own framework may help reduce delivery timescales. However, for additional contingency, and to ensure a robust delivery programme, the same procurement timescales have been assumed for both the 221/22x and the CCS.

7.5 - Indicate whether the following have been secured, agreed fully or agreed in part, or provide an estimation of when they are likely to be secured. Provide detail which will support your business case. Insert N/A if not applicable to the scheme.

Delivery Constraint / Risk	Scheme Position and Indicative Date
Planning Consents	RMBC has confirmed that the proposed pantograph chargers at Rotherham Interchange is Permitted Development under the Town and Country Planning (General Permitted Development) (England) Order 2015 (as amended), Part 9, Class C – tramway or road transport undertakings.
CPOs	N/A
Public Consultation	Public Consultation is not needed for the 22x, 221 or the City Centre shuttle bus proposals.
Public Inquiry	N/A
Traffic Regulation Orders	N/A
Transport and Works Act	N/A
Public Sector Match Funding	£2,683,051
Private Sector Match Funding	[redacted]
Procurement Contracts	See the commercial case for details on procurement.
Revenue Funds	£5,788,652 over 16 operational years (gross)
Other Statutory Processes (please specify)	-

7.6 - Governance

7.6.1 – Description of key roles and responsibilities

Effective governance structures have already been established as part of the City Region Sustainable Transport Settlements (CRSTS) programme, and it is intended to retain these for the ZEBRA project delivery. Ultimate financial accountability for the ZEBRA project will rest with the SYMCA.

The SYMCA Assurance Framework will provide the basis of Governance for the ZEBRA project (SYMCA Assurance Framework)

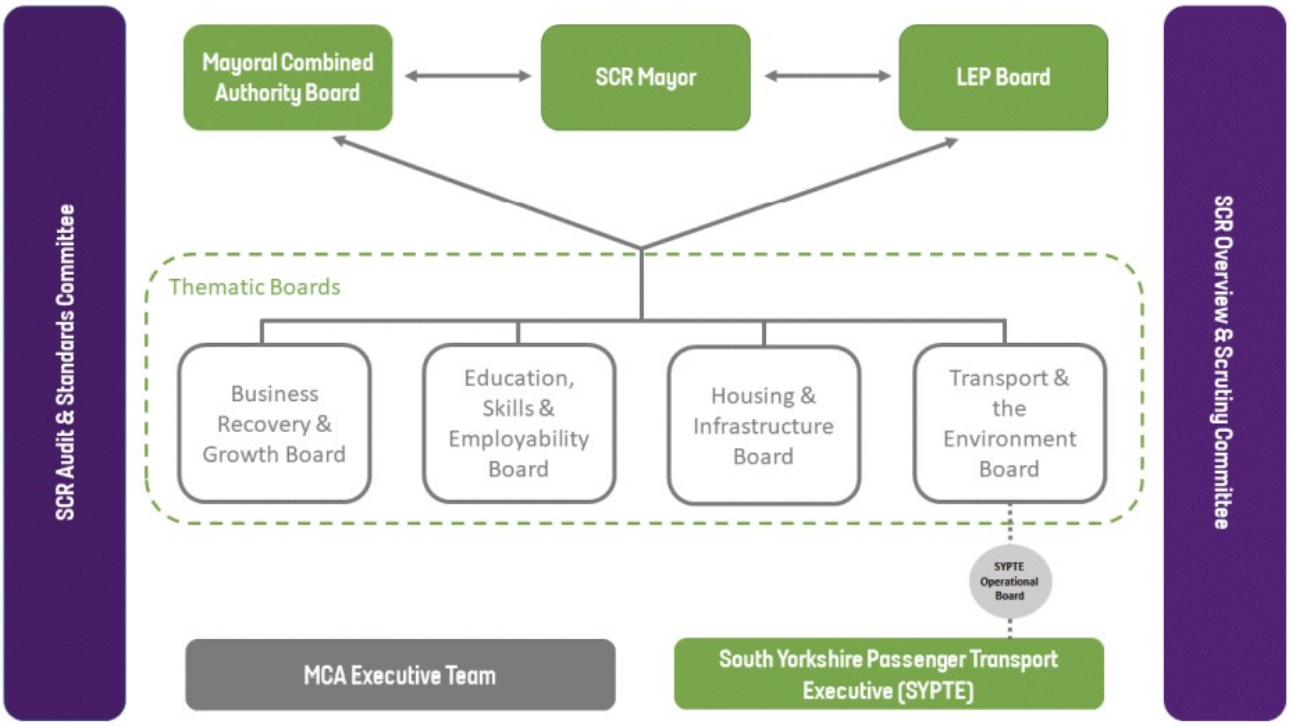
The Assurance Framework sits alongside several key governance and policy documents including the Strategic Economic Plan (SEP) and Renewal Action Plan (RAP) and sets out:

- The roles and responsibilities, decision-making and delivery structure of the SYMCA and LEP.
- The processes for ensuring accountability, probity, transparency, legal compliance, and value for money.
- How potential investments will be prioritised, appraised, approved, and delivered.
- How the progress and impacts of investments will be monitored and evaluated.

The Mayor, SYMCA Board and LEP Board are supported by four Thematic Boards, including for Transport and the Environment, and the MCA Executive Team.

Figure 7.1 below sets out the overall governance structure, and how the Boards and Committees relate to one another.

Figure 7.1: Relationship between the combined autority boards and committees



**In 2021/22 SYPTE will be amalgamated into the MCA with all SYPTE staff becoming part of the MCA Executive Team.*

The Mayor is directly elected by the electorate of South Yorkshire, Chairs the SYMCA, and is a member of the LEP Board. The MCA is the legal and accountable body for funding devolved and awarded to the MCA and LEP. The SYMCA is also the Local Transport Authority for South Yorkshire.

Membership of the SYMCA Board is set out in **Figure 7.2**.

Figure 7.2: Membership of the MCA 2021/22

Member	Post	Membership Type
South Yorkshire	Mayor	Constituent
Barnsley Metropolitan Borough Council	Leader	Constituent
Doncaster Metropolitan Borough Council	Mayor	Constituent
Rotherham Metropolitan Borough Council	Leader	Constituent
Sheffield City Council	Leader	Constituent
Bassetlaw District Council	Leader	Non-constituent
Bolsover District Council	Leader	Non-constituent
Chesterfield Borough Council	Leader	Non-constituent
Derbyshire Dales District Council	Leader	Non-constituent
North East Derbyshire District Council	Leader	Non-constituent
Sheffield City Region LEP	Chair	Non-voting
Barnsley Metropolitan Borough Council	Nominated Representative	Rotational
Sheffield City Council	Nominated Representative	Rotational

The Transport and Environment Board (TEB) is responsible for driving forward the agenda of this thematic area. The Board meets on an eight weekly cycle and is made up of:

- One Leader from the MCA of a South Yorkshire local authority.
- Executive Director of SYPTE.
- A nominated representative of each of the South Yorkshire local authorities.
- A lead Chief Executive from a South Yorkshire local authority.
- Two private sector LEP Board members.
- Head of Paid Service (or their nominated representative).
- A non-voting representative for the non-constituent local authorities from the MCA.

More information on the current MCA and TEB Board members is available on the SYMCA governance website:

https://governance.southyorkshire-ca.gov.uk/mgCommitteeDetails.aspx?ID=200

The MCA Executive Team advises the Mayor, MCA and LEP on policy, seeks agreement between those bodies and subsequently commissions, manages and monitors the delivery of projects. The MCA Executive Team and local authority Chief Executives also support the decision-making process. Two independent committees, the Audit and Standards Committee and Overview and Scrutiny Committee, ensure that the MCA, LEP and Mayor are fulfilling their legal obligations, and developing and delivering strategies that are in the best interests of local people.

The ZEBRA project will be specifically overseen by the Transport and Environment Board and the SYMCA. The SYMCA will approve the submission of the ZEBRA Full Business Case in January 2022 following endorsement by the Transport and Environment Board in December 2021, and if a funding award is made, the SYMCA will be responsible for formally accepting the grant.

The Transport and Environment Board will, at each eight-weekly meeting, receive delivery and performance reports on the project from the SYMCA Executive Team. Reports will outline achievements towards output, outcome and expenditure targets, and agree or make recommendations to the SYMCA on any performance issues, risks, or changes to the project.

This project has been included in the proposed South Yorkshire Enhance Partnership Scheme, subject to successfully securing DfT ZEBRA funding. Therefore, if the South Yorkshire Enhanced Partnership Plan and Scheme are approved, the newly formed Enhance Partnership Board will also have a role in supporting the successful delivery of the ZEBRA project.

PRINCE2 Project Management principles will be used to plan and manage the delivery of ZEBRA, the same approach that SYMCA adopted in delivering the TCF programme of works. The Senior Responsible Owner (SRO) for the project is Pat Beijer, who is the Business Development Director (Public Transport) at SYMCA. The SRO is responsible to the Transport and Environment Board, and ultimately the SYMCA. The ZEBRA SRO is supported by the scheme Project Manager – Ben Hardy, Principal Project Manager at SYMCA. The experience and credentials of both the SRO and Project Manager are provided in **Section 7.6.3** below. The SRO and / or the Project Manager will be responsible for reporting progress to the DfT.

The Senior Supplier represents the interests of those designing, developing, facilitating, procuring, and implementing the project's products. The named Senior User is Andy Wright, the Bus Services Manager at SYMCA.

The Senior User is be responsible for specifying the needs of those who will use the project's products. The ZEBRA Senior User is Tim Taylor, Director of Customer Services at SYMCA.

The Project Executive will ensure that the project gives value for money, ensuring a cost-conscious approach to the project, balancing the demands of the business, user and supplier. The named Executive for the ZEBRA project is Adam Midgely, Head of Programme Management at SYMCA.

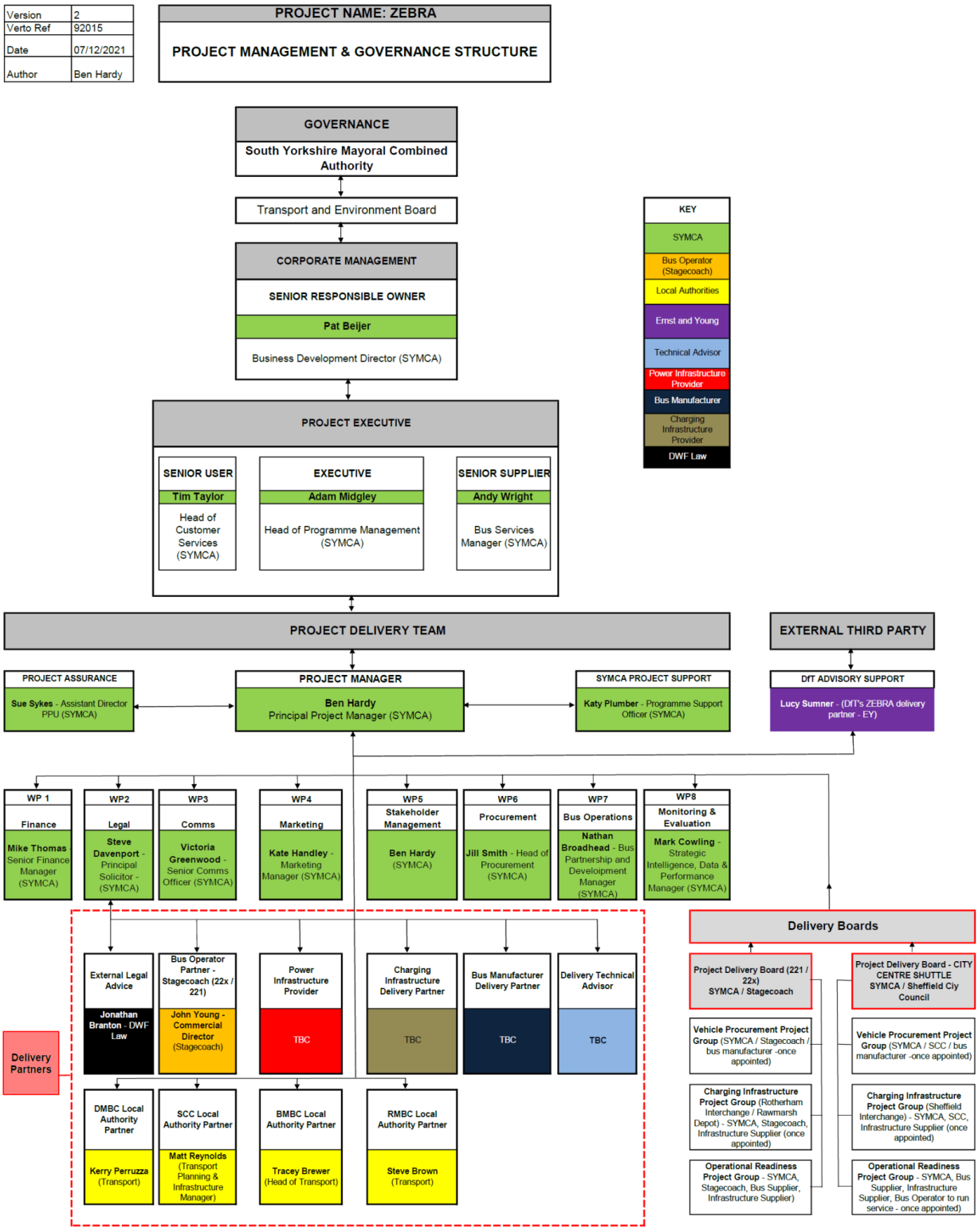
It should also be noted that the SYMCA holds a Project Management Office (PMO) function led by Sue Sykes, Assistant Director – Programme and Performance Unit. This team maintains oversight of all SYMCA programme activity and leads on all reporting to funders on programme performance and compliance.

As shown in **7.6.2** below, delivery boards will be established for the 221/22x and the electric shuttle bus elements of delivery, following confirmation of funding. Resources will be used from within the individual work package lead teams, and leads are aware of the ZEBRA project and potential timescales, subject to a successful bid. Where there is an identified gap in capacity or capability, we have the option of using our Engineer's framework, to bring in additional support as and when needed.

7.6.2 – Diagram showing project team / governance structure

Figure 7.3 below provides an overview of the ZEBRA project team and governance structure.

Figure 7.3: Proposed ZEBRA Project Management Structure



7.6.3 – Experience of key members of the project team

SRO – Pat Beijer

Pat joined the SYMCA organisation almost two years ago, initially in the capacity of Director of Transport Operations and is currently the interim Business Development Director. Pat has over 19 years' of experience working in public transport in the private and public sector, of which 10 years in senior leadership positions, having been accountable for major contractual and operational change programmes, business model changes, business impact appraisals, stakeholder engagement and more recently capital programmes for the bus, tram and heavy rail sector. Pat, a former MSP practitioner, graduated with a bachelor's degree in Business/Managerial Economics and has an Executive Leadership Certificate from Leeds Beckett University.

Executive – Adam Midgley

Adam has over 15 years senior leadership experience, which includes responsibility for delivering major public sector capital projects and programmes in transport, housing, education, and health. Adam is a Chartered Civil Engineer and a full member of both the Institution of Civil Engineers and Chartered Institute of Managers, and is Prince2 and MSP Practitioner certified.

Project Manager – Ben Hardy

Ben is a Principal Project Manager with over 10 years of Project Management experience in both the public and private sectors. Ben is a Chartered Geographer with qualifications including Prince2 Practitioner (2013) and Better Business Cases Practitioner (2019). Current projects include the iPort Bridge TCF scheme[3] and upgrading the Community Transport fleet to electric. As part of Ben's work on zero emission public transport, he led the development of the Electric Bus Toolkit, led a commission on hydrogen bus feasibility in South Yorkshire, and attends the North of England Hydrogen Forum.

Work Package Leads

As per the project structure, the work package leads would be resourced internally within SYMCA, covering all the delivery packages.

External Resources

Some external technical resource needs have been identified, to assist with project delivery. This includes:

- *DWF law* - External legal advisers, with specialist knowledge from similar previous Zero Emission Bus projects, will be used to ensure compliance with state aid and bus subsidy rules.

- *Delivery Technical Advisor* - A specialist Zero Emission Bus technical advisor will be appointed, upon a successful award of the ZEBRA fund, to bring in specialist knowledge where there are gaps in delivery knowledge. SYMCA, South Yorkshire Local Authorities, and SYPTE have experience in delivering an extensive range of projects. However, as this proposal would be the first ZEB project in South Yorkshire, additional technical resource would be brought in, to provide greater confidence in programme delivery, using knowledge from similar projects elsewhere across the country.

[3] https://travelsouthyorkshire.com/en-GB/LandingPage/iPort-Bridge-Scheme-consultation

7.7 – Track Record on Project Delivery

The SYMCA, South Yorkshire Local Authorities and SYPTE have experience in delivering a diverse range of projects, and have a strong track record in procurement and delivery of schemes, with some examples of recent projects delivered on time and to the agreed budget, including:

- **Barnsley Quality Bus Corridor Improvements** (A61 Phase 3 Burton Road - £7 million)
- **M1 Junction 37 signalisation** (DfT pinch point scheme – £1.567 million)
- **A638 Quality Bus Corridor** (£12 million)
- **Doncaster Station improvements** (£7 million)
- **Rotherham Sheffield BRT North** (£29.8 million)
- **Rotherham Central Station improvements** (£8.5 million)
- **Rotherham Interchange improvements** (£12 million)
- **A61 Penistone Road Pinch Point / Better Buses scheme** (£5 million, including a £1 million contribution to a major junction improvement from a large retailer)
- **Sustainable Transport Access Fund in Sheffield and Rotherham** (including Cycleboost, Independent Travel Training, Busboost and EcoStars – £7.5 million)
- **Clean Bus Technology Fund** (covering 117 buses in Sheffield).

In addition to the schemes highlighted above, specific mention should be made for South Yorkshire Passenger Transport Executive's (SYPTE – soon to become SYMCA) Tram-Train pilot project, which was delivered in 2018, which was the start of the 2-year pilot period. The project won the Global Light Rail Awards in 2019. This project (£55m value of SYPTE-led elements) was a Government funded Tram-Train project, delivered in partnership between South Yorkshire Passenger Transport Executive, Stagecoach Supertram and Northern Rail, which piloted the pioneering technology which allows passengers to make a single continuous journey, connecting tram stops with conventional railway stations. The zero emission Tram-Train connects Sheffield City Centre to Parkgate Shopping Centre, via Rotherham Central Railway Station.

Due to the nature of Tram-Train being zero emission transport, lessons learnt from delivering this scheme will be implemented in our ZEBRA project. Relevant lessons learnt will be applied from the Tram-Train pilot project in South Yorkshire, including:

1. *The scheme was initiated as a limited trial of new technology and over time the focus changed to operating a trial service and more recently as an ongoing operational service. This has brought into focus some competing imperatives between the original objective and operational reality.* This is of relevance to our ZEBRA project due to the need to deliver on the objectives set out in this business case, but also ensure lessons are learnt for future roll out of electric bus schemes – as this would be our first Zero Emission Bus scheme in South Yorkshire.

2. *Effective early engagement between SYPTE and the operator is essential, and the overall programme should be developed in an integrated manner. For example, the work should be phased such that the vehicle specifications are known prior to the Design Stage of the infrastructure work.* For ZEBRA we have been working closely and in an integrated manner with Stagecoach in developing the proposals, including a joined-up approach to market engagement. The lesson on vehicle specifications are also of relevance to ZEBRA.

3. *Other key operating constraints, such as the traction power solution, should be specified from the outset and remain unchanged. The scope must be absolutely fixed before contracting.* For ZEBRA this has relevance for what is needed prior to contracting.

4. *Client Requirements and Concept of Operations should be clearly set out at the outset and Governance arrangements sufficiently robust to ensure both are met.* For ZEBRA, this governance clarity is set out in the Management Case, but the requirements of the ZEBRA operation will be clearly set out in the legal agreement between the SYMCA and Stagecoach for the 221 and 22x.

5. *Driver/staff training took longer than was originally envisaged.* In the case of ZEBRA, the driver/staff training would be simpler than training the tram drivers to operate on the railway network. That said, sufficient time will be allowed in the programme to ensure sufficient training.

6. *For any future vehicle procurement, a longer period of testing and commissioning of vehicles should be allowed.* For ZEBRA, the vehicle procurement (buses) is different to that of Tram-Trains. That said, close engagement with bus manufacturers during December 2021 has ensured robust timescale estimates for vehicle (and infrastructure) procurement.

Collectively, the SYMCA has successfully delivered various DfT-funded programmes (including Local Sustainable Transport Fund (LSTF) and the Better Buses Area (BBA) programme). The BBA programme probably represents the most directly applicable example of delivery for the LUF programme and has provided several 'lessons learnt' for other programmes across the SCR.

The longer-term impact of the BBA programme is being reported to the DfT as part of the agreed monitoring plan, and highlights to date include the Penistone Road bus lane with early findings since implementation showing a 32% reduction in average bus journey times.

7.8 – Contract Management Procedures

Contracts will be awarded in accordance with Public Contracting Regulations 2015 and SYMCA Contract Procedure Rules. The tender, contract award, and subsequent contract management will be supported through the SYMCA's Procurement, Contract, and Controls team within the Finance and Investment Directorate. The project will be supported by a designated member of this team. SYMCA Legal Service will also provide support through the tender and contract award stages.

7.9 - STATE AID

Please confirm if State Aid is applicable to this scheme.

If you have received formal state aid advice from a solicitor, please provide further details below. If not, please confirm when this is expected.

State Aid is applicable to the 221/22x elements of our ZEBRA proposal, albeit a legitimate one. Further details are set out in **Section 7.9** below**.**

State Aid is not applicable to the City Centre shuttle bus aspect of our ZEBRA proposal.

7.9 A - If Yes, detail the amount of state aid that will be provided and under what scheme(s). Provide any issues and anticipated mitigation plans (if applicable). Any mitigation must also be included in the project risk assessment.

External legal advice has been provided by DWF Law. Key elements from this advice, as included in **Section 5.9** of the Commercial Case, for both the 221/22x and the city centre shuttle bus elements are provided below. The full legal advice is provided in **Appendix C**. The full legal advice includes both options of leasing buses to Stagecoach on the 221/22x and Stagecoach owning the buses. It should be noted that we will be progressing with the option of Stagecoach owning the buses and not the leasing option. In either approach, there is a clear subsidy and similar considerations apply in order to render the subsidy lawful, in particular with the focus on ensuring the amount of grant was no more than necessary to achieve the relevant objective.

22x/221

DWF law's view is that the DfT grant (and the additional SYMCA funding) may be delivered in compliance with Subsidy Control law, but care will be required in order to achieve this, as set out below.

By supporting Stagecoach with grant funding to enable it to buy zero emission buses to operate the same routes, this would be clear subsidy to the level of grant funding provided. Whilst the starting intention would be to support only the additional costs against conventional diesel buses comparators, this would need to be bolstered with further work to ensure the grant support was no more than necessary to secure the objective (of making Stagecoach do this switch to zero emission buses now). For example, if there were other (perhaps less obvious) benefits to Stagecoach of making the switch as proposed, then this should be factored in to ensure suitable adjustments to the grant funding amount. Subject to due care with the above, the project would be compliant with Subsidy Control law.

City Centre Shuttle Bus

The proposed city centre shuttle bus will be a tendered service operated by a third party through an open competition. This will ensure that there will be no over-compensation and therefore no subsidy to that third party for providing the public service. This arrangement should similarly mean no subsidy to SYMCA accordingly, which in this respect will be doing no more than fulfilling its ordinary role as a State body and public transport authority.

Subsidy Control Bill

For completeness, DWF Law noted that a new *Subsidy Control Bill* was set before the UK Parliament on 30 June 2021 and is currently being scrutinised by the Subsidy Control Bill Select Committee. It is not yet law and would only apply to subsidies which are awarded from the date of entry into force of resulting legislation, which is anticipated to be in Autumn 2022. The legal advice provided by DWF Law is on the assumption of entering into the relevant arrangements prior to this time, but should this be delayed for any reason then a check should be made as to any potential impact from the future *Subsidy Control Act* (resulting from the Bill).

7.9 B - If No, provide an explanation as to why no State Aid is provided for this scheme making specific reference to the State Aid tests.

N/A

7.10 - RISK MANAGEMENT

Risk Management Overview

Internal governance in relation to risk management of programmes and projects have been established and outlined in the Sheffield City Region Assurance Framework. The Audit and Standards Committee monitors the operation of the organisation. Their role is to ensure that the SYMCA is fulfilling its legal obligations, complies with statutory requirements, is managing risk effectively and has robust control measures in place for all devolved powers and funding.

The approach to risk management is comprehensive and in accordance with HM Treasury's Orange Book principles and other project management guidance. The Deputy Chief Executive of the SYMCA is the named officer for managing risk on the SYMCA and LEP activity.

Robust control measures and a Strategic Risk Management Framework are in place to provide accountability and support due diligence. The Strategic Risk Management Framework guides the identification, assessment and management of risks for all activities.

Quarterly Performance Monitoring reports are compiled for the Transport and Environment Board to identify any issues with delivery, perceived or actual risks to the project, any corrective action and any change requests. SYMCA will develop an approach to risk that identifies, analyses and evaluates commercial risks pre-procurement, and that ensures these risks are treated appropriately and allocated to those best able to manage them.

Risk Register

A project risk register has been created for this ZEBRA project (see **Figure 7.4**). This Risk Register is the primary means of recording risk information and monitoring risk exposure throughout the life of the programme. It not only records all identified risks, but also includes suggested mitigation measures and responsibilities. The registers will be refined throughout project life, including supplier engagement during the tender stage and preferred bidder engagement pre-contract award. Through long-term partnering arrangements and use of frameworks, early contractor involvement will mitigate those risks that contractors and their supply chain are best placed to manage during the pre-construction phase.

Figure 7.4: ZEBRA - Risk Log

Ref. No.	Risk Type [Dropdown list]	Risk Description	Impact / Consequence of Risk	Risk action owner and responsible officer	Likeliness of occurring	Impact [1(low) - 5(high)]	RAG	Risk Control / Mitigation	Control/mitigation owner	Likeliness of occurring	Post mitigation impact	Post mitigation risk	Risk Status	Comments
1	[redacted]													
2	Programme	Alignment of the City Centre Shuttle Bus ZEBRA project with Sheffield City Council's Transforming Cities Fund developments in the city centre	Potential delays to programme	Principal Project Manager - SYMCA	4.00	4.00	16	Close working between SYMCA and SCC to confirm the shuttle bus route and align project programmes for both projects. The works for the city centre shuttle bus (Sheffield Interchange) are different from the works resulting from the TCF projects. However, the SCC TCF works will be along some of the shuttle bus route. As such, delays to SCC's TCF programme could impact on the ZEBRA delivery programme.	Principal Project Manager - SYMCA	3.00	3	9		Frequent meetings are taking place between SYMCA and SCC regarding the ZEBRA project and alignement with the TCF programme of works in the city centre.
3	Operational	Uncertainty over charger specifications	Insufficient vehicle charge to complete the proposed services.	Principal Project Manager - SYMCA	4.00	5.00	20	Use SYMCA's 'electric bus toolkit' to model the routes to determine specific charger requirements based on the available technology. Engage with Stagecoach to learn from their electric buses elsewhere and to model the routes. Market engagement to determine requirements based on the specific route requirements. Engage with the bus and charger manufacturers to determine what will be availble by early 2024 (delivery date).	Principal Project Manager - SYMCA	1.00	1	1	Active	Initial modelling has shown that pantograph chargers are not needed in Sheffield for the shuttle bus service. However, it is marginal as to whether pantograph chargers are needed for the 22x and 221. Following market engagement, to ensure operational viability, to provide contingency and to reduce operational risk, two pantograph chargers have been included in the proposal at Rotherham. One bus manufacturer has offered to test their electric buses on the 22x and 221 routes - to provide even greater confidence in the modelling work from both the bus manufacturers and the Electric Bus Toolkit. It is likely that this will take place during February 2022.
4	Operational	The project will be scoped to meet the existing demands of the operations. However, with increases in battery technology in future, the pantograph chargers proposed in Rotherham Interchange may not be needed.	Potentially the pantograph chargers might not be needed in the future, so could be abortive infrastructure.	Principal Project Manager - SYMCA	3.00	1.00	3	There will need to be a degree of acceptance that technology will advance in future, however there is an urgent air quality problem in our region alongside a climate emergency. This may mean that we need to provide infrastructure that is needed at least in the short term, so that the services can operate effectively. The addition of pantograph chargers could have the additional benefit of opening up other longer routes in future, which might not otherwise be possible without rapid chargers. Use SYMCA's 'electric bus toolkit' to model the routes to determine specific charger requirements based on the availavle technology. Engage with the bus and charger manufacturers to determine what will be availble by early 2024 (delivery date).	Principal Project Manager - SYMCA	5.00	1	5	Active	
5	Programme	Capacity of the bus and charger manufacturers	Risk around the e-mobility supply chain. Although supply chains are gearing up to meet demand, delivery timescales in 2-3 years may differ from those assumed.	Principal Project Manager - SYMCA	4.00	4.00	16	Early engagement with potential suppliers regarding delivery timescales. However, this is a risk that will be difficult to mitigate due to the scale of similar e-mobility projects across the country at the same time.	Principal Project Manager - SYMCA	3.00	4	12	Active	Market engagement has taken place in December 2021 with 7 bus manufacturers, 4 charging infrastucture providers and one IDNO.
6	Programme	DNO works and connections	One of the biggest timing risks for ZEBRA is around the DNO works and connections. These are generally unknown until firm orders are placed.	Principal Project Manager - SYMCA	4.00	4.00	16	Early engagement with the local DNO. However, some degree of acceptance is needed that the risk can't be fully mitigated until the orders are actually placed.	Principal Project Manager - SYMCA	4.00	4	16	Active	
7	Financial	DNO works and connections	Risk around DNO / IDNO budget estimate risk	Principal Project Manager - SYMCA	4.00	5.00	20	Budget estimate requested from the local DNO (Northern Powergrid). In addition, estimates also to be provided from an IDNO to help provide greater confidence in the budget estimates and budget risk allocated. However, there is some acceptance that this cannot be fully mitigated until detailed estimates are provided.	Principal Project Manager - SYMCA	3.00	4	12	Active	IDNO and DNO budget estimates expected in January 2022, to form part of the business case submission on the 31 January 2022.
8	Programme	SYMCA approvals for FBC submission	Failure to receive MCA approval to submit the business case to DfT could delay submission or risk not being able to submit.	SRO and Principal Project Manager - SYMCA	2.00	5.00	10	Early engagement with SYMCA colleages to ensure the business case proposal recieves the correct sign off prior to the Jan 31st 2022 final submission. Also, early engagement with the relevant parts of the organisation (finance, procurement, legal, marketing etc) to ensure all comments are incorporated into the proposal, to reduce the risk during the approvals process.	SRO	1.00	1	1	Active	A report went to the Transport and Environment Board (TEB) on the 16 December 2021. This board approved the continuation of the business case. Final approval to submit the business case will be made at the MCA meeting on the 24 January 2022.

9	Financial	Uncertainty over the source of SYMCA match funding for the project.	If we are unable to secure match funding, the viability of the project will be at risk.	Senior Financial Manager (SYMCA)	3.00	5.00	15	Engagement with SYMCA finance and SRO to secure the match funding source. Engagement with DfT regarding the acceptance of the match funding source (CRSTS) - or whether it needs to come from another internal match funding pot. Explore alternative match funding sources with SYMCA finance if the proposed CRSTS can't be used.	Senior Financial Manager (SYMCA)	2.00	2	4	Active	CRSTS funding has been ringfenced for use in the ZEBRA project.
10	Financial	Reaching a commercial agreement with Stagecoach (leasing vehicles to Stagecoach or Stagecoach owning the vehicles) - ensuring compliance with state aid / subsidy rules.	Failure to reach agreement would mean the project could not proceed.	Bus Services Manager (SYMCA)	2.00	5.00	10	Early engagement with Stagecoach to set out the principles of the 'no better no worse' lease agreement principle. Explore alternative commerical arrangements including the option of Stagecoach owning the buses. Head of Terms agreement to be included in the final business case.	Bus Services Manager (SYMCA)	2.00	2	4	Active	Agreement in principle reached with Stagecoach for the bus operator to own the buses, with contibutions from DfT and SYMCA through the ZEBRA fund. Stagecoach will also own the infrastructure at their depot. The high level terms of the agreement between Stagecoach and SYMCA have been appended to Stagecoach's letter of support (Appendix D of the business case). This will be developed into a full legal agreement.
11	Financial	Cost estimate could be higher than set out in the EoI	If the costs go up, either additional funding will be needed or some of the proposals will need to be scaled back.	Principal Project Manager - SYMCA	4.00	4.00	16	Engagement with the bus and charger market, as well as the DNO to get a better understanding of costs for the FBC. Identify potential additional funding sources if additional funding is needed. Engagement with bus manufacturers, charging infrastructure providers and an IDNO will help inform the business case costs, to provide greater confidence in the costs included in the FBC.	Principal Project Manager - SYMCA	3.00	3	9	Active	The current proposal is to reduce the number of pantograph chargers from 4 to 2, with the same number of zero emission buses. This will reduce some of the costs, as specified in the EoI. However, some additional costs will be needed to cover risk and contingency - which weren't included in the EoI.
12	Other	Compliance with state aid / bus subsidy rules	The project can't proceed without assurance that the proposals comply with state aid / bus subsidy rules	Principal Solititor (SYMCA)	4.00	5.00	20	Internal legal advice from SYMCA. External legal advice to be provided by DWF Law regarding compliance with state aid and subsidy rules. Engagement with Stagecoach to determine how compliance has been acheived in other similar projects across the country. Review 'fast track' ZEBRA submissions to understand how state aid has been dealt with elsewhere.	Principal Solititor (SYMCA)	2.00	2	4.00	Active	External legal advice has been obtained from DWF law. The details of which have been included in the business case, demonstrating compliance with subsidy rules and state aid requirements.
13	Strategic / Policy	City centre benefits in the business case	The city centre proposal involves a new electric shuttle bus, where there isn't a service currently operating. As such, need to ensure the benefits are appropriately accounted for.	Principal Project Manager - SYMCA	3.00	1.00	3	Discussions with EY regarding how to deal with this in the Greener Bus Model. Compare the benefit of the shuttle buses with the scenario of a diesel bus option being implemented - to derive the benefits.	Principal Project Manager - SYMCA	1.00	1	1.00	Active	
14	Reputational	Reputational risk if the project fails.	If the project fails, there would be a reputational risk to the authority.	SRO	2.00	5.00	10	The electric bus technology has worked extensively elsewhere in the UK, which reduces the risk significantly. We are making use of our 'electric bus toolkit' to ensure the right level of infrastructure is provided - to give greater comfort that the propsals will work. Close engagement with SYMCA Comms - to reduce the reputational risk. Market engagement during December 2021 - helping to inform the project requirements and reduce the project risk.	SRO	1.00	1	1.00	Active	Whilst the two pantograph chargers at Sheffield Interchange are no longer needed for the Sheffield shuttle bus, the provision of two pantograph chargers at Rotherham Interchange will significantly reduce the risk of project failure.
[redacted]														

[redacted]

17	Delivery	Lack of Resource / Technical skills to deliver the project	Delays to programme	Principal Project Manager - SYMCA	2.00	3.00	6	SYMCA has an extensive track record of project delivery, with a dedicated Projects team. As delivery of an electric bus project would be a new type of project, technical expertise will be brought in where necessary.	Principal Project Manager - SYMCA	1.00	1	1.00	Active	SYMCA's engineers framework can be used if there are any requirements for additional resources to deliver the project.
18	Programme	Risk of poor governance within SYMCA	Delays to programme	SYMCA Project Assurance	1.00	1.00	1	SYMCA has a strong track record of good governance processes, which have been used on similar DfT funded schemes such as TCF. A similar governance approach will be adopted by SYMCA.	SYMCA Project Assurance	1.00	1	1.00	Active	
19	Delivery	Resources to deliver the project	Insufficent number of resources and resources with the relevant skills could impact on project delivery	Principal Project Manager - SYMCA	4.00	4.00	16	SYMCA has a strong track record of project delivery. Resource management is a key element of this delivery. Resource planning across the different teams within the organisation will ensure resources are allocated accordingly and any gaps identified at the earliest opportunity. External technical exprtise will be brought into the delivery team where there are gaps in skills / knowledge.	Principal Project Manager - SYMCA	2.00	2	4.00	Active	
20	Programme	Planning requirements at Rotherham Interchange	Potential increases to programme if a planning application is needed	Principal Project Manager - SYMCA	3.00	2.00	6.00	Request clarification from RMBC with regards to whether pantograph chargers can be classed as permitted development. If they can't, and a planning application is needed, this will be incorporated as part of the pantograph charger procurement contract.	Principal Project Manager - SYMCA	2.00	1	2.00	Active	RMBC has now confirmed that a planning application is not required at Rotherham Interchange for the proposed pantograph chargers.
21	Operational	The quiet sound levels from electric buses could be a potential danger to blind and partially sighted pedestrians who are reliant on the sound produced by the buses to hear electric buses approaching.	Increased risk of accidents with blind and partialy sighted pedestrians.	Principal Project Manager - SYMCA (in liaison with H&S Officer)	3.00	5.00	15.00	AVAS recommended to be developed in conjunction with stakeholder engagement to improve the safety of vulnerable road users. The AVAS will emit vehicle warning sounds and alert vulnerable road users to the presence of the ZEBs, leading to greater pedestrian safety and awareness.	Principal Project Manager - SYMCA (in liaison with H&S Officer)	1.00	1	1.00	Active	

7.11 - Confirm the total value of risk / contingency included in the cost plan and the % of total cost.			
Total Risk	7.59% blended rate	**% of Total Cost**	7.1%

7.12 - Top 5 Risks on Risk Log

Risk *[State the risk and identify both its probability and impact on a scale of high-medium-low]*	**Mitigation** *[State how you will mitigate the risk]*	**Owner** *[State who is responsible for mitigating this risk]*
1. DNO works and connections – programme implications	See risk register in **Figure 7.4**	Project Manager
[redacted]	See risk register in **Figure 7.4**	Senior Financial Manager (SYMCA)
3. Capacity of the bus and charger manufacturers	See risk register in **Figure 7.4**	Project Manager
4. City Centre shuttle bus route still to be confirmed	See risk register in **Figure 7.4**	Project Manager / SCC Transport Planning Manager
5. DNO works and connections – budget estimate risk	See risk register in **Figure 7.4**	Project Manager

7.13 - STAKEHOLDER MANAGEMENT / COMMUNICATION
Please complete the table below detailing key stakeholders that will have known involvement and what their involvement will be.

Communication and Stakeholder Engagement Plan

- A Communication and Stakeholder Engagement Plan (CSE Plan) will be finalised and resource identified, informed by and to compliment the ZEBRA marketing strategy, to ensure that the project information from the period of FBC submission to project completion is clearly communicated and fully understood.
- The ZEBRA CSE Plan will outline the proposed communications and engagement opportunities to build and sustain the positive reputation of, and encourage advocacy for, the scheme. It will build on engagement to date with stakeholders, throughout the feasibility and EoI preparation phases of the project. It will also take note of experience gained on similar projects.
- The CSE Plan will map the project's stakeholder landscape (as detailed in **Table 7-1** below) and set out systems and processes for managing the communications approach, including responding to the public, stakeholder and media enquiries.
- The CSE Plan will identify key stakeholders, and the level of engagement required for each, as the scheme is developed. The key ZEBRA stakeholders, have been categorised according to the following interest/influence categories:

Strong Buy-In (High Interest/ High Influence): This group has both significant interest and influence and may include stakeholders whose support is critical to the project's success. It is essential that they understand the project and its objectives and have the opportunity to input to the design and decision-making process.

Need to Consult (High Interest/ Low Influence): These stakeholders may have significant interest in the outcome of the project but do not have a direct role (e.g. local interest groups). A common misconception is that engagement with these stakeholders can be managed through generic, one-way communication. Their influence could change over time, and there is benefit in

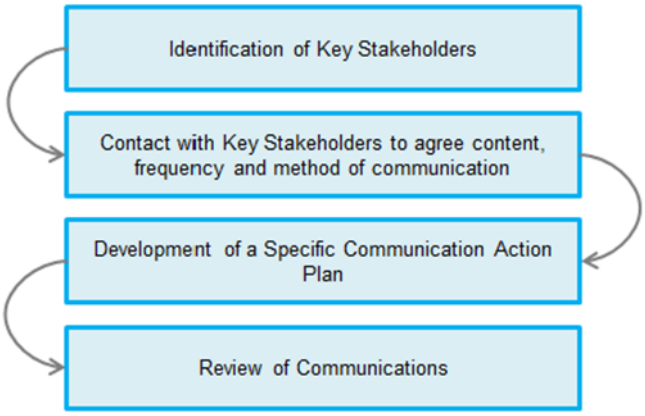
working with this group to identify any key concerns and issues and garner their support/ advocacy.

Keep Satisfied (Low Interest/ High Influence): These stakeholders may have little interest in the project but nevertheless carry influence or have access to information or data that could strengthen the project.

Keep Informed (Low Interest/ Low Influence): These stakeholders are low influence and low interest and therefore building awareness may identify opportunities to collaborate. This group, once more aware of the project and objectives, can become supporters and advocates.

- The stakeholder communications process is illustrated in **Figure 7-1** below.
- Stakeholder consultation and engagement is key to the success of the ZEBRA project because: It is a statutory requirement; It assists in attaining support for and encouraging advocacy of the scheme; and, it contributes to optimising the solutions proposed.
- The CSE Plan will detail public and stakeholder engagement required throughout scheme development and delivery, to ensure that aims and aspirations are taken into account, recorded and considered, and to manage the communication of information relating to the project. Engagement objectives will be identified within the CSE Plan, informed by and closely aligned to the ZEBRA Marketing Plan.

Figure 7-1: Stakeholder communications process



A summary of identified stakeholders, the engagement approach, and outcomes to date, and their contributing role within the delivery programme is shown in **Table 7-1**.

Table 7-1: The key ZEBRA stakeholders

Stakeholder Name	Stakeholder Group	Keep Informed	Keep Satisfied	Need to Consult	Strong buy-in	Engagement to date	Follow up actions
SYMCA	Client				✓	Engagement with key departments including: • Finance • Procurement • Comms & Marketing • Data Services • Bus Services; • Legal	Ongoing engagement through project delivery, including setting up delivery work packages for the different teams.

SYMCA Board Members, Transport & Environment Board (TEB), and the LEP	Client (Governance)				✓	Ongoing engagement including via formal Governance processes.	Ongoing engagement through project delivery.
Stagecoach	Delivery partner				✓	Ongoing engagement including: • Agreement on ZEBRA routes (221 / 22x) • Commercial model for ZEBRA. • Market engagement for buses & infrastructure • Marketing	For the ZEBRA delivery phase – inclusion of Stagecoach on a ZEBRA delivery board for the 221 / 22x elements of ZEBRA.
Sheffield City Council	Local Government				✓	• Engagement to develop the city centre shuttle bus proposals including the route for the service and the source for revenue funding.	For the ZEBRA delivery phase – inclusion of SCC on a city centre shuttle bus delivery board.
Rotherham MBC (Transport Planning/Highways & Local Planning Authority)	Local Government			✓		• Engagement with Transport Planning/Highways Officers to develop the 221 and 22x bus services. • Engagement with the local planning authority regarding the planning requirements at Rotherham Interchange. Note – a pre-app enquiry to RMBC confirmed that the proposed development is permitted development.	Ongoing engagement with RMBC to inform of project progress.
Doncaster MBC (Transport Planning/Highways)	Local Government			✓		• Engagement with Transport Planning/Highways Officers to develop the 221 and 22x bus services.	Ongoing engagement with DMBC to inform of project progress
Barnsley MBC (Transport Planning/Highways)	Local Government			✓		• Engagement with Transport Planning/Highways Officers to develop the 221 and 22x bus services.	Ongoing engagement with DMBC to inform of project progress
Councillors	Local Government		✓			ZEBRA progress updates provided in the stakeholder briefings as per the ZEBRA marketing strategy.	Engagement as per the ZEBRA marketing strategy. This will be information and promotion rather than consultation.

South Yorkshire Bus Partnership	Public-private partnership	✓				ZEBRA progress updates provided during the voluntary South Yorkshire bus partnership	Ongoing ZEBRA progress updates during the project delivery, including the new enhanced bus partnership.
Bus Passengers	Non-statutory		✓			No direct engagement taken place to date. ZEBRA progress updates provided to local media as per the ZEBRA marketing strategy.	Engagement as per the ZEBRA marketing strategy. This will be information and promotion rather than consultation.
General Public	Non-statutory	✓				No direct engagement taken place to date. ZEBRA progress updates provide to local media as per the ZEBRA marketing strategy.	Engagement as per the ZEBRA marketing strategy. This will be information and promotion rather than consultation.
DfT	Central Government				✓	Ongoing engagement via DfT's ZEBRA delivery partner (EY).	Continued engagement through the delivery phase, including the provision of monitoring data, as set out in the monitoring and evaluation plan.
Bus and Infrastructure Providers	Delivery partners				✓	Market engagement with bus and infrastructure providers during December 2021. Individual meetings / presentations were held with 12 companies in total.	Further engagement during the procurement stage of delivery, following DfT's funding announcement. Inclusion of the selected bus and infrastructure provider(s) within delivery boards for the 221/22x and city centre shuttle bus.
Other stakeholders including chambers, businesses, and interest groups	Non-statutory		✓			No direct engagement taken place to date. ZEBRA progress updates provided to local media as per the ZEBRA marketing strategy.	Engagement as per the ZEBRA marketing strategy. This will be information and promotion rather than consultation.

7.14 - MONITORING & EVALUATION
Detail in full how the scheme will be monitored, and performance managed to assess whether objectives, milestones and targets are being met.

This section of the business case sets out the Monitoring and Evaluation (M&E) plan for the South Yorkshire ZEBRA scheme.

As per DfT's ZEBRA guidance document, the SYMCA would be responsible for the scheme monitoring, but the evaluation would be undertaken by the evaluation contractor appointed by DfT (at the ZEBRA programme level). SYMCA will therefore engage with the evaluation contractor, but our focus will be on the monitoring requirements for the South Yorkshire scheme. SYMCA is prepared to share relevant monitoring data with DfT and participate in programme level evaluation activities.

The M&E plan is in line with SYMCA's Assurance Framework. The M&E Framework was a requirement of the SYMCA's devolution deal and was approved by the MHCLG (now the DfLUHC). The framework is the primary mechanism for how the Mayoral Combined Authority will assess progress towards the delivery of the South Yorkshire Devolution Deal, and delivery of the strategic vision, objectives and outputs, and outcome targets of the Strategic Economic Plan (SEP) and the Renewal Action Plan (RAP). This framework highlights the importance of measuring success, as this provides "important lessons which are used to further improve the decision-making processes" and can increase the likelihood of successfully delivering future projects. The Assurance Framework also highlights the importance of understanding the outcomes achieved by the funds available to the SYMCA.

The proposed frequency of the data monitoring will be as follows:

1. Data provided to DfT following implementation of the scheme (e.g. number of electric buses purchased, number and type of diesel buses being replaced). This data would be provided to DfT once following implementation, as this data would not change post implementation.

2. As per DfT's guidance document, most other data would be provided to DfT on a quarterly basis (collated by DfT's programme level evaluator) up to five years post implementation. This would include data that would change over time such as the average daily vehicle mileage and the average daily energy consumption.

3. Some data will be collected and issued to DfT annually (such as on board attitudinal / perception surveys).

The scheme M&E will help DfT and SYMCA determine the extent to which the project objectives have been realised, providing key lessons towards future projects, as well as support manufacturers in the development of ZEB technology, by providing monitoring data from real world situations.

The scheme-specific objectives, outcomes and outputs will form the basis of the monitoring requirements for our M&E plan. Our monitoring approach seeks to check progress against the scheme outputs and outcomes, which will mean we will be able to see whether our scheme has achieved what it intended to do, and how the success metrics change over time.

The proposed data monitoring would be as follows:

South Yorkshire ZEBRA Objective	Outputs and Outcomes	Monitoring Data	How this will be measured	Data frequency
Objective 1: To support the Government's commitment to decarbonisation	Electric vehicles purchased for the ZEBRA routes	Number of electric buses purchased	Details included in the procurement and delivery for the 221/22x and the city centre shuttle bus projects	Following Implementation
		Purchase cost per electric bus purchased	Details obtained from the bus manufacturer based on the vehicle procurement process	Following Implementation
		Purchase cost for a Euro 6 diesel equivalent bus	Details obtained from the bus manufacturer as part of the electric bus procurement process.	Following Implementation
		Average monthly operational cost (including maintenance and infrastructure) per electric bus	Costs determined through details included in the infrastructure procurement process	Following Implementation
	Electric vehicles in operation on the 221, 22x and city centre shuttle bus service	Number of electric buses in operation	Confirmation from SYMCA and Stagecoach regarding the number of electric buses in operation	Following Implementation
	Replacement of diesel buses with electric buses on the 221 and 22x	Number and type of diesel buses being replaced	Confirmation from Stagecoach regarding the number and type of buses being replaced on the 221 and 22x	Following Implementation
	New electric charge points introduced	Number and capacity of the charging facilities introduced	Details obtained from the charging supplier(s), as per the procurement specifications	Following Implementation
		Information regarding the type of charging infrastructure implemented across all parts of the project	Details obtained from the charging supplier(s), as per the procurement specifications	Following Implementation
		Information regarding whether AC or DC charging has been used	Details obtained from the charging supplier(s), as per the procurement specifications	Following Implementation
		Capital up front cost of the electric charging infrastructure	Details obtained from the charging infrastructure provider as part of the procurement process.	Following Implementation

Objective 2: To improve the local air quality in South Yorkshire and help address the climate emergency	Reduction in NOx and CO2 emissions	Average diesel mileage and fuel consumption for each route pre implementation	Information obtained through Stagecoach for the 221 and 22x	Pre-implementation
		Average daily electric bus mileage	Potentially collected automatically via telematics. Discussions to be held with bus manufacturers during the procurement process.	Quarterly up to five years post-implementation
		Average electric well-to-wheel greenhouse gas emissions	Potentially collected automatically via telematics. Discussions to be held with bus manufacturers during the procurement process.	Quarterly up to five years post-implementation
	Improved health outcomes	It isn't possible to directly measure the health improvements of the population resulting from this ZEBRA project in isolation – due to other road users causing pollution.	Improved health outcomes resulting from the ZEBRA scheme would therefore be considered through the above measures on reducing NOx emissions.	Same data as above.
Objective 3: To provide a zero-emission public transport shuttle bus service in Sheffield City Centre	New electric shuttle bus service in operation in Sheffield City Centre	Monitoring data would be the same as per Objective 1 but would be specific for the Sheffield electric shuttle bus service	As per objective 1 but would be specific for the Sheffield electric shuttle bus service.	As per objective 1 but will include the Sheffield electric shuttle bus service
		Shuttle bus route and frequency of service provided	Details provided from SYMCA	Following implementation
		Details of the tender process and confirmed operator to run the service	Details provided from SYMCA	Following implementation

Objective 4: To increase bus patronage within South Yorkshire, on the ZEBRA services.	Increased passenger journeys by bus on the ZEBRA services	Bus patronage data	Provided from SYPTE and Stagecoach *Note, for the Stagecoach patronage data, due to data sensitivities, a data sharing agreement would need to be signed between Stagecoach and DfT.*	Patronage data pre-implementation and quarterly five years post implementation
		Associated bus priority schemes	Details of any related bus priority schemes, which could have contributed to bus patronage growth, will be provided	Quarterly over five years post implementation.
		ZEBRA bus service on-board attitudinal / perception surveys	Undertaken by SYMCA	Undertaken within 12 months post scheme completion and annually thereafter up to five years
		ZEBRA service customer complaints tracking	SYMCA customer complaints data	Monthly tracking for 12 months post implementation (issued to DfT quarterly)
Objective 5: To increase the proportion of ZEBs on the South Yorkshire network	A greater proportion of ZEBs post implementation compared to pre implementation	Number of ZEBs on the South Yorkshire network	Data provided from SYMCA	Confirmation of the proportion of ZEBs on the South Yorkshire network prior to ZEBRA implementation. Then, confirmation of the updated proportion post implementation

Objective 6: To undertake scheme monitoring and lessons learnt pre and post ZEB implementation	Greater learning from the electric bus technology	Average battery state of charge before / after charging.	Potentially collected automatically via telematics. Discussions to be held with bus manufacturers during the procurement process.	Quarterly up to five years post-implementation.
		Time of day ZEB charged and electricity tariff (including electricity generation source)	Potentially collected automatically via telematics. Discussions to be held with bus manufacturers during the procurement process. Electricity tariff to be confirmed from Stagecoach and SYMCA.	Quarterly up to five years post-implementation.
		Monitoring Surveys	All the surveys specified above for objectives 1 to 5.	As per the frequencies specified above for objectives 1 to 5.
		Document any lessons learnt through project delivery	Ongoing documentation of lessons learnt during project delivery, as well as specific lessons learnt workshops to capture all lessons.	Captured through the implementation process and provided post implementation
	Greater learning from the ZEBRA marketing campaign	Marketing – record of visits to the campaign landing page.	Provided from SYMCA	Post implementation
		Marketing – sales / including the potential for any introductory offers (subject to agreement by Stagecoach on the 221/22x)	Provided from SYMCA	Post implementation
		Marketing – social media engagement	Provided from SYMCA (Travel South Yorkshire webpage, Twitter, Facebook, LinkedIn)	Post implementation

In addition to the information provided in Table above, a further point should be made on the attitudinal surveys. We have not specified that attitudinal surveys will be done pre-scheme implementation. This is because in our experience, pre-scheme attitudinal surveys can be difficult to implement due to:

- it being is a scheme that is yet to be implemented, so attracting responses can be hard to obtain.
- the survey could be too generic in which case the results could be based on views of people who might never use the scheme. For example, people are highly likely to say yes that they would support a zero-emission bus scheme in South Yorkshire. As such, in our experience, it is often difficult to make comparisons pre and post completion with attitudinal surveys.

However, if DfT feel that a pre-implementation survey is a requirement for this scheme, we could plan to do a pre-implementation attitudinal survey as part of the scheme delivery.

Resources for delivering the monitoring programme would be led by the work package lead Mark Cowling, who is the Head of Strategic Intelligence, Data and Performance at South Yorkshire Passenger Transport Executive. The resource needed to provide the monitoring data, as specified above, would be from existing resources within Mark's team, using existing team budgets.

With regards to expected milestones for providing the monitoring data, the project is currently programmed to be delivered by September 2023. This would provide the following monitoring data milestones:

- August 2023 - provision of pre-implementation data as specified above.
- December 2023* – provision of the first post-implementation monitoring data, as specified above, for the September to November 2023 period.
- Ongoing quarterly provision of monitoring data as specified above until five years post implementation.

**The first month of data collection may take longer due to practicalities with understanding the new telematics system.*

8 – EQUALITY IMPACT ASSESSMENT (EIA)

An Equality Impact Assessment (EIA) is an evidence-based approach designed to help organisations ensure that their policies, practices, events and decision-making processes are fair and do not present barriers to participation or disadvantage any protected groups from participation. This covers both strategic and operational activities.

The term 'policy', as used throughout this document, covers the range of functions, activities and decisions for which South Yorkshire Mayoral Combined Authority (SYMCA) is responsible, including for example, strategic decision-making, arranging strategy & funding panels and meetings.

The EIA will help to ensure that:

- We understand the potential effects of the policy by assessing the impacts on different protected groups, both external and internal.
- Any adverse impacts are identified, and actions are planned to remove or mitigate them as far as is practicable.
- Decisions are transparent and based on evidence with clear reasoning.

When might I need to complete an EIA?

Ideally, an EIA should form part of any new policy, event or funding activity and be factored in as early as one would for other considerations such as risk, budget or health and safety.

Section 1 – Overview

a	**Name proposal.** *If a policy, list any associated policies*	South Yorkshire Zero Emission Bus Regional Scheme (ZEBRA)
b	**Type of proposal:**	New
c	**Name of department:**	Transport
d	**Lead Officer:**	Ben Hardy
e	**Date of EIA:**	10/12/21
f	**Names of those involved in the EIA (Should include at least two other people):**	Hebe Jenner (Arup), Rowena Ekermawi (Arup), Rebecca Powell (Arup)

g. Summary of the aims and objectives of the proposal – if this is an existing policy please state the current aims and objectives.
The proposed scheme includes the first roll out of zero emission buses (ZEBs) across South Yorkshire to help to achieve the ambition of a fully zero emission bus fleet by 2035. The proposed scheme includes all four districts and crosses the two Clean Air Zones (CAZs). More specifically, the proposed scheme comprises: • Electrification of Stagecoach's route 221 (Rotherham to Doncaster). • Electrification of Stagecoach's route 22x (Rotherham to Barnsley). • Introduction of a new Sheffield City Centre electric shuttle bus service (to be tendered). • Introduction of plug-in charging infrastructure at Stagecoach's Rawmarsh bus depot and Sheffield bus interchange. • Introduction of Pantograph charging infrastructure at Rotherham Interchange.

h. What are the proposed changes *(if an existing policy/funding activity/event)?*

The proposed scheme will replace existing diesel fuelled buses with electric buses on 3 bus routes. The proposed scheme is assumed to require:

- 23no. 12m single deck for Stagecoach routes 221 and 22X (10no. to operate each route and 3no. spares).
- 4no. 9-10.5m deck buses for use of a new Sheffield City Centre Shuttle service (3no. to operate the route and 1no. spare).
- Vehicles will be dedicated to these services and will not be used on other routes.
- Charging infrastructure and supporting installation/civils contracts will also be required.
- Infrastructure requirements:
  - Depot based chargers for Stagecoach depot at Rawmarsh, Rotherham and Sheffield Interchange (city centre shuttle).
  - 2no. opportunity charger mast(s) at Rotherham Bus Interchange for 221 and 22X.
  - Power supply upgrades where required.

The new ZEBs must meet enhanced accessibility standards, going beyond that required by the Public Services Vehicle Accessibility Regulations (PSVAR). It is expected that vehicles will provide:

- Incorporation of equipment to identify the route, each upcoming stop, and the beginning and end of diversions:
  - Visibly, using at least one screen on any deck, with the lower deck screen visible from all priority seats;
  - Audibly, with announcements audible on any deck, including in the priority seats and wheelchair space; and
  - Using induction loops, in priority seats and the wheelchair space.
- Provide an induction loop to aid direct communication between drivers and passengers who use a hearing aid.
- 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.

i. Why is this being proposed (*e.g., policy, deliverables, changes to systems/processes)*?

The Government has made up to £120million available through the ZEBRA scheme to support the government's commitment to decarbonisation, deliver the roll-out of the Government's 4,000 ZEBs commitment and to support partnership working between LTAs, bus operators and other stakeholders as set out in the National Bus Strategy.
The ZEBs will provide a better quality experience for the bus user, making the air cleaner and reduce noise along the bus routes. The buses will comply with the enhanced accessibility requirements set out in Public Service Vehicles Accessibility Regulations 2000 (PSVAR).

As stated in the DfT Bus Back Better Report: "buses are vital to ensuring the economy meets Net Zero carbon emissions and driving the green transformation"[4].

[4] DfT, 2021. Bus Back Better: National Bus Strategy for England. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/980227/DfT-Bus-Back-Better-national-bus-strategy-for-England.pdf

Section 2: Impact Analysis

j. What equality information has been used in this analysis?

The baseline provides an overview of the distribution of people with protected characteristics and from low-income groups in Sheffield, Rotherham, Doncaster and Barnsley. Data has been compiled from a wide range of sources including Sheffield City Council, Office of National Statistics (ONS), Indices of Multiple Deprivation (IMD), 2011 Census and the Department for Work and Pensions statistics.

As the proposed scheme is based in the City Centre of Sheffield and also between Rotherham, Doncaster and Barnsley, the baseline considers the distribution of people and groups across each of the districts.

The following is a headline list of references that have been reviewed to inform the outcomes of this EIA:

- DfT Transport and Accessibility Statistics,
- Government Equality Office Trans People in the UK;
- Bus Back Better;
- Inclusive Transport Strategy ;
- Transport Statistics 2019;

k. How will engagement with stakeholders inform practice?

The communication and stakeholder engagement plan (refer section 7.13 of the FBC) will include involvement with local Disability User Groups, SY Community Foundation, Community First Yorkshire, Yorkshire MESMAC, Age UK Sheffield.

l. Will this proposal affect people with protected characteristics and, if so, in which group?

Characteristic	*Impact Level*	*State any evidence you have, and explain what you feel the impact may be*
Age	Positive	The age profiles of Rotherham, Doncaster, Barnsley and Sheffield follow the England average[5]. However, the population of individuals aged 20 to 24 years in Sheffield is significantly above average[6]. It is considered that this is caused by Sheffield's significant student population at its two universities.

[5] Office for National Statistics, 2021. Analysis of population estimates tool for UK. Available online at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/analysisofpopulationestimatestoolforuk

[6] Office for National Statistics, 2021. Analysis of population estimates tool for UK. Available online at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/analysisofpopulationestimatestoolforuk

		Potential positive equality effects Updating the bus fleets to ZEBs will replace the use of fossil fuels, reducing greenhouse gas emissions that contribute to climate change and improve local-air quality. The proposed scheme will have a positive impact on improving air quality providing health benefits, especially in built-up areas which are typically more polluted. It would be of importance for groups more vulnerable to the health-effects of poor air quality, such as children or older people, and those with existing health conditions. The ZEBs will be legally required to install additional measures to meet enhanced accessibility standards. It is considered that these measures will provide an easy-to-understand service that improves legibility and understanding for older people, leading to subsequent confidence when using the public transport system.
Disability	Positive	The 2011 Census reported around one fifth of each cities' population as having a long-term health condition or disability: **Sheffield**: 103,715 people (20%) in Sheffield, of which 50,470 people (9%) are limited a lot by their long-term health condition or disability. **Rotherham**: 56,588 people (22%) in Rotherham, of which 29,067 people (11%) are limited a lot by their long-term health condition or disability. **Doncaster**: 65,535 people (22%) in Doncaster, of which 33,644 people (11%) are limited a lot by their long-term health condition or disability. **Barnsley**: 55,268 (24%) people in Barnsley, of which 29,147 people (13%) are limited a lot by their long-term health condition or disability. Disabled people rely on public transport and have low levels of car ownership.[7] In 2020, disabled adults in England made 28% fewer trips than non-disabled adults. **Potential positive equality effects** The proposed minimum legal requirements for accessibility measures on ZEBs will benefit disabled people, improve passenger confidence and those

[7] DfT (2021) Transport: Disability and Accessibility Statistics, England 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1019477/transport-disability-and-accessibility-statistics-england-2020.pdf

		additional measures will ensure users feel safe and comfortable using the bus network. **Potential negative equality effects** The quiet sound levels from electric and hybrid buses could be a potential danger to blind and partially sighted pedestrians who are reliant on the sound produced by buses to hear the bus approaching.[8] Acoustic Vehicle Alert Systems (AVAS) are recommended to be developed in conjunction with stakeholder engagement to improve the safety of vulnerable road users.
Gender reassignment	None	There is limited information about what proportion of the population is transgender, but the Government Equalities Office tentatively estimates it may be around 200,000-500,000 people nationally[9]. Statistics from Sheffield City Council estimate that there could be over 3,000 trans people in Sheffield[10], around 1,300 in Rotherham[11] and 30 people in Doncaster[12]. No estimates are available for Barnsley. In 2018, 41% of trans men and women stated they had experienced a hate crime or incident because of their gender identity in the last 12 months. **Potential positive equality effects** Improved bus services would positively benefit transgender users, due to the additional enhancement measures improving feelings of safety such as through improved lighting and 'help' buttons. This will improve transgender passenger confidence and ensure users feel safe and comfortable using the bus network.
Marriage/Civil Partnership	None	There are no aspects that are expected to impact positively or negatively on marriage or civil partnership from the proposed scheme.

[8] https://equalitytogether.org.uk/disability-and-public-transport-consultation/
[9] Government Equalities Office, 2018. Trans People in the UK. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/721642/GEO-LGBT-factsheet.pdf
[10] Based on applying the national statistics rate to the population of Sheffield. See Sheffield Community Knowledge Profile: Lesbian, Gay, Bisexual and Transgender (LGBT) Community.
[11] NHS Rotherham. NHS Rotherham CCG Equality and Diversity Annual Report 2019/2020. Available online at: http://www.rotherhamccg.nhs.uk/Downloads/Equality%20Docs/Equality%20and%20Diversity%20in%20NHS%20Rotherham%20CCG%20Annual%20Report%202019%2020%20-%20Final.pdf
[12] https://www.doncasterccg.nhs.uk/wp-content/uploads/2016/08/A-picture-of-Doncaster-Census-2011.pdf

Pregnancy/Maternity	Positive	Nationally, there were around 613,936 live births in England and Wales in 2020, with approximately 5,763 in Sheffield, 2,736 in Rotherham, 3,267 in Doncaster and 2,504 in Barnsley[13]. **Potential positive equality effects** Improvements to air quality will have a positive impact on pregnant and post-partum women, and the children. Provision of a new city centre shuttle service will have a positive impact by connecting pregnant and post-partum women, and the children to required services, and providing additional flexible space for pushchairs in order to meet the enhanced accessibility standards.
Race	None	The majority of people in Sheffield, Rotherham, Doncaster and Barnsley are from a white (English, Welsh, Scottish, Northern Irish, British) ethnicity. Rotherham, Doncaster and Barnsley are higher than the national average for the white ethnic groups, whereas Sheffield is similar to the national average.[14]In addition, the population of individuals in Sheffield from a Pakistani ethnicity is above average. In contrast, the population of individuals in Rotherham, Doncaster and Barnsley are lower than the national average for other ethnicities than White. BAME groups have higher rates of bus and coach travel than any other group[15], although also reporting to experience low confidence and concerns over safety. **Potential positive equality effects** The ZEBs will be legally required to install additional measures to meet enhanced accessibility standards. It is considered that these measures will provide an easy-to-understand service that improves legibility and understanding for people who do not speak English as a first language, leading to subsequent confidence when using the public transport system. Improved bus services would positively benefit BAME users that are particularly reliant on public transport, due to the additional enhancement measures improving

[13]ONS Live births in England and Wales: birth rates down to local authority areas. https://www.nomisweb.co.uk/query/construct/submit.asp?forward=yes&menuopt=201&subcomp=

[14] ONS (2011). 2011 Census QS201EW - Ethnic group. Available at: https://www.nomisweb.co.uk/census/2011/qs201ew

[15] National Travel Survey 2017

		feelings of safety such as through improved lighting and 'help' buttons. This will improve BAME passenger confidence and ensure users feel safe and comfortable using the bus network.
Religion/Belief	None	The majority of people in Sheffield, Rotherham, Doncaster and Barnsley are predominantly Christian or have no religion. Sheffield also has a larger population of persons from Muslim backgrounds compared to the national average. **Potential positive equality effects** There are no aspects that are expected to impact positively or negatively on people with religion or belief from the proposed scheme.
Sex	None	There were estimated 589,214 people in Sheffield in 2020, of which 49.8% were male and 50.2% female. In Rotherham, there were an estimated 264,984 people in 2020 (50.8% male and 49.2% female). In Doncaster, there were an estimated 312,785 people in 2020, of which 50.3% were male and 49.7% female. In Barnsley, there were estimated 248,071 people in 2020, of which 50.7% were male and 49.3% were female. [16] Women are more likely to be a non-driver in households with a car (14% compared to 9% of men) and in general are less likely to hold a driving licence than men, with this disparity increasing with age[17]. Nationally, women also make more trips than men, but generally travel shorter distances. Nationally in 2011[18], lone parents were predominately women (90%), of which 42% were not in employment and therefore face a higher risk of relative poverty. Women are also statistically more likely to be carers (57.7% compared to 42.3% of men). 12.1% of women in England were providing unpaid care whilst working full time.

[16] Office for National Statistics, 2021. Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2020. Available online at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2020#age-structure-of-the-uk-population
[17] National Travel Survey (2020). NTS0206. Available at: https://www.gov.uk/government/statistics/national-travel-survey-2020
[18] Nomis, 2011. KS107UK – Lone parent households with dependent children. Available at: https://www.nomisweb.co.uk/census/2011/KS107UK/view/2092957697?cols=measures

		Potential positive equality effects Improved bus services would positively benefit female users that are reliant on public transport, due to the additional enhancement measures improving feelings of safety such as through improved lighting and 'help' buttons and improved accessibility. This will improve female passenger confidence and ensure users feel safe and comfortable using the bus network.
Sexual Orientation	None	The Annual Population Survey 2019 found that 2.7% of the UK population age 16 years and over (1.4 million people) identified themselves as lesbian, gay or bisexual[19]. A statistically significant increase of 2.2% from 2018. 2.7% of the population of Yorkshire and Humber are therefore estimated to identify as gay, lesbian, bisexual or other. **Potential positive equality effects** There are no aspects that are expected to impact positively or negatively on sexual orientation from the proposed scheme.

m. How will any adverse impact(s) be mitigated?

The updates to the bus fleets to ZEBs will have a positive health impact to older people, young people, children, pregnant and post-partum women, and those with existing health conditions by improving the air quality. Additionally, the installation of enhanced accessibility measures will improve passenger experience and confidence for people with disabilities and older people.

It is recommended that AVAS be developed in conjunction with stakeholder engagement to improve the safety of vulnerable road users by generating a sound for the quiet ZEBs.

No further impacts are considered as relevant in relation to the different protected groups.

n. What are the arrangements for monitoring and reviewing the actual impact of the proposal?

A monitoring and evaluation plan will be provided as part of the ZEBRA Full Business Case application (refer section 7.14 of the FBC).

19 https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/sexuality/bulletins/sexualidentityuk/2019

This should include consideration of how protected characteristic groups are involved in monitoring and evaluation which would include, e.g.

- Embedding evaluation in programme management
- Evaluation of current information systems such as Complaints recording
- Continuous evaluation and engagement with stakeholders (including protected characteristic groups such as the Disability User Group)
- Passenger satisfaction surveys
- Usage statistics per route by user group
- Concessionary travel data.

Section 3 – EIA Action Plan

Identified Impact in section 2	Mitigating Action(s) identified	Anticipated outcome	Lead Officer	Resource(s) Required	Target Date
The quiet sound levels from electric and hybrid buses could be a potential danger to blind and partially sighted pedestrians who are reliant on the sound produced by the buses to hear electric buses approaching.	AVAS recommended to be developed in conjunction with stakeholder engagement to improve the safety of vulnerable road users.	The AVAS will emit vehicle warning sounds and alert vulnerable road users to the presence of the ZEBs, leading to greater pedestrian safety and awareness.	Ben Hardy	AVAS	During bus specification phase

Full Business Case

Zero Emission Bus Regional Areas (ZEBRA)

Document Sign Off

9 – SYMCA DECLARATION AND SIGN OFF	
Person responsible for the application (Chief Executive or relevant Executive Director in your organisation)	
Name:	 Dave Smith
Role:	Chief Executive, SYMCA
Date:	31 January 2022

ARUP

South Yorkshire ZEBRA Scheme

Route Analysis

November 2021

DRAFT

ARUP

Introduction

Introduction

The Scheme

South Yorkshire Mayoral Combined Authority (SYMCA) are developing proposals to introduce electric buses onto three routes in South Yorkshire through the Department for Transport's Zero Emission Bus Regional Area (ZEBRA) scheme, as follows:

- 221 Stagecoach service between Rotherham and Doncaster
- 22x Stagecoach service between Rotherham and Barnsley
- A new city centre shuttle service in Sheffield

This slide deck summarises the route analysis that has been undertaken to establish the vehicle and charging requirements of operating these routes as electric services.

An early market engagement exercise is planned for December 2021 to confirm the analysis in this slide deck.

Introduction

Assumed Requirements

- 23 x12m single deck buses for Stagecoach routes 221 and 22X (PVR of 10 for each route plus 3 spares)
- 4 shorter (nominal 9-10.5m length) single deck buses for use of a new Sheffield City Centre Shuttle service (PVR of 3 plus 1 spare)
- Vehicles will be dedicated to these services and will not be used on other routes
- Charging infrastructure and supporting installation/civils contracts/power upgrades will also be required
- Infrastructure requirements:
  - Depot based chargers for Stagecoach depot at Rawmarsh, Rotherham (221 and 22x) and Sheffield Interchange (city centre shuttle)
  - 2 opportunity charger mast(s) at Rotherham Bus Interchange for 221 and 22X
- A 20% battery safety buffer is required (vehicles return to the depot with at least 20% battery charge remaining) – the route analysis presented in this briefing pack includes this buffer

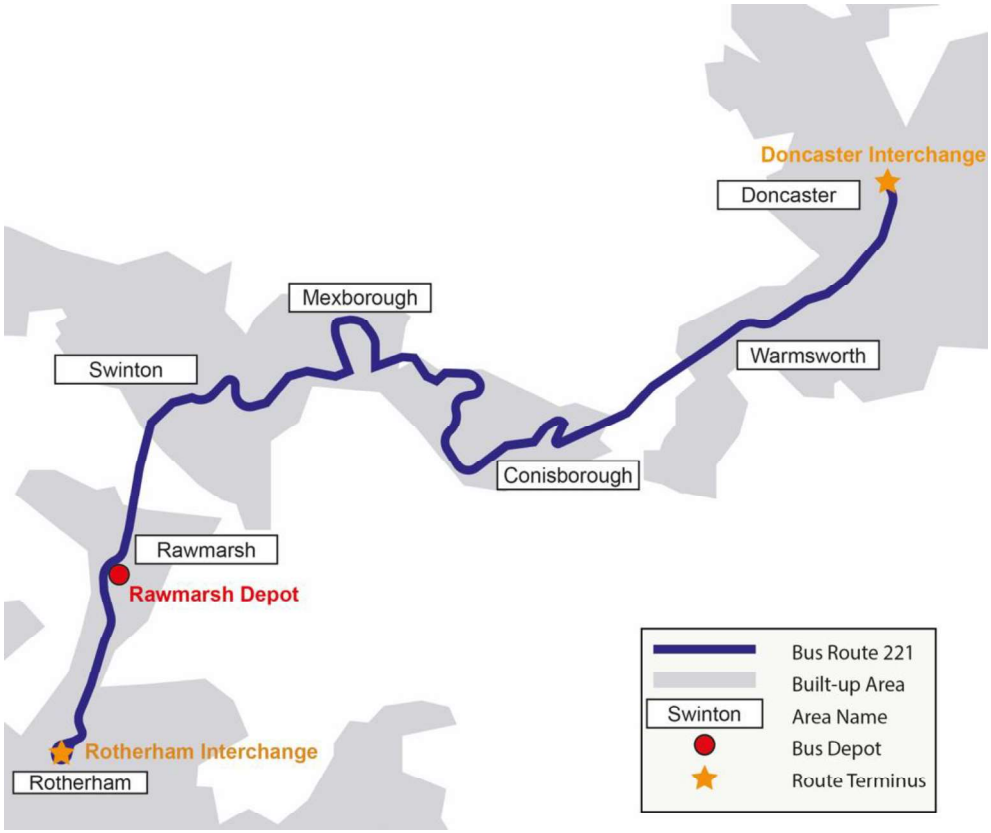
ARUP

Route 221

Route Summary 221

Overview

- A map of the route is provided to the right.
- The buses start and end their day at the Stagecoach Rawmarsh depot.
- The services operate between Rotherham Interchange and Doncaster Interchange
- Opportunity chargers would be located at Rotherham Interchange
- Buses have max. 7-8 minute turnaround at Rotherham, which would be the maximum time for opportunity charging
- The buses operate at 20 minute frequency during peak hours
- Link to the service information: 221 Bus Route & Timetable: Doncaster Interchange - Rotherham Interchange | Stagecoach (stagecoachbus.com)



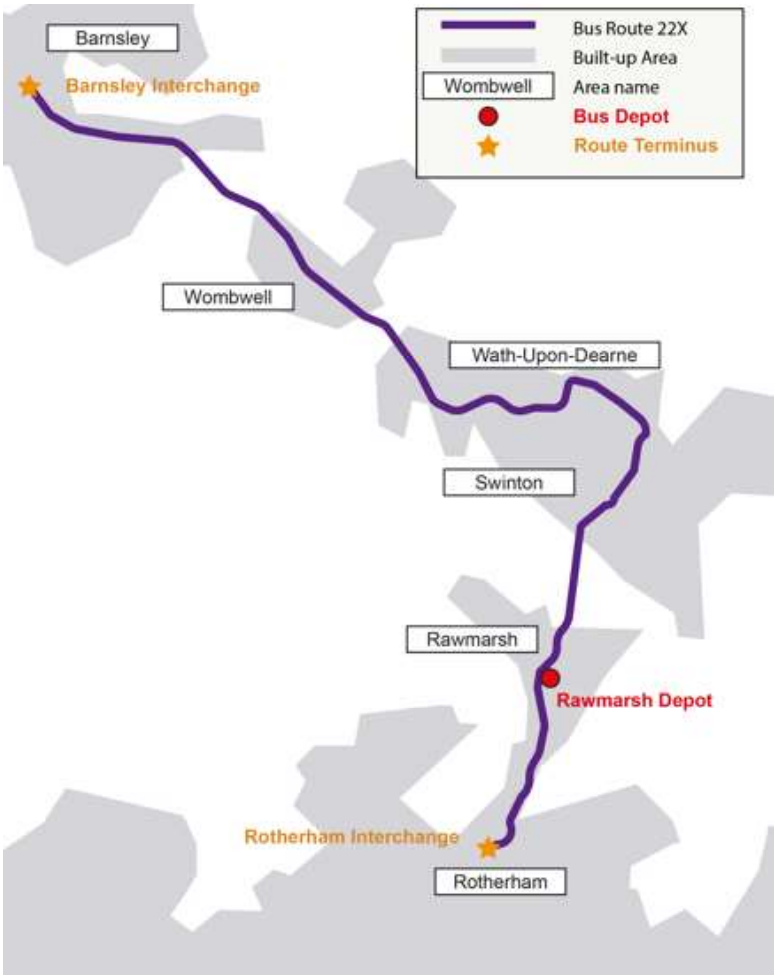
ARUP

Route 22x

Route Summary 22X

Overview

- A map of the route is provided to the right.
- The buses start and end their day at the Stagecoach Rawmarsh depot.
- The services operate between Rotherham Interchange and Barnsley Interchange
- Opportunity chargers (if required) would be located at Rotherham Interchange
- The buses operate at 15 minute frequency during peak hours
- Buses have max. 7-8 minute turnaround at Rotherham, which would be the maximum time for opportunity charging
- Link to the service information: 22X Bus Route & Timetable: Rotherham - Barnsley | Stagecoach (stagecoachbus.com)



Appendix B

SYTPE ZEBRA Bus Project – Overview of Bus Specification for routes 221, 22X and the Sheffield City Centre Shuttle (CCS)

A. General Vehicle Requirements

Overview of Vehicle Requirement
Buses must be of single deck design, low floor and meet the requirements of the Public Service Vehicle Accessibility Regulations 2000 (PSVAR). All buses must conform to all relevant current legislation and take account of any known forthcoming legislative changes and the additional ZEBRA accessibility requirements. The bus should be designed for an operational life of 17 years.

Overview of Operational Requirements
The 12m buses will operate on routes 221 and 22x which are high frequency bus services currently using diesel single deck buses by Stagecoach. The CCS buses will operate on a new service around Sheffield City Centre. The proposed vehicles must be capable of operating in adverse traffic conditions during typical UK weather conditions and the operating range forecast should take account of variations in ancillary electrical loads over an annual period, such as heating, ventilation and lighting. Buses should be capable of operating for typical operating day of 18 hours a day, 7 days a week, 364 days a year.

B. Bodywork Specification

Vehicle Dimensions
Buses for routes 221 and 22x will be approximately 12m in length. Buses for the CCS service should be between 9m and 10.5m in length.
Passenger Capacity
Buses for routes 221 and 22x must have a passenger capacity of approximately 80 with 42 seated and 38 standees. Buses for the CCS service must have an overall capacity of around 60.

Entrance, Exit and Emergency Exit Requirements

A single front entrance and exit door to provide an individual clear width of 1035mm minimum (1100mm for single door vehicles excluding door mounted handrails) and utilise an equal width two door leaf closure.

Doors should be electrically operated and have sensitive edge fitted.

Door or door partition handrails positioned to assist boarding and alighting must be fitted at the entrance.

Seating

Buses to be fitted with high quality individual seat e-leather or equivalent.

Forward facing seats are the preferred layout, except where the chassis design over wheel boxes necessitates inward or rearward facing.

A minimum of 4 priority seats which at least meet the legal space requirement in the low floor area for disabled passengers and must be clearly identified with signage.

A further 2 preferential passenger seats of similar space requirement to the priority seats, in the low floor area, for passengers who are less able to stand or travel with small children.

Priority or preferential seating on the low floor area shall have under seat space maximised as much as possible to free the under-seat space for use by guide/assistance dogs.

Tip Up Seats not allowed.

Accessibility Including Wheelchair Access and Wheelchair Bay Requirements

Manual book leaf wheelchair ramp with driver deployment handle.

On deployment of the ramp the bus must be prevented from any movement via an interlock. The interlock should be released only once the ramp is fully and securely stowed.

Wheelchair Bay position to have a minimum dimension of 1,500mm with wheelchair backrest and floor to ceiling stanchion with ramp request button. 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 should also be provided. If the second bay is designated as second wheelchair bay it must have all the necessary equipment (back-rest, restraint, bell push etc) to allow the bus to be homologated as a second wheelchair bay.

Layouts with a longer wheelchair bay(s) which do not reduce the overall seating capacity are encouraged.

Tip-up seats are not allowed in these areas.

The floor of the wheelchair bay(s) must be clearly marked with the wheelchair logo.

An induction loop system linked to the passenger information system and for driver/passenger communication with T band electronic hearing devices covering the cab and entrance area, wheelchair bay and priority seats. A driver's cab microphone to allow drivers to communicate with passenger using T band equipment must also be provided.

Handrails & Petitions/Barriers

30mm smooth tube, nylon coated crackle finish. Polished aluminium fittings. Sufficient handrails to achieve safe movement through vehicle whilst in motion although the provision of seat back handles are encouraged to reduce the number of vertical handrails where possible.

Hand poles should be colour contrasting. The preferred colour will be determined post contract award.

Barriers must be positioned in front of all forward-facing passenger seats, except for the centre seat on rear five ways or where passenger seats face each other.

Rear 5 seats - where next row of seats are rear facing - additional vertical stanchion & arm rest to centre seat.

Saloon Lighting

All saloon lighting to be LED which can be controlled and dimmable by the driver. The light towards the front of the lower passenger saloon should be blue to avoid driver glare at night.

Passenger Information Systems

Buses to be fitted with audio and visual passenger information system with one enhanced TFT passenger information scree. Routes 221 and 22x will require the provision Hanover equipment as this is compatible with the current systems used by Stagecoach.

Suppliers can offer other options for the CCS service which might offer better value for money, enhanced features etc will also be considered.

TFT screens should be at least 18.5" in size although larger screens subject to space are encouraged.

In addition to the TFT flat screen monitor a single line display to be located front facing at the back end of the nearside wheelchair bay which can be viewed from the wheelchair bay.

The system should be capable of displaying the following features:

- Audio/Visual Next Stop info combining previous stop, next stop and stop after that (next stop only on single line additional display)

- Destination information adjacent to next stops (TFT screens only but including audio announcements) which can suggest "alight here for" large employers or major destinations of interest
- Scrolling 24-hour news and weather feed (TFT screens only)
- Rail or Metro Real Time Info on the approach to a bus stop that is located with a rail or metro station (TFT screens only) and this should show service info such as operator, end destination, platform number and number of mins to departure/timetable time/delayed etc

Buses to be fitted with wireless seat back phone chargers with phone holder/carrier also incorporating a USB socket.

Buses for routes 221 and 22x should be prepared to allow the fitment of Wi-Fi supplied by Icomera
https://www.icomera.com/

Wi-fi supplier for CCS to be agreed with successful bus operator

Passenger bell system – BMAC wireless system as standard - Additional 'repeater' light to be position in top shelf of driver's cab.

Seatback bell pushes required where no vertical hand poles are provided.

Heating & Ventilation

Tenderers are required to provide details on how their proposed heating & ventilation system will operate including details of system capacity and its operating parameters in terms of performance in various external weather conditions. Tenderers to provide details of proposed temperature settings which strike a balance between passenger comfort and energy consumption.

Where the saloon heating temperature control is automated an override facility must be provided on the driver's dashboard. This to allow the driver to temporarily increase or decrease the set temperatures at which the heating switches on or off. The increase/decrease to be equivalent to 2 degrees centigrade, the system will reset with the ignition.

CCTV

Wiring for CCTV cameras and recorder (located in dry, secure and accessible position) to be provided. Exact position to be agreed post contract award.

System to be cloud based and accessible for a minimum of 30 days.

Internal cameras should be fitted to ensure clean lines of sight to pick up all areas of the bus including driver’s cab. In reference to the drivers cab there should be a camera above the driver to observe transactions with passengers, and one that clearly identifies boarders.

Images should be played on a loop system (via the TFT screens – section B10) so passengers can see CCTV in operation on both decks of the bus.

Audio recording should also be provided in the cab area but must be capable of being deactivated by vehicle technician.

Exterior Lighting, Destination Equipment & Other External Features

All rear lights to be LED and dipped headlamps to be LED.

Side markers or other lighting to clearly indicate the side of the bus are required.

Buses for routes 221 and 22x to be fitted with Hanover LED blinds. Front and Rear to display route number and destination and nearside to display route number only.

Destination display specification as follows:

Quantity	Description	Product Code
1	Front LED Destination displays in the colour white	DD006W-144X19
1	Side LED Destination display in the colour white	DD010W-96X8
1	Rear full LED Destination display in the colour white	DD008W-128X17
1	Drivers Console	DG3-0100

Destination equipment requirements for the CCS service will be determined following agreement with the operator once known.

Reverse Alarm linked to rear facing CCTV camera system.

Operator Specific Requirements

Ticket machine mounting facilities/power supply to be confirmed.

Tyres – supplier to be confirmed.

CCTV recorder and system – supplier to be confirmed.

Minimum Warranty Requirements & Extended Warranty Options

All warranties will commence upon entry into service of the individual vehicle.

The route analysis provides details of expected annual mileages.

Body & Chassis Warranty – 5 years

Structural, Chassis and Body Warranty – 12 years

External Paint Warranty – 5 years

Anti-Corrosion Warranty – 12 years

Chassis/Powertrain warranty (all major components including all driveline and powered system components including batteries and hybrid components – 5 years.

Energy Storage System (batteries) – 7 years

SOUTH YORKSHIRE
SYMCA
MAYORAL
COMBINED
AUTHORITY

Matthew Bentley
Green Bus Policy Lead, Buses, Light Rail and Taxis
Department for Transport
3rd Floor, Great Minster House,
33 Horseferry Rd
London
SW1P 4DR

South Yorkshire
Mayoral Combined Authority
11 Broad Street West
Sheffield, S1 2BQ

Tuesday, 25 January 2022

Dear Matthew

FULL BUSINESS CASE: DFT'S ZERO EMISSION BUS REGIONAL AREA SCHEME ("ZEBRA")

I am writing on behalf of the South Yorkshire Mayoral Combined Authority to express our keen interest in securing capital funding for Zero Emission Buses as part of the Department for Transport's ZEBRA scheme.

Our attached Full Business Case for the region is focused on securing the first zero-emission buses for South Yorkshire as a key stepping-stone towards our regional Transport Strategy goal of a zero-carbon public transport network by 2040.

We would be delighted to commence rollout of zero-emission buses, working in concert with our bus operators, across our four districts, which include two Clean Air Zones, and to do so in partnership with DfT.

These first zero-emission buses would perfectly complement our tram system, which is already zero-emission, as well as making a significant contribution towards South Yorkshire's aim of an integrated transport system that is fully zero-carbon.

We look forward to hearing the outcome of our Full Busines Case in March 2022 and continuing to work both with the Department for Transport and our bus operators to make South Yorkshire a great place to work, live, visit and invest in.

With very best wishes

Dan

Dan Jarvis MBE MP
Mayor, Sheffield City Region Mayoral Combined Authority
South Yorkshire
Mayoral Combined Authority

1 January 2022

Pat Beijer
Business Development Director
SYMCA
11 Broad Street West
Sheffield S1 2BQ

Dear Pat

SUPPORT FOR SYMCA'S FULL BUSINESS CASE FOR DFT'S ZERO EMISSION BUS REGIONAL AREA SCHEME ('ZEBRA')

This letter is to express our support for submission of South Yorkshire Mayoral Combined Authority's Full Business Case for the Department of Transport's ZEBRA scheme.

Sustainable public transport is critical to the future of our planet: decarbonising local journeys, reducing road congestion, improving air quality and tackling climate change. Last August, we published our sustainability strategy, which set out our vision to deliver a greener, smarter, safer, healthier and fairer future for the country. A key element in that strategy was a commitment to continue to invest in cleaner, zero-emission vehicles as we work towards a fully zero-emission UK bus fleet by 2035.

Stagecoach confirms its support of the outline assumptions in the commercial section of the Business Case submitted for ZEBRA, as described in Appendix A to this letter of support, and, subject to further assessment of the overall affordability of these investments, will continue to work with SYMCA to develop an agreement on participation.

We are looking forward to our continued work on the ZEBRA scheme in liaison with the Department for Transport and key stakeholders.

Yours sincerely

Martin Griffiths
Chief Executive
Stagecoach Group Plc

APPENDIX A

ZEBRA: OUTLINE ASSUMPTIONS CONTAINED WITHIN

COMMERCIAL SECTION OF THE FULL BUSINESS CASE

1) The 221 and 22x electric single decker buses (23 in total) will be owned and maintained by Stagecoach.

2) Bus battery replacement will be the responsibility of Stagecoach.

3) The depot infrastructure in Stagecoach's Rawmarsh depot will be owned and maintained by Stagecoach.

4) The 221 and 22x electric buses to remain on these specific routes for a minimum of 5 years and operating on a daily basis on routes within South Yorkshire for a minimum of 10 years, and a straight line repayment of 10% of grant for each year less than 10 years.

5) Stagecoach will pay the diesel equivalent cost of the electric buses, with the remaining bus costs funded by DfT and SYMCA through the ZEBRA scheme.

6) Stagecoach will pay the 25% of charging infrastructure and associated civils costs at Rawmarsh depot with the remaining costs funded by DfT through the ZEBRA scheme.

7) The existing Euro 6 vehicles on the 22x will be cascaded to other Stagecoach services within South Yorkshire.

8) Pantograph charging infrastructure to be provided at Rotherham Interchange by SYMCA, through the ZEBRA scheme - which will be used by Stagecoach's 221 and 22x to top up charge the buses during the day. The electricity used from Rotherham Interchange would be paid by Stagecoach – charging mechanism to be agreed.

BARNSLEY
Metropolitan Borough Council

Place Directorate
Regeneration & Culture

My Ref:
Your Ref:
Date: 24 January 2022
Enquiries to: Kathy McArdle
E-Mail: [redacted]

Pat Beijer
Business Development Director
SYMCA
11 Broad Street West
Sheffield S1 2BQ

Dear Pat

SUPPORT FOR SYMCA'S FULL BUSINESS CASE FOR DFT'S ZERO EMISSION BUS REGIONAL AREA SCHEME ('ZEBRA')

This letter is to express our support for submission of South Yorkshire Mayoral Combined Authority's Full Business Case for the DfT's ZEBRA scheme.

The use of Zero Emission buses will deliver one our key objectives within the Transport Strategy: Objective 4 – To reduce and mitigate the impact of transport based emissions and noise in Barnsley. Reductions in exposure to pollutants would result in significant health benefits for Barnsley residents.

We are looking forward to our continued work on the ZEBRA scheme in liaison with the Department for Transport and key stakeholders.

Yours sincerely

Kathy McArdle
Service Director Regen and Culture

Doncaster Council

Tel: [redacted]

Pat Beijer
Business Development Director
SYMCA
11 Broad Street West
Sheffield S1 2BQ

E-mail: [redacted]

Date: 20th January 2022

Dear Pat

SUPPORT FOR SYMCA'S FULL BUSINESS CASE FOR DFT'S ZERO EMISSION BUS REGIONAL AREA SCHEME ('ZEBRA')

This letter is to express our support for submission of South Yorkshire Mayoral Combined Authority's Full Business Case for the Department of Transport's ZEBRA scheme.

In Doncaster, we are committed to working towards a cleaner, greener public transport network, and a successful bid for the Zebra would be an initial start to this.

We are looking forward to our continued work on the ZEBRA scheme in liaison with the Department for Transport and key stakeholders.

Kind regards.

Yours sincerely

Ros Jones

Ros Jones
Mayor of Doncaster

Regeneration & Environment
Riverside House
Main Street
Rotherham
S60 1AE
E-mail:
Email the Council for free @ your local library!

Our Ref: 01/22

Please Contact: Andrew Moss

Telephone Number:

17th January 2022

Pat Beijer
Business Development Director
SYMCA
11 Broad Street West
Sheffield S1 2BQ

Dear Pat

SUPPORT FOR SYMCA'S FULL BUSINESS CASE FOR DFT'S ZERO EMISSION BUS REGIONAL AREA SCHEME ('ZEBRA')

This letter is to express our support for submission of South Yorkshire Mayoral Combined Authority's Full Business Case for the Department of Transport's ZEBRA scheme.

The Council wholeheartedly supports the submission of the ZEBRA full business case, which will (if successful) be a landmark in the transformation of public transport in Rotherham. The opportunity to operate modern electric buses on two major routes linking the town with other neighbouring centres will improve the image of public transport and serve to reduce pollution on a busy corridor through an Air Quality Management Area. Linking with the tram-train it will provide for zero carbon journeys to and through Rotherham. Over many years the borough has struggled to attract investment in new buses with most vehicles cascaded from other areas. New electric buses will act as a catalyst for further investment and development in support of the levelling up agenda.

We are looking forward to our continued work on the ZEBRA scheme in liaison with the Department for Transport and key stakeholders.

Yours sincerely

Andrew Moss
Interim Head of Transport Infrastructure

Telephone: [redacted]
Email: [redacted]
Date: k 19/01/2021

Co-operative Executive Member for Climate, Environment & Transport
Councillor for City Ward

Town Hall, Sheffield, S1 2HH

Pat Beijer
Business Development Director
SYMCA
11 Broad Street West
Sheffield S1 2BQ

Dear Pat

SUPPORT FOR SYMCA'S FULL BUSINESS CASE FOR DFT'S ZERO EMISSION BUS REGIONAL AREA SCHEME ('ZEBRA')

This letter is to express our support for submission of South Yorkshire Mayoral Combined Authority's Full Business Case, for the Department of Transport's ZEBRA scheme.

Sheffield City Council is already taking significant action on air quality and is progressing towards the implementation of a Category C charging Clean Air Zone (CAZ) later in 2022. Commencing the transition towards zero emission buses not only supports further improvements to air quality but is an essential part of delivering our ambition to become Net Zero by 2030.

Transport is the greatest contributor of greenhouse gas emissions within the city, and we are delivering significant changes to the infrastructure across the city to accelerate a shift to public transport and active travel through our Connecting Sheffield programme. We are also turning our city streets from Grey to Green; have delivered public and taxi EV charging infrastructure; and have launched an EV van trial scheme, with our EV taxi trial scheme launch planned for early 2022. However, we need to ensure that buses in Sheffield also move to zero emission and decarbonise as quickly as possible. Funding from ZEBRA is key to kick starting this ambition in Sheffield and South Yorkshire.

ZEBRA funding will support the delivery of an electric city centre shuttle bus which will enhance connectivity across, and accessibility within, the city centre without contributing towards the emissions that our Clean Air Zone aims to improve, and our Net Zero ambitions aim to remove. This will complement our Connecting Sheffield proposals to deliver truly transformational changes in Sheffield City Centre.

We are looking forward to our continued work on the ZEBRA scheme in liaison with the Department for Transport and key stakeholders.

Yours sincerely

Councillor Douglas Johnson

Co-operative Executive Member for Climate Change, Environment & Transport
Councillor for City Ward