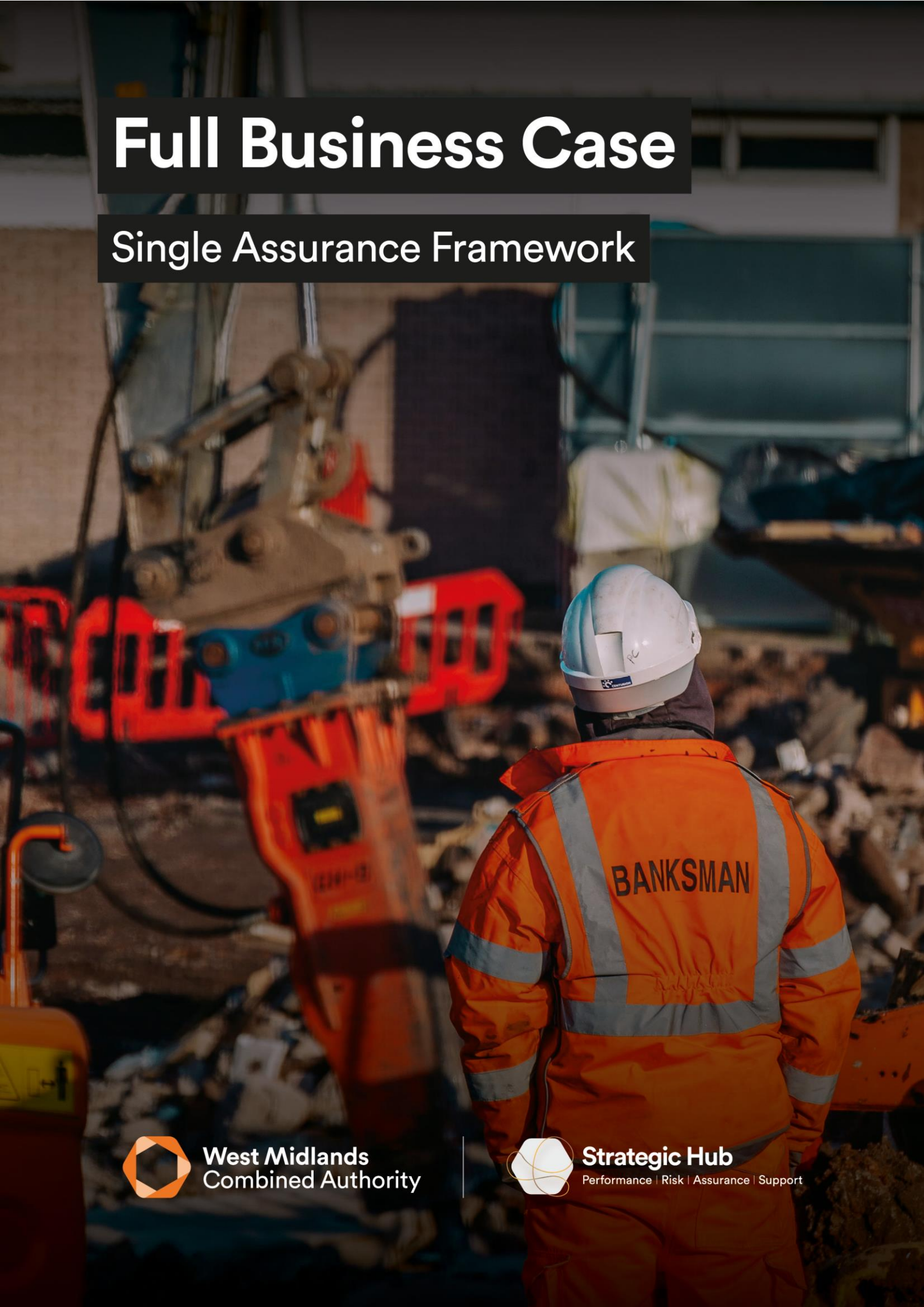
Full Business Case

Single Assurance Framework



West Midlands Combined Authority

Strategic Hub
Performance | Risk | Assurance | Support

FULL BUSINESS CASE

ZEBRA 2021/22 – WMCA

Version	1-Standard	**Date**	11/02/2022
Prepared By		**Job Title**	

Lead WMCA Directorate	TfWM Integrated Transport Services
Lead WMCA Executive Director	

Has BCAT been submitted to Strategic Hub?	**Yes**	
Has this FBC been approved by Lead WMCA Executive Director?	**Yes**	

Approved By	
Signature	
Date	11/02/2022

Please refer to the Strategic Hub FBC Guidance Document and HM Treasury Green Book / Blue Book for assistance when completing this template

Strategic Hub
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FULL BUSINESS CASE

Single Assurance Framework

APPLICANT DETAILS			
Project Name:	ZEBRA 2021/22 – WMCA rev1 (Standard)	WMCA Project Code:	n/a
Lead Organisation:	TfWM - Integrated Transport Services		
Lead Contact:		Job Title:	Director - Integrated Transport Services
Phone Number:	-	Email:	
Address:	16 Summer Lane, Birmingham		
Local Authority Area (lead organisation)	n/a	Local Authority:	Birmingham; Sandwell; Solihull; Walsall; Dudley, Wolverhampton
Other Organisations involved in project bid:	Bus Operators: West Midlands Travel. Central Government: Department for Transport		

FACTUAL SUMMARY					
	OBC (£M)	FBC (£M)		OBC (£M)	FBC (£M)
Total Project Costs	n/a	86.74	Operational Costs		0.6
WMCA Funding	n/a	0.6	Revenue		0.0
Funds Secured (in principle)	n/a	56.36	Financial Benefit	n/a	30.383
Funds Not Secured	n/a	30.383	Monetarized Benefit	n/a	51.0
Unit Cost		0.7	NPV		18.5
BCR (Overlay)	n/a	1.57	ROI		57%

To support better spending, investment decisions and better procurement, this Full Business Case has been written using FBC guidance from the WMCA Strategic Hub. In addition, it is a requirement that all bids for public funds submitted to WMCA are guided and based around the HM Treasury's Green Book 2020.

1A – Executive Summary

1 EXECUTIVE SUMMARY

Strategic Case

Under its net zero strategy, the UK Government sets out policies and proposals for decarbonising all sectors of the UK economy to meet its net zero target by 2050. The West Midlands aims to lead the green revolution and become a net zero carbon economy nearly a decade earlier in 2041. It can make progress on that journey through the Zero Emission Bus Regional Areas (ZEBRA) Scheme, designed to help local transport authorities outside London introduce zero-emission buses and the infrastructure to support them. The scheme will also contribute to DfT's three strategic priorities: Grow and Level Up the Economy; Reduce Environmental Impacts and Improve Transport for the User.

The Business Case sets out the proposal for DfT to invest £30.4 million under the ZEBRA scheme to secure the building and deployment of 100 hydrogen-powered double decker buses in the West Midlands, as well as 24 articulated hydrogen buses for the Sprint Bus Rapid Transit corridor, and hydrogen refuelling system (HRS) infrastructure, which also would be able to provide the fuel for new hydrogen-powered taxis, HGVs and long-distance coaches as demand grows. All the buses will be powered by green hydrogen.

If implemented, this proposal would lead to the largest-ever order for hydrogen buses in Europe as well as creating the world's largest hydrogen BRT system. The new buses will abate more-than 12,000 tonnes of CO2-equivalent emissions every year and reduce noise and particulate pollution. Through more reliable and cleaner offerings, they will accelerate the transition away from private vehicle use, boosting public confidence in decarbonisation technologies and the concept of hydrogen as a safe, credible fuel.

The proposal is in line with the UK Hydrogen Strategy, which targets 1 gigawatt (GW) of low carbon hydrogen production capacity by 2025 and 5GW by 2030. To ensure progress toward this goal, DfT would benefit from a small number of anchor projects of sufficient size, which would establish proof of concept and lay the groundwork for additional investment and scaling. In the longer term, it is likely that hydrogen clusters will emerge around larger-scale centres of demand, as envisaged by the Hydrogen Council.[1] The hydrogen bus services will be centred in the Midlands emerging cluster, creating an innovation nexus, which draws in investment and talent to the region. This includes the Energy Research Accelerator, supported by Innovate UK and the private sector, which draws on Midlands-based universities to create the first embedded cross-disciplinary energy research hub in the UK, which has committed to working with TfWM and partners to accelerate the development of hydrogen buses.

On an economic front, by 2030, hydrogen-powered fuel cell electric vehicles (FCEVs) will be the most cost-efficient way to reduce emissions for long distant buses and coaches, as well as HGVs, regional trains and taxi fleets[2]. Operating 124 hydrogen buses will employ 250 drivers, 22 engineers and 40 apprenticeships in a sustainable and high-value industry, with a net additional GVA per year of £23.4m. Producing and supplying hydrogen to the HRS infrastructure could lead to 100 temporary and 10-20 permanent jobs in the direct supply chain, with a further £13.7m GVA. TfWM expect this will be

[1] Hydrogen Insights 2021. Hydrogen Council
[2] Hydrogen Insights 2021. Hydrogen Council

significantly more once the full impact on the supply chain and additional R&D is determined, and if the project is expanded to 224 hydrogen buses as proposed in the original bid.

Economic Case

The DfT's Greener Bus Model used for the economic benefit calculations gives a helpful view of the benefits accruing to the West Midlands Hydrogen Bus programme that emerge from savings to greenhouse gas emissions. Using the parameters in this model shows a benefit cost ratio (BCR) of , which is considered value for money (VfM) under Department for Transport VfM categories. However, this model does not allow the inclusion of other Green Book compliant direct and monetisable benefits that the investment would expect to deliver. For this submission, we have created a BCR 'overlay' that captures several of these additional monetisable benefits and delivers a BCR of VfM.

Scenario	Description	BCR	VfM category	NPV (£ millions)	Benefits (£ millions)	Costs (£ millions)
Base BCR	Greenhouse gas impacts only					
Overlay BCR	**Base + direct transport and non-transport job impacts of those involved in operation, maintenance and supplying energy.**					

The overlay BCR includes all the costs and benefits from the base model, but adds several quantifiable benefits considerations, calculated in line with Green Book business case requirements. The additional benefit categories included are:

- **Direct transport job impacts** – This includes upskilling for 250 bus drivers who will transition from diesel engine buses to hydrogen buses; creating an additional 22 engineering jobs to service the hydrogen engines; and creating 40 two-year apprenticeships to train and develop.

- **Direct non-transport impacts** – Jobs will be created to produce and transport hydrogen to HRS infrastructure. Although not included in this case, we expect there will be further investment from other elements of the overall supply chain

The BCR of the new overlay demonstrates [redacted] value for money, and we believe that this BCR could be categorised into a [redacted] VfM category were we to include all the additional benefits not monetised by the model in this assessment. This BCR, for example, excludes the long-term impacts of R&D in hydrogen transport, which could improve performance and reduce price for future users, and the social benefits from improved reliability of the bus service for people that may rely on public transport. Additional wider benefits from improvements to coach services, are also not included in this valuation. These wider benefits are further assessed, qualitatively, in Appendix 003C 3D.

Financial Case

The DFT grant covers up to 75% of the additional costs of zero emissions vehicles over the costs of diesel vehicles, and up to 75% of the costs of upgrading associated infrastructure for those

vehicles, with operators providing the rest of the funding. The Grant Funding request per bus is £245,026 or £2,856 per passenger**.**

Element	Total	Grant Funding	Local Contribution	Local Funder
Total	£86,743,000	**£30,383,250**	£56,359,750	**-**
[redacted]				

Commercial Case

[redacted]WMCA will conduct a competitive regulated grant application process to allocate the Grant Funding to commercial bus operator/s, who will the use the Grant Funding towards acquiring and owning hydrogen buses and associated infrastructure (in line with the grant funding requirements detailed above and outputs of the business case).

WMCA have concluded that Regulation 13 of the Public Contract Regulations 2015 is not relevant for the FBC.

Management Case

The project management team and governance structure has been established, with agreed Terms of Reference (ToR) and has been operational to develop this FBC. This will continue through the life of the project, being adjusted to best support the project as it develops. This will be reviewed and confirmed for the start of the project delivery stage, subject to award of funding. It is anticipated that a new Project Manager and Technical Hydrogen Specialist will be appointed in TfWM, with the core project team members from TfWM/WMCA Senior Responsible Officer (Pete Bond), Sponsor (Steve Hayes), and Finance and Legal remaining in place throughout project delivery. This will ensure that there is consistency in delivery approach and knowledge retention, whilst strengthening the project management and technical delivery resource for TfWM and operator/s (subject to a competitive grant application process). All team members will work closely with the Department for Transport and other Government Departments as necessary. The project management approach follows successful delivery arrangements of comparable projects, such as Coventry All-Electric Bus City (£140m) and Dudley Interchange (£24m).

Equality Impact Assessment (EqIA)

A thorough EqIA has been conducted that highlights positive impacts for people from protected characteristics (Appendix 008). This was informed through engagement with people from protected characteristics. It is noted, there is a concern around the quiet noise zero emission vehicles can pose as a safety risk for passengers from some equality groups, namely passengers with hearing impairments. As they are quieter than traditional buses, it can be difficult for these individuals to be aware of when a bus is within close proximity. As a mitigation, Acoustic Vehicle Alerting Systems (AVAS) will be installed on all zero emission vehicles to ensure people are aware of an approaching vehicle.

Conclusion

In conclusion, through the funding provided by ZEBRA, the West Midlands can create a world-class public transport offering, which will foster innovation, attract investment, and put the UK on a more secure path to net zero emissions. The transition will bring significant environmental, social and economic benefits to the region. More broadly, as the UK aims to Build Back Better after the pandemic, it presents a significant opportunity to make real progress on the government's economic and social agenda.

1B - Project Progress - If applicable, bullet point what has been achieved since previous business case stage below:

- Revised the project outputs from 234 zero emission buses (200 hydrogen double deck, 24 hydrogen articulated buses and 10 single deck electric) to 124 zero emission buses.
- The expected project outputs for the number of zero emission buses has been confirmed as 124 buses (100 hydrogen double deck; 24 articulated hydrogen).
- Confirmed infrastructure needs for project delivery – [redacted].
- Updated the Strategic Case to be clear on the case for change and how the project delivers key regional and national policies, including but not limited to #WM2041; National Bus Strategy for England, UK Hydrogen Strategy and Levelling Up.
- Management Case developed with appropriate governance and management framework and risk management.
- Economic Case developed using DfT Greener Buses Model. Updated the hydrogen double deck bus cost [redacted].
- Confirmed the proposed Commercial delivery approach.
- Financial Case developed to identify and secure WMCA contribution, in principle private bus operator contributions and grant funding request to Government for £30.383m.
- Confirmed that Regulation 13 of the Public Contracts Regulations 2015 is not relevant for the FBC.

1C – Changes – The table below highlights any key changes and the rationale behind the changes.

Change	What has changed since previous business case stage i.e. OBC?	Outline the rationale for this change
[redacted]		

2 STRATEGIC CASE

2A – Strategic Case Summary

The objectives of the ZEBRA scheme are fivefold: support the government's commitment to decarbonisation and reduce the transport sector's contribution to CO2 emissions; to support the roll-out of 4,000 zero emission buses; to support manufacturers in the development of new technologies; to foster partnerships between Local Transport Authorities, bus operators, and other local stakeholders; and to better understand the challenges of introducing zero emission buses and supporting infrastructure.

These objectives are to be achieved in conjunction with DfT's strategic priorities to Grow and Level Up the Economy; Reduce Environmental Impacts and Improve Transport for the User. Wider government objectives[3] of increasing UK's R&D base and attracting investment and talent into high value sectors of the economy should also be achieved wherever possible.

Submission of this business case has been endorsed by the West Midlands Combined Authority Board (Appendix 19), consisting of the West Midlands Mayor and the seven constituent District Authority Leaders (Birmingham, Coventry, Dudley, Sandwell, Solihull, Walsall and Wolverhampton), recognising the strong alignment with the Combined Authority's strategic objectives, as set out in section 2C.

2Ai. The case for hydrogen

By 2030, FCEVs will be the most cost-efficient way to reduce emissions for long distant buses and coaches, HGVs, regional trains, and taxi fleets. They will also be competitive for short-distance urban buses.[4] Unlike electric vehicles, FCEVs do not need to be attached to charging stations overnight and have higher range, creating more flexibility in how services are operated.

The UK Hydrogen Strategy sets out an approach to developing a thriving low-carbon hydrogen sector. It targets 1 gigawatt (GW) of low carbon hydrogen production capacity by 2025 and 5GW by 2030. This will ensure the UK maintains parity with the roll out of hydrogen technologies across Europe.[5] There is a benefit to developing multiple technologies at this stage in the low carbon journey, as evidenced by DfT's commitment to trial both battery electric and hydrogen long-haul HGVs. Hydrogen has been identified as the preferred fuel source for buses on the routes highlighted in this case. These are longer, typically higher speed routes which exceed the range of electric battery operation and the cost of taking vehicles out of service to charge would incur disproportional operational costs. An options appraisal has been undertaken and is presented in Appendix 010a-d.

To drive the hydrogen opportunity, DfT would benefit from a small number of anchor projects of sufficient size, which would establish proof of concept and lay the groundwork for additional investment and scaling. In the longer term, it is likely that hydrogen clusters will emerge around larger-scale centres of demand, as envisaged by the Hydrogen Council. This will attract hydrogen producers and provide a range of end users with access to low-cost hydrogen.[6] [redacted] The viability of a longer-term proposal for an East Midlands Hydrogen Pipeline, as referenced in the Midlands Engine Hydrogen Technology Strategy, is also dependent on the level of hydrogen demand across the region, which this project would help support.

[3] UK Research and Development Roadmap, 2021. UK's Innovation Strategy 2021
[4] Hydrogen Insights 2021. Hydrogen Council.
[5] UK Hydrogen Strategy BEIS 2021
[6] Hydrogen Insights 2021. Hydrogen Council.

2Aii: The case for WMCA hydrogen buses and infrastructure project

The case presented in this bid asks the DfT to invest £30.4 million under the ZEBRA scheme to secure the building and deployment of:

- **100 hydrogen-powered double decker buses**, Each bus will have enhanced accessibility standards and will hold 80 customers, 63 seated and 17 standing or 60 seated, 17 standing and one wheelchair. The maximum range will be around 400km. Further specification details in appendix 002J.
- **24 articulated hydrogen buses**, to operate on the Sprint Bus Rapid Transit System (BRT) - for further details see appendix 10d. These are likely to hold 44 seated, 66 standing, with the potential for 44 seated, 63 standing and one wheelchair. The range will be between 300 and 350km per day. There are currently no similar vehicles operating in the mainland UK, so the final specification will be subject to agreement with the chosen supplier but will include enhanced accessibility standards.
- **One hydrogen refuelling systems (HRS) infrastructure,** supplied by green hydrogen from electrolysis, able to provide the fuel for new hydrogen-powered taxis, HGVs and long-distance coaches.

The proposed project would represent Europe's largest order of hydrogen buses, and once completed would comprise the world's largest hydrogen BRT system.

Hydrogen buses will run in the entire area of the West Midlands Combined Authority excluding Coventry because it is home to UK's first all-electric bus city, funded through the Government's all-electric bus town competition.

[redacted]

Scale of impact

Allocation of funding to this bid will have a significant economic and social impact in the West Midlands, and the UK more broadly. It will directly support the UK Transport Decarbonisation Plan and Regional #WM2041 Action Plan[7] to tackle climate change. We estimate it would cut emissions of CO2-equivalents by more than 12,000 tonnes every year. That's the same as around 24,000 individual passenger flights from Paris to New York, or around 70 million miles driven in a diesel-powered car.

From an economic perspective, the funding would complement existing capital flows in the Midlands hydrogen sector, which include funding for Tyseley Energy Park[8], HydroFlex hydrogen train[9], HyDEX research programme, H2GVMids hydrogen HGV programme[10], longer-term ambition for an East Midlands Hydrogen Pipeline (feasibility stage)[11] and HyDeploy blending pilot.[12] As these projects, and this bid for hydrogen buses, reach critical mass, they will create an innovation nexus, drawing further investment and talent into the region. Appendices 016, 017 and 018 demonstrate support for this bid from the main academic and business partnerships driving the above programmes, with the scale of this bid creating a significant enough level of anchor demand to sufficiently stimulate investment from the commercial sector and provide confidence to invest.

[7] www.wmca.org.uk/media/3638/wm2041-one-pager.pdf
[8] www.tyseleyenergy.co.uk
[9] www.birmingham.ac.uk/research/spotlights/rail-decarbonisation.aspx
[10] www.era.ac.uk/H2GVMids
[11] Midlands Engine Hydrogen Technology Strategy 2021
[12] https://hydeploy.co.uk/

The bid will align with TfWMs contribution to the Midlands Engine, a local partnership spanning the largest regional economy in the UK outside London. The Engine acts as a positive force for economic, social and environmental change, driving prosperity for communities and businesses. It is a key agent in supporting the government's levelling up agenda. Midlands Engine is working towards a net zero future for the UK, based on the Midlands Engine Hydrogen Technologies Strategy ten-point plan for green growth[13]. On hydrogen, it has set out a range of policies, including to create 167,000 new or safeguarded jobs, to contribute £10 billion of gross value added (GVA), and to reduce CO2e emissions by 17 million tonnes by 2041.

The hydrogen infrastructure planned for the West Midlands will not only support new bus networks but will also provide the fuel for new hydrogen-powered taxis, HGVs and long-distance coaches, in which hydrogen is predicted to be the most efficient net zero fuel by 2030.[14] Already, some of the UK's most important businesses are on board.

[redacted]

This project also offers a significant opportunity to build national and international capabilities for hydrogen. As Europe's largest pilot project of hydrogen buses, lessons learnt about the operation, costs and opportunities will be systematically gathered and shared with national and international stakeholders. TfWM will work with the Black Country Innovative Manufacturing Organisation to run supplier briefing days, showcasing the development of hydrogen transport technologies, in partnership with market leaders [redacted]. TfWM will develop a comprehensive Monitoring and Evaluation Plan to ensure consistent review and improvement, with open communication amongst partners and wider stakeholder groups.

As the world's largest hydrogen Bus Rapid Transit (BRT) network, this proposal will support the case for operating zero emissions BRT services, in line with the National Bus Strategy (NBS). BRT is a forerunner for Light Rail and can deliver a similar experience to trams for a much lower cost. The NBS notes that BRT could be a game-changer for bus networks, with an ambition to see development of proposals for up to five BRT systems in England's towns and cities. In order to support this, articulated, tram style buses need to be introduced to make good use of the revised infrastructure and enable the full benefits of reduced vehicle dwell time at bus stops to be achieved (Appendix 10d).

Finally, with Birmingham set to host the first net-zero Commonwealth Games in 2022, there is an opportunity for the region to highlight the ZEBRA scheme and the positive benefits of hydrogen for business and consumers. This will create enthusiasm for the project, foster broader awareness of the opportunities presented by the government's net-zero strategy and build on the successful recent deployment of the initial 20 hydrogen buses operating in Birmingham, funded through the EU's JIVE programme[15].

Alignment with DfT strategic priorities

DfT investment in the West Midlands transition will enable the department to make significant progress on its strategic priorities to grow and level up the economy, reduce environmental impacts and improve transportation for users.

<u>Grow and level up the economy</u>

[13] Midlands Engine Hydrogen Technology Strategy 2021
[14] Hydrogen Insights 2021. Hydrogen Council.
[15] www.fuelcellbuses.eu/projects/jive

On the economy, a hydrogen-focused company operating 124 hydrogen buses will employ 250 drivers, 22 engineers and 40 apprenticeships in a sustainable and high-value industry. The net additional GVA per year from upskilling and job creation is around a £1.4m present value benefit, which results in £23.4m calculated over the 17-year lifetime of hydrogen buses. Jobs in the supply chain to supply green hydrogen and manufacture hydrogen buses will also be created[16].

[redacted]

[17]. This adds a present value benefit of £13.7m net additional GVA calculated over 17-year lifetime of hydrogen buses. Regardless of the feasibility of this as a short-term solution, there is an absolute commitment to utilise green Hydrogen to fuel the vehicles, the generation and transportation of which will create additional jobs of similar magnitude. OBJ Further detail on jobs and assumptions are included in the Economic Case.

There will also be further economic impact, on both jobs and Gross Output, which we have not quantified in the Economic Case, but would likely drive the BCR to above 2. We touch on these below but see Appendix 003C 3D for more detail.

An exciting additional impact of the proposed roll out of hydrogen buses in the West Midlands is the potential for a ramp up of R&D in related and tangential businesses. TfWM have already committed to collaborate with the Energy Researcher Accelerator (see appendix 018), which draws on the expertise and world-class facilities of the Midlands Innovation group of universities. Among its initiatives is the HyDEX project, which is designed to support and foster the creation of a new hydrogen industrial economy in the Midlands. The ERA will work with TfWM and partners to accelerate the development of hydrogen buses, transition toward a greener economy, train and re-skill workers, and partner with government and other local authorities to support the growth of the market for low-carbon hydrogen solutions.

Looking ahead, we believe there is significant opportunity to scale technologies and skill sets. This will enable UK-based manufacturers to build world-class offerings in zero emissions transport, supported by a local skills base.

Dependent on the result of a competitive bid, [redacted] will offer a hydrogen certification module at Birmingham South and City college, while [redacted] will provide tours and education resources at its production facilities.

There will also be positive cross-border business benefits. As the UK builds out its green hydrogen infrastructure, it will achieve critical mass that will enable it create value in international markets, helping improve the economy's competitiveness in line with the government's objectives.[18]

<u>Reduce environmental impacts</u>

The positive environmental impacts of the new buses will be substantial. Aside from the more-than 12,000 tonnes of CO2-equivalent emissions abatement, there will reductions in noise and particulate pollution, as well as emissions declines associated with the increased attractiveness of public transport. Along the bus routes, NOx will decline by 5.03 tonnes per year and PM2.5 by 0.13 tonnes per year.

Of course, if more hydrogen buses are added, the positive emissions impacts will rise commensurately. If the fleet were expanded to the desired 224 hydrogen buses, as set out in the original TfWM plan, we would anticipate an additional 10,000 tonnes reduction in annual CO2e emissions.

[16] OECD Input-Output multipliers for Transport and Storage, based on creation of 22 engineer jobs, 40 apprenticeships and protection of 250 upskilled bus driver jobs.
[17] Appendix 015
[18] Build Back Better 2021. HM Treasury

These combined efforts will have a positive impact on demand. When [redacted] buses, it saw 4 percent year-on-year growth in passenger numbers, which it attributed to increased comfort and reliability, as well as higher levels of appetite for green alternatives. Similarly, a YouGov survey in 2018 indicated passengers are 7 percent more likely to use a Sprint articulated bus than a diesel double decker.

To ensure the program has the maximum impact, TfWM and the operator will undertake an outreach initiative, aimed at creating excitement around the technology and broadening understanding of how hydrogen-powered mobility will change lives for the better. We expect to work with schools and social organisations to build confidence and knowledge.

Improve transport for the user

Among the biggest beneficiaries of a hydrogen-powered transport system will be the consumers. Over 50 percent of the current West Midlands bus fleet is more than 10 years old, of which 124 would be replaced with higher standard hydrogen buses. Along with the complementary investment described in section 2C, the new buses would enable improved local services, including increased reliability, particularly at peak hours, and shorter dwell times at stops (reduced to 1 minute for the 24 articulated buses).

In line with the Bus Back Better[19] ambition, the West Midlands plan envisages streamlined operations between TfWM, operators and other stakeholders, that will reduce frictions in the service for passengers. All 124 hydrogen buses will be equipped with state-of-the-art accessibility enablers, as well as WIFI and audio-visual functionality. Acoustic Vehicle Alerting systems will ensure people on paths and walkways, as well as cyclists, are aware of approaching vehicles.

[19] National Bus Strategy for England 2021.DfT

2B Project Objectives

Objectives	Critical Success Factors	How Success is Measured	Alignment with WMCA Strategic Objectives	Alignments with DfT Priorities / *ZEBRA Objectives*	Indicative Key Milestones
1.Replace 100 double decker diesel buses with 100 hydrogen alternatives by Spring 2024	100 hydrogen double deck buses operating local bus services	Number of fully operational hydrogen double decker buses operating Number of diesel double decker buses replaced	A healthier West Midlands A greener West Midlands	Reduce Environmental Impacts *All 5 ZEBRA Objectives*	June 2023: HRS construction begins August 2023: First hydrogen buses operational Mar 2024: All hydrogen buses operational
2. Introduce 24 articulated hydrogen buses for Sprint Rapid Transit Route by Spring 2024	24 articulated zero emission buses in operation	Number of articulated hydrogen buses operational on the Sprint Rapid Transit route	A healthier West Midlands A greener West Midlands	Reduce Environmental Impacts *All 5 ZEBRA Objectives*	December 2023: First articulated buses operational Mar 2024: All articulated buses operational
3. Reduce bus emissions and improve air quality	CO2 emissions reduced by >12,000 tonnes per year Improved air roadside air quality along routes: reduction in NOx of 5.03 tonnes per year, reduction in PM2.5 of 0.13 tonnes per year	CO2e emissions of zero emission bus service mileage and operation against 2020 baseline Air quality index improvement against 2020 baseline; measurements taken by air quality sensors in key network locations	A healthier West Midlands A greener West Midlands	Reduce Environmental Impacts *To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO2 emissions*	August 2023: First impact on bus emissions Mar 2024: Annual reduction in bus CO2 emissions of >12,000 tonnes, annual NOx reduction of 5.03 tonnes, annual reduction PM2.5 of 0.13
4. Direct job creation and upskilling: protect 250 bus driver and 22 new engineer jobs, and create 40 apprenticeships	250 drivers equipped with knowledge to drive hydrogen buses 22 new upskilled engineers, able to share knowledge	Number of protected and new jobs and apprenticeships directly operating or maintaining the service, or providing HR support to those who do	A more prosperous West Midlands	Grow and Level Up the Economy	Sept 2023: First investment in apprenticeships June 2023: First hydrogen bus drivers and engineers employed

	40 apprentices trained in hydrogen vehicle maintenance and repair				Mar 2024: All jobs and apprenticeships in place
5. Indirect economic growth: attract additional investment in the West Midland's hydrogen economy and wider UK hydrogen market	Increased investment in the local and national hydrogen economy, including green hydrogen suppliers, hydrogen vehicle manufacturers, hydrogen transport operators reliant on fueling system .	Proportion of GBP invested by the public and private sector in the hydrogen supply chain in the west midlands vs the 100m+ target Number and size of projects supported by hydrogen fueling infrastructure	A more prosperous West Midlands A better-connected West Midlands	Grow and Level Up the Economy *To support bus manufacturers in the development of zero emission bus technology* *To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO2 emissions*	June 2022: Establish hydrogen production [timeline dependent on competitive process] June 2022: Hydrogen buses ordered from manufacturer Mar 2024: Hydrogen production facility at full capacity. All buses manufactured
6. Indirect jobs: Create new jobs in the West Midland's hydrogen economy	> 200 long-term sustainable jobs created in local based hydrogen projects	Number of long-term and permanent jobs created in west-midlands based hydrogen projects	A more prosperous West Midlands	Grow and Level Up the Economy	June 2022: Establish hydrogen production [timeline dependent on competitive process] June 2022 Hydrogen buses ordered from manufacturer Mar 2024: Hydrogen production facility at full capacity. All buses manufactured
7. Increased investment in hydrogen-related R&D in the West Midlands and wider UK	Increased investment in research and development of hydrogen opportunities e.g., Energy Research	Quantum of GBP invested in hydrogen R&D university programmes and private R&D	A Greener West Midlands A more prosperous West Midlands	Grow and Level Up the Economy Reduce Environmental Impacts	June 2022: Establish hydrogen production [timeline dependent on

	Accelerator Network HyDEX project			*To support the government's commitment to decarbonisation and to reduce the transport sector's contribution to CO2 emissions*	competitive process]
8. Develop and improve system-wide understanding of introducing hydrogen buses and infrastructure, including: - understand driver and maintenance staff challenges and improve satisfaction -support manufacturers to develop hydrogen bus and apply lessons learnt - improve understanding of operating costs of hydrogen buses and supporting infrastructure versus diesel and other low-carbon alternatives	Bi-monthly 'lessons learnt' sessions with operator throughout process, to collectively improve service, lower operating costs and drive satisfaction Increased operator understanding of running zero emission buses at scale Increased operator satisfaction with running zero emission bus fleet Increased manufacturer capabilities to build hydrogen buses	Comprehensive Monitoring and Evaluation Plan, supported by industry partners and stakeholders Comparison of operator satisfaction with hydrogen buses to a bench-mark diesel fleet satisfaction, baselined in 2020, Number of upskilled manufacturing jobs supported to produce hydrogen buses Operating costs for operating hydrogen bus fleet compared to diesel equivalents; data to be collected and shared by operator.	A greener West Midlands A better-connected West Midlands A fairer West Midlands	Improve Transport for the User *To support bus manufacturers in the development of zero emission bus technology* *To support partnership working between LTAs, bus operators and other local stakeholders as set out in the National Bus Strategy* *To understand better the challenges of introducing zero emission buses and supporting infrastructure to inform future government support for ZEBs*	Sep 2022: Comprehensive Monitoring and Evaluation Plan drafted and agreed June 2022: Hydrogen buses ordered from manufacturer March 2024: First lessons learnt session and operating cost assessment (ongoing)
9. Educate and excite the local community around climate change and the role of hydrogen in decarbonisation	Increased local awareness of climate change and the possibilities of hydrogen	Number of students educated through new hydrogen module within apprenticeship course at the local Birmingham South and City College Number of local community visits	A greener West Midlands A more prosperous West Midlands	Reduce Environmental Impacts	Sep 2022: Hydrogen module introduced August 2023: Tours of green hydrogen facility begin Sept 2023: School

		to new green hydrogen production facility Results of school satisfaction survey with operator hydrogen bus outreach programmes			outreach programmes begin.
10. Increase bus patronage on local services	Passenger growth on services Modal shift along the routes	Operator data on number of passengers each year on hydrogen service, compared to 2022 baseline Increased modal share by bus, collected through regular TfWM modal share monitoring	A greener West Midlands A more prosperous West Midlands A fairer West Midlands	Grow and Level Up the Economy Reduce Environmental Impacts *To support partnership working between LTAs, bus operators and other local stakeholders as set out in the National Bus Strategy*	August 2023: First hydrogen buses operational Mar 2024: All hydrogen buses operational Mar 2025: Full year on year comparison possible
11. Increase passenger satisfaction on local services	Improved customer satisfaction	Annual customer satisfaction survey, compared to 2022 baseline of 85%	A happier West-Midlands A greener West Midlands A more prosperous West Midlands A better-connected West Midlands A fairer West Midlands	Improve Transport for the User	August 2023: First hydrogen buses operational Mar 2024: All hydrogen buses operational Mar 2025: Full year on year comparison possible
12. Improve bus accessibility for people from protected characteristics	Improved satisfaction of people from protected characteristics Higher bus patronage of people from	Annual customer satisfaction survey from people with protected characteristic, compared to 2022 baseline	A better-connected West Midlands A fairer West Midlands	Improve Transport for the User	August 2023: First hydrogen buses operational Mar 2024: All hydrogen buses operational

	protected characteristics	Number of passengers of people from protected characteristics compared to 2022 baseline.			Mar 2025: Full year on year comparison possible

2C. Alignment with other strategic national and regional priorities and programmes

The objectives and outcomes of this bid are in line with national and local strategies beyond WMCA strategic objectives, DfT strategic priorities and ZEBRA objectives. These include goals to increase hydrogen investment, R&D, regional rejuvenation, and bus patronage. This is presented in matrix and tabular form below as well as in Appendix 002Ci.

The proposal is aligned with DfT, West Midlands and wider government strategic objectives

Objectives	DFT priorities: 1 Grow and level up the economy	DFT priorities: 2 Reduce environmental impacts	DFT priorities: 3 Improve transport for user	ZEBRA objectives: To support A Gov. commitment to decarb.	ZEBRA objectives: To support B Roll out of 4000 ZEBs	ZEBRA objectives: To support C Bus manufacturers to develop ZEB tech	ZEBRA objectives: To support D System partner-ship, in line with NBS	ZEBRA objectives: To under-stand E Challenges of ZEBs and infra-structure	WMCA strategic objectives: I Healthier WM	WMCA strategic objectives: II Happier WM	WMCA strategic objectives: III Greener WM	WMCA strategic objectives: IV Prosperous WM	WMCA strategic objectives: V Better connected WM	WMCA strategic objectives: VI Fairer WM
1. Replace 100 double decker diesel buses with 100 hydrogen alternatives by Spring 2024		✓		✓	✓	✓	✓	✓	✓		✓			
2. Operationalize 24 articulated hydrogen buses for Sprint Rapid Transit Route by Spring 2024		✓		✓	✓	✓	✓	✓	✓		✓			
3. Reduce bus emissions and improve air quality		✓		✓					✓		✓			
4. Direct job creation and upskilling: protect 250 bus driver and 22 engineer jobs, and create 40 apprenticeships	✓											✓		
5. Indirect economic growth: attract additional investment in the West Midland's hydrogen economy and wider UK hydrogen market	✓	✓		✓								✓	✓	
6. Indirect jobs: Create new jobs in the West Midland's hydrogen economy	✓					✓						✓		
7. Increased investment in hydrogen-related R&D in the West Midlands and wider UK	✓	✓	✓	✓				✓			✓	✓		
8. Develop and improve system-wide understanding of introducing hydrogen buses and infrastructure, including[1]:		✓	✓			✓	✓	✓			✓		✓	✓
9. Educate and excite the local community around climate change and the role of hydrogen in decarbonization		✓									✓	✓		
10. Increase bus patronage on local services	✓		✓	✓							✓	✓		✓
11. Increase passenger satisfaction on local services			✓							✓	✓	✓	✓	✓
12. Improve bus accessibility for people from protected characteristics			✓										✓	✓

Other strategies and objectives

- UK Hydrogen Strategy, 2021
- UK Transport Decarbonisation plan, 2021
- UK Innovation strategy, 2021
- UK Research and Development Roadmap, 2021
- National Bus Strategy for England, 2021
- Ten point plan for a Green industrial revolution, 2020 Midlands Engine Hydrogen Strategy, 2021
- West Midlands Ultra Low Emission Vehicle Strategy
- WMCA#2041
- West Midlands Enhanced Partnership, 2021
- West Midlands Vision for Bus 2019 (to be replaced by West Midlands Bus Service Improvement Plan 2021)
- West Midlands Low Emission Bus Delivery Plan 2016,
- Repowering the Black Country, 2020 Birmingham Clean Air Zone 2021,
- West Midlands Local Transport Plan Movement for Growth (refresh underway)
- Birmingham Transport Plan 2021

National Strategies	Regional Strategies
• UK Hydrogen Strategy, 2021 • UK Transport Decarbonisation plan, 2021 • UK Innovation strategy, 2021 • UK Research and Development Roadmap, 2021 • National Bus Strategy for England, 2021 • Ten-point plan for a Green industrial revolution, 2020	• Midlands Engine Hydrogen Strategy, 2021 • West Midlands Ultra Low Emission Vehicle Strategy, 2020 • WMCA#2041 • West Midlands Enhanced Partnership, 2021 • West Midlands Vision for Bus 2019 (to be replaced by West Midlands Bus Service Improvement Plan 2021) • West Midlands Low Emission Bus Delivery Plan 2016, sets our high ambition scenario for the future uptake of zero emission buses. • Repowering the Black Country, 2020 - one of seven industrial cluster decarbonisation projects funded by BEIS and UKRI. • Birmingham Clean Air Zone 2021, the UK's first category D CAZ, to reduce levels of NO2 to a maximum of 40µg/m3 as soon as possible. • West Midlands Local Transport Plan Movement for Growth (refresh underway) • Birmingham Transport Plan 2021

Additionally, our existing West Midlands Bus Alliance commitments will complement the delivery of 124 hydrogen buses and supporting infrastructure by improving passenger experience, reducing delays, and building the Bus Rapid Transit system required to support 24 articulated hydrogen buses.

There is over £200m of complementary Bus Alliance investments in the region, including:

- Sprint bus rapid transit (BRT) system (£88m) – bus priority infrastructure and stops currently under construction supported by one of the first Enhanced Partnerships. The 24 articulated hydrogen buses in this bid will operate on this BRT.
- Further Sprint BRT bus priority measures (£59m) – continued expansion of the rapid transit network, funding provisionally allocated through the City Regional Sustainable Transport Settlement, enabling operation of zero emission articulated buses
- Account-based ticketing (£20m) – to enable fully integrated multi-modal, multi-operator contactless ticketing
- Dudley Interchange (£24m) – redevelopment and regeneration of Dudley Bus Station
- Birmingham City Council 20 Hydrogen Double Decker Buses (£10m) – delivered through EU JIVE programme, fueled at Tyseley Energy Park, now operational.
- Wolverhampton Interchange (£175m) – new hub for rail, metro and bus with mixed-use commercial development and regeneration in Wolverhampton city centre

The plans and commitment of the WMCA and award-winning West Midlands Bus Alliance, published in the West Midlands Bus Service Improvement Plan 2021, demonstrate we and our local operators are deeply committed to tackling bus emissions and improving passenger experience. We will continue to collaborate with all local stakeholders, upskilling one another, to meet this challenge.

Strategic Case supporting appendices:

2D	CASE FOR CHANGE
2E	DEFINING THE PLACE
2F	BENEFITS REALISATION PLAN
2G	RISK MANAGEMENT STRATEGY
2H	COMMUNICATIONS STRATEGY
2I	COVID-19 RECOVERY
2J	VEHICLE SPECIFICATION

3 ECONOMIC CASE

3A – Economic Case Summary

3Ai. Monetised benefits

The DfT's Greener Bus Model used for the economic benefit calculations gives a helpful view of the benefits accruing to the West Midlands Hydrogen Bus project that emerge from savings to greenhouse gas emissions. The core input assumptions on the number of buses and costs are shown below.

Number of vehicles for the Full Business Case (February 2022)

[redacted]

CBA Costs	Grant	Non-Grant	Total
[redacted]			
Total	**£30,383,250**	**£56,359,750**	**£86,143,000**

Using the parameters in this model and input assumptions, shows a benefit cost ratio (BCR) of value for money (VfM) under Department for Transport VfM categories. However, this model does not allow the inclusion of other Green Book compliant direct and monetisable benefits that the investment would expect to deliver.

For this submission, we have created a BCR 'overlay' that captures several of these additional monetisable benefits and delivers a BCR of [redacted] VfM. The overlay BCR includes all the costs and benefits from the base model, but adds several quantifiable benefits considerations, calculated in line with Green Book business case requirements.

Section 6.3 of the Green Book recommends valuing the benefits of these changes in productivity and employment. There will be productivity improvements associated with the re-skilling of bus drivers, and there will be additional employment impacts from engineers, apprenticeships, construction, maintenance, and manufacturing jobs. The Green Book guidance allows these effects on employment and productivity to be counted where they are truly additional and are built bottom-up from the different planned investments, rather than top-down multipliers. To monetise the employment and productivity impacts, and include in the BCR, we translate the employment effects into GVA using regional productivity statistics.

£, 2022, PV	Base	**Overlay**
Present Value of Benefits	[redacted]	
Present Value of Costs		
Net Present Value		
Benefit Cost Ratio		
VfM Category		
Cost Effectiveness Indicator		

The additional benefit categories included are:

- **Direct transport job impacts** – This includes upskilling for 250 bus drivers who will transition from diesel engine buses to hydrogen buses; creating an additional 22 engineering jobs to service the hydrogen engines; and creating 40 two-year apprenticeships to train and develop.
- **Direct non-transport impacts** – Jobs will be created to produce and transport hydrogen to HRS infrastructure. [redacted] Although not included in this case, we expect there will be further investment from other elements of the overall supply chain.

Other metrics to report include:

- Cost Effectiveness Indicator (CEI): 307.5. The CEI demonstrates the cost per tonne of carbon
- Average cost per bus:
- Average infrastructure cost per bus:
- Average cost per passenger capacity:
- Grant funding per bus: £245,026
- Grant funding per passenger capacity: £2,856

3Aii. Non-monetised benefits

The BCR overlay demonstrates [redacted] value for money, and we believe that this BCR could be categorised into a [redacted] VfM category were we to include all the additional benefits not monetised by the model in this assessment. The BCR, for example, excludes the long-term impacts of R&D in hydrogen transport, which could improve performance and reduce price for future users, and the social benefits from improved reliability of the bus service for people that may rely on public transport. Additional wider benefits from improvements to coach services, are also not included in this valuation. These wider benefits are further assessed, qualitatively, in Appendix 003C 3D and include:

- Additional R&D spend on hydrogen transport
- Expansion of project to original bid of 224 hydrogen buses
- Multi-modal use of hydrogen refuelling systems infrastructure
- Upskilling the wider community
- UK hydrogen bus manufacturing capability creating direct jobs and potential to develop an export industry
- Job growth and additional gross output in the West Midlands and UK hydrogen economy
- Increased bus patronage
- Increased accessibility
- Social impact of bus improvement

3Aii. Sensitivity Analysis

Several sensitivity tests have been assessed. These include the requested tests by the DfT and additional tests to capture local sensitivities:

A. Application of High Carbon Values
B. Increase in vehicle km by 10%

C. Decrease in vehicle km by 10%
D. BSOG based sensitivity – BSOG remains at 6p in the Do Something
E. Change to Well-to-Wheel savings (from Tank-to-Wheel)
F. Change to hydrogen costs and hydrogen consumption, to reflect quoted prices and observed real world operations respectively
G. Increase of the number of hydrogen double deck buses by 100 (224 total) and associated infrastructure costs by £ [redacted]m.

These are reported and detailed in the Economic Case Appendix, along with a further breakdown of the base case benefits and costs between the hydrogen project components.

3Aiv. Changes from EOI Phase

The economic case presented in the Phase 1 EOI for the project remains relatively unchanged in its underlying principles. Stated below is a list of changes made since the EOI.

EOI	FBC	Justification
[redacted]		

Economic Case supporting appendices:

3B	ECONOMIC CONTEXT
3C	ECONOMIC APPRAISAL
3D	APPROPRIATE TOOLS

4 COMMERCIAL CASE

4A – Procurement Arrangements

A competitive, regulated Grant Application Process is required and will be undertaken to allocate grant funding to commercial bus operators to deliver the hydrogen buses in the scheme.

[redacted]

The payments will be made under a grant funding agreement, which will give WMCA rights to step into the Operator's supply contracts if conditions have been breached. These conditions and approach will be similar to the successful undertaking for Coventry All-Electric Bus City.

The total value of money available for the scheme will be set by Government, but not all of this will be used for the procurement under this option. Some will be set aside for procurements which will happen separately for supported subsidised services operated by WMCA. More detail of this is set out in section 4C below.

4B – Procurement Outcome - Summary of the outcome of the Procurement and details that confirm that the deal is still affordable

The Grant funding cannot be allocated until the Grant funding has been received by WMCA, therefore the competitive Grant Application Process is yet to take place. As WMCA will have a limited amount of grant available, grants will be limited to a fixed number of buses, with recipients being selected based on quality ranking.

To be eligible for funds bidders will need to meet criteria prescribed by WMCA, which will include the Commercial Operators demonstrating that they have a viable plan to operate the hydrogen buses in the areas prescribed in the FBC. This will include evidence of having advanced towards a supply agreement for the new buses and HRS, access to depots and credible business plan for running commercial services.

There will also be a quality threshold for the vehicles and HRS provided, and bidders would be required to provide evidence of the incremental costs being incurred over and above those for conventional diesel vehicles.

The amount of payment made will be linked solely to capital expenditure capped at the grant level, and initially be set as per the ZEBRA funding formulae:

- 75% of the demonstrable incremental cost of the zero-emission vehicle over a comparable diesel vehicle.
- 75% of the cost of infrastructure specific to the zero emission vehicles.

The evidence regarding capital expenditure will need to show the costs of delivery of the assets, and installation, and cannot include any operating or maintenance costs. Bidders will also have to provide a high level of detail and transparency in their bids.

The indicative high-level timeline and stages of procurement are as follows. These timeframes have been reduced by learning lessons from the Coventry EBC process and feedback from market

engagement in developing the FBC. Please note this remains subject to refinement prior to any Grant Application Process commencing.

Activity	Indicative Start Date
[redacted]	
[redacted]	

4C - Commercial Case Summary – Set out summary of the commercial case and how options appraised have been reviewed, recording any changes since last business case stage (max. 500 words)

The proposed project is hugely significant for the West Midlands region and for the UK as a whole, as it marks a step change in decarbonisation capability from demonstration projects to an order of 124 hydrogen vehicles (meeting enhanced accessibility standards), and full-scale conversion of a bus depots to zero emission bus operation using green hydrogen. The scale of the project is such that it could kick start wider deployments of hydrogen bus and vehicle fleets in the West Midlands, and potentially nationally. Whilst the technology is proven, the supply chain is not as fully developed as other technologies, but this means that the relatively small number of supply chain actors are well known, and their capabilities and shortcomings are fully understood.

[redacted]

Commercial Case supporting appendices:

4D	COMMERCIAL CONTEXT
4E	PROCUREMENT
4F	AGREED DEAL
4G	MARKETING PLAN

5 FINANCIAL CASE

5A - Capital Funding - Overview of the proposed funding package to deliver the project with written confirmation of all confirmed funding and details of any conditions.

Funder	Amount	% of Total	Status *(Confirmed/ Pending Approval)*	Details of Funding Status / Timing / Conditions etc.
Department for Transport	£30,383,250			

5B - Financial Case Summary – Summary of the financial case and how it has been revisited and reviewed, recording any changes since last business case stage (EOI).

The scheme costs of £86.743m are comprised of the following elements:

Expenditure Stream	Revenue / Capital	£m

The Department for Transport grant is for up to 75% of the additional costs of zero emissions vehicles over the costs of diesel vehicles, and for up to 75% of the costs of upgrading infrastructure for those vehicles, with operators providing the rest of the funding.

The table below shows the funding statement breakdown:

Element	Total	Grant Funding
Total	£86,743,000	**£30,383,250**

[redacted]

[redacted]

A condition of the Department for Transport grant is that any additional costs of the scheme are to be borne by WMCA. In relation to the hydrogen vehicles, this will be mitigated through a process of grant application by the operators to WMCA which will consider the projected usage of the Department for Transport grant on each application, with WMCA seeking to cap the available grant funding to operators to the £30.383m thereby transferring the risks of any cost overruns e.g. inflation to operators and minimising the risk to WMCA.

[redacted]

Financial Case supporting appendices:

5C	FINANCIAL CONTEXT

6 MANAGEMENT CASE

6A – Management and Governance

The project management team and governance structure has been established, with agreed Terms of Reference (ToR) and has been operational to develop this FBC. This will continue through the life of the project, being adjusted as necessary to best support the project as it develops and grows. This will be reviewed and confirmed for the start of the project delivery stage, subject to award of funding. It is anticipated that a new Project Manager and Technical Hydrogen Specialist will be appointed in TfWM, with the core project team members from TfWM/WMCA for Senior Responsible Officer, Network Transformation (Sponsor), Finance and Legal remaining throughout project delivery to ensure that there is both consistency in delivery approach and knowledge retention, whilst strengthening the project management and technical delivery resource for TfWM, as well as bring an Operator into the project governance structure (subject to a competitive grant application process.

A formal Governance structure has been implemented for the FBC phase and this can be seen in diagram form within the management context appendix and below. This structure will be taken forward into successful delivery. The structure shows the persons or organisations that either provide a management role or a supporting role. The structure defines the specific groups that are established together with the Boards that the project either reports for decisions or to provide information to. The structure identifies the areas where briefing/updates are to be provided and the clear route for approvals. The Technical Steering Group will continue its role from the development of the FBC through the delivery phase. The Activity specific working groups are also identified that will be established from and report into the Project Delivery Steering Group. Throughout the structure is representation by the Operator thus providing clear and integrated project management, communication and delivery.

The role and function of the Activity Working Groups are to be responsible for the delivery of the discrete components to the project (some of these Groups are subject to change depending on the outcome of the competitive, grant application process to allocate grant funding to bus operator/s):

The Governance structure also identifies the management of the project, this will be primarily controlled by the members of the Project Delivery Steering Group. The membership of the Project Delivery Steering Group consists of a healthy mix of skill sets and organisations led by TfWM together with bus operators (as they are appointed via a separate procurement exercise). The Project Delivery Steering Group defines and establishes separate task specific working groups, these are led by an identified member of the Project Delivery Steering Group who have the responsibility to manage the working group to deliver agreed outcomes and to report these back to the Project Delivery Steering Group.

A live risk register (Appendix 006G) has been utilised through to FBC and is based upon a standard Excel form used within TfWM, the intention is to move from this format to utilise ARM (Active Risk Manager) which is a software Enterprise package used on many large projects within WMCA. ARM allows us to identify, analyse, control, monitor, mitigate and report on risks, issues and opportunities.

As the project enters delivery phase the development of the Activity specific working groups, provision of briefings and updates to Stakeholders and interested partners and reporting through TfWM formal Boards will develop to ensure that the project is robustly managed. This will follow existing successful project management and governance structures within TfWM Integrated Transport Services Directorate, applied for other successful project delivery (e.g. Coventry All-Electric Bus City).

The Project Delivery Steering Group will again agree and establish the formal roles and responsibilities of the members and those of Activity specific groups reporting into the Steering Group that impact upon the delivery of the project. These will be established through formal ToR for each group and assigning roles and

responsibilities specific to the membership, the ToR will be approved by TfWM Network Programme Board as the primary approval route. Changes to the management and governance structures will be reviewed through the lifecycle of the project deliver on the monthly basis and any proposed changes approved through the relevant governance structures and implemented in line with the change management (and project management) approach.

6B - Monitoring & Evaluation

A Monitoring and Evaluation Plan (MEP) has been prepared in line with both the DfT Framework and the TfWM M&E Framework. In line with the Frameworks, the project is required to undertake Fuller Evaluation and Enhanced Monitoring given the size and cost (greater than £50 million). This will be developed and monitored to support and as part of the Department's programme-level evaluation as it is developed. This includes the commitment to provide the required data and participate with the programme-level evaluation. The key elements of Enhanced Monitoring include:

- Project delivery (including the assessment of schedule, stakeholder engagement, risk and benefits)
- Costs
- Actual delivered project (compared with that proposed)
- Project Objectives
- Bus travel demand (i.e. patronage)
- Bus travel times (absolute and reliability)
- Bus operational performance
- Impacts on the economy (including the percentage of working age population accessible to jobs and the percentage of residents able to access strategic centres in 45 minutes)
- Carbon impacts (including air quality CO_2e, NOx and PM)
- Accidents involving bus
- Bus operating costs
- Charging usage, costs and performance

In addition to the above, we propose to undertake a review of the project's value for money alongside a wider set of outcome monitoring. The proposed approach is therefore more comprehensive than the core requirements and reflects the intent to undertake a robust assessment of the project, both during and post-completion. Elements of impact evaluation, process evaluation and economic evaluation are included within this MEP, as it is proposed to undertake a Fuller Evaluation because this is an innovative project (as a pilot for Government); with an adjusted cost benefit ratio of less than 2, and due to the ability to generate beneficial evidence on the effectiveness of this type of scheme.

- **Impact evaluation**: to provide reliable evidence of the extent to which the project has caused the changes in the outcomes and impacts. This will be considered through an outcomes report, which assess the outcomes in relation to the defined objectives identified in the logic map (shown below) and comparing the post intervention situation with the pre intervention situation.
- **Process evaluation**: to identify what lessons have been learnt during implementation. This is likely to be presented through the series of quarterly progress reports produced during the implementation stage, followed by an end of delivery report to fully assess how the project has been delivered.
- **Economic evaluation**: aimed to establish the benefits of the scheme and relating these to the cost of the interventions.

Logic Map showing a project-level Theory of Change. The Logic Map will be reviewed and tested throughout the project monitoring. The logic map is shown separately in Appendix 006B MEP Figure 1 Logic Map v2.

Data requirements and collection approaches

The approach to monitoring aims to minimise data collection costs. The bus operators and TfWM already collect a vast range and breadth of data, to be supplemented by new data collection on the zero-emission vehicle operation, performance, costs and infrastructure usage and costs. The types of data are detailed in the MEP, covering and committing to the minimum data requirements under ZEBRA with additional data requirements for our local circumstances and design of the scheme.

Resourcing, Delivery and Dissemination including expected milestones

The project evaluation outlined within the MEP has been budgeted (£0.15m) by the WMCA and will resourced by TfWM across the programme period. Although the majority of data is already collected as part of routine monitoring activities, there should be expectation and planning for areas of additional expenditure required. These include the process monitoring during scheme implementation, additional primary data collection and ongoing collation/analysis of data. The revenue budget identified within the FBC to deliver the monitoring and evaluation is set out below.

- Process Evaluation Reporting (including End of Actual Project Delivery Report – Q2 2024)
- Baseline Reporting (Q2 2022)
- Interim Annual Data Reports x 1 (Q2 2023) - including process evaluation for learnings through each phase of the delivery
- One Year Post Completed Delivery (Opening) Reporting (Q2 2025)
- Five Year Post Completed Delivery (Opening) Reporting (Q2 2029)
- Meetings and Project Management

The estimated total cost for WMCA undertaking the above monitoring and evaluation activities is estimated to be . These costs should be treated as indicative only and should be subjected to further refinement prior to commencement of the project and competitive appointment of a suitably qualified and experienced sub-contractor to required data protection/sharing and quality assurance standards (i.e. ISO-9001).
The MEP will operate a risk register that feeds into the programme risk register and will be subject to the same review process as the scheme risk registers. The sub-contractor will be responsible for updating the MEP risk register whenever a new risk is identified as well as on a standard monthly basis throughout the evaluation activity period.

The logic map (ZEBRA Appendix 006B MEP Figure 1 Logic Map v2) enables the identification of suitable monitoring points within the chain to guide the approach for evaluation.

Attach Link to Monitoring & Evaluation Plan here:

Separate Appendix: ZEBRA Appendix 006B MEP v4

6C - Management Case Summary – Summary of the management case and how it has been revisited and reviewed, recording any changes since last business case stage (EOI)

Diligent project management will be key to successful commercial delivery of the project which will look like:

- Hydrogen buses delivered on time and on budget
- Hydrogen refuelling station delivered on time and on budget
- Hydrogen articulated vehicles secured and delivered on time and on budget

- Project spend completed by March 2024
- Positive customer experience measured through the MEP
- Delivery of at least 22 new jobs in the supply chain and for engineers in the local support network
- Upskilling of the existing operator workforce of engineers, drivers, and maintenance support.
- Enhancement of the green hydrogen supply chain in the region and the facilitation of additional hydrogen deployments (not just hydrogen) leveraging the low-cost hydrogen supply into the region

There is nothing further to add within this section at this stage given that the project has commenced at FBC with no prior OBC or management structure to refer to or that has changed from that already proposed within this document.

Management Case supporting appendices:

6D	MANAGEMENT CONTEXT
6E	SCHEDULE
6F	PROJECT MANAGEMENT STRATEGY
6G	RISK REGISTER AND ISSUE LOG
6D	CHANGE MANAGEMENT STRATEGY
6D	CONTINGENCY PLAN
6J	PDPOAP