

Written Evidence submitted by Porterbrook

1 Introduction

- 1.1 Porterbrook is pleased to respond to this important inquiry into achieving net zero by 2050
- 1.2 The British rail network can play a significant role in achieving the target by encouraging modal shift from road transport to rail and, more widely, enabling active forms of travel such as walking and cycling. Investment in rail infrastructure can have a substantial economic and environmental impact which can positively support the post-pandemic recovery through the transition to green jobs. Many private sector businesses, including Porterbrook, have both the finance and expertise to assist the government in achieving net zero by 2050

2 About Porterbrook

- 2.1 Porterbrook has been at the heart of the UK rail network for over 25 years and owns almost a quarter of the national passenger rail fleet. Our rolling stock supports around 1.5m passenger journeys and travels over a million miles a day when the railway operates at full capacity
- 2.2 We currently have around 4,000 vehicles on lease or on order. Since privatisation, we have invested £3bn in 2,500 new passenger and freight vehicles, and we are looking to invest c£1bn in UK rail in the coming years
- 2.3 Our role as a leading asset owner and manager goes well beyond financing. As a long-term custodian of Britain's rolling stock, we take a 30-year view of assets that optimise value to passengers, taxpayers and the environment
- 2.4 Innovation is at the heart of Porterbrook's whole life asset management approach. In collaboration with our industry partners, we are constantly looking ahead to anticipate future needs and proactively develop our rolling stock assets. Last year we introduced HydroFLEX, the UK's first hydrogen-powered train, in partnership with the University of Birmingham
- 2.5 We are committed to supporting and developing the UK rail supply chain. We trust 100+ UK-based companies to maintain and upgrade our assets, investing over £100m each year and supporting c.7,000 jobs
- 2.6 Porterbrook employs 150 people of which three quarters are engineers and project managers. In addition, over a third of Porterbrook's workforce is female including a number of our executive team which compares favourably to the UK rail industry average of 16%

3 Sustaining investment in rail and wider infrastructure

- 3.1 Porterbrook recognises the government's commitment to invest £53bn in the railway across England, Wales, and Scotland between 2019 and 2024 and its strong support for the industry during the pandemic. We further note the government's commitment to investing in infrastructure and the March 2020 budget pledge to spend £600bn over the next five years
- 3.2 Rail investment offers the opportunity to reduce carbon emissions across transport by encouraging modal shift to rail and active travel. We look forward to further details of the rail reform agenda and a long-term rail strategy which acknowledges the requirement for continuous investment in new rolling stock
- 3.3 That strategy should include a phased process of electrification and traction decarbonisation. Network Rail's Traction Decarbonisation Network Strategy shows that a clearly scoped and planned programme of incremental upgrades can support the optimum utilisation of rolling stock both in the transitional period to net-zero and beyond 2050
- 3.4 The UK public finances face significant economic challenges. The private sector has an important role to play in helping to meet the funding gap needed to deliver the government's infrastructure vision and net zero target
- 3.5 The level of private sector capital available to fund infrastructure remains robust as traditional fixed income yields remain low. This capital is largely in the form of pension funds, including UK pension fund money, and insurance institutional investments, which are focused on long-term, stable infrastructure income. In addition, the UK has historically low interest rates at present which makes raising long-term financing more attractive
- 3.6 Current investor demand for infrastructure remains strong although issues such as regulation and uncertainty on investment plans could have a negative impact on future decisions. Realising key government policy objectives such as reaching net-zero will require significant investment in industries such as transport including rail. To encourage the level of investment required particularly as we rebuild from the pandemic, the government needs to develop the right environment, risk profile and interface for private investment to flow into infrastructure.
- 3.7 In addition to building back better, we believe that the UK railway should use what it has got better. The future of public transport would benefit from a circular economy-based approach which can drive both economic efficiency and decarbonisation by ensuring that resources and assets are used for as long as possible while extracting the maximum value from them while in use. In turn, those assets can recover, regenerate and recycle products and materials at the end of each service life

4 Rail decarbonisation policy context

- 4.1 UK government policy is for the country to be net carbon zero by 2050. Its widely accepted that rail is a low-carbon form of transport with passenger and freight services responsible for just 1.4% of the UK's domestic transport emissions in 2018. The Westminster government has set a target of 2040 for diesel trains to be removed from the network
- 4.2 Carbon emissions from rail are reducing both from new trains coming into service and longevity benefits arising from existing fleets being more sustainability maintained and refurbished. Emissions from both diesel trains and electricity

generation per rail passenger kilometre in 2018-2019 fell by more than 10% from the same period in 2017-2018

- 4.3 In March 2020, the government published a draft transport decarbonisation plan in which it recognised that electrification is the optimum high-level strategy for decarbonising the network. Rail electrification delivers better performance, lowers fuel costs and can reduce carbon dioxide and nitrogen dioxide emissions which provide improvements for both the environment and air quality
- 4.4 This view was reaffirmed in the government's Energy White Paper which was published in December 2020 which states that 'for areas of the rail network with significant freight flows or long-distance high-speed services, electrification is a proven technology that is able to support these service types. Analysis suggests that electrification may also be the best whole-life cost solution for more intensively used areas of the network. Away from these areas of operation the deployment of emerging technologies such as battery traction and hydrogen rolling stock on both an interim and permanent basis may offer alternative solutions to help in achieving decarbonisation of rail at a lower cost'
- 4.5 We note that the Committee on Climate Change's 6th Carbon Budget and path to Net Zero were also published in December 2020 which quantify rail's contribution to achieving the UK's long-term decarbonisation objectives particularly reaching net zero in surface transport. The CCC asserts that total passenger rail traffic should grow to 58% above today's levels by 2050 ("today" being understood as pre-covid) and that total rail freight hauled should grow to 9% above today's levels by 2050
- 4.6 The Committee also sets out an assumption that the rail network is steadily electrified at a rate of 200 km/year which would take the electrified proportion of the network to 55% by 2050. The CCC also projects that all diesel trains are removed from category A passenger routes by 2035 and from all passenger routes by 2040. By 2040, most new passenger trains are electric (68%) or battery-electric (26%) with smaller roles for diesel-electric and hydrogen
- 4.7 It is therefore clear that future rail energy requirements will be determined both by the electrification strategy and the profile of individual routes. Network Rail plans to electrify long-distance, inter-city, high-speed passenger and freight services. Such a rolling and incremental approach to electrification can be supported and enhanced by alternative traction and self-powered trains which will bring passenger benefits forward more quickly
- 4.8 Network Rail's Traction Decarbonisation Network Strategy (TDNS) has estimated that to achieve traction decarbonisation of the more than 15,000 single track kilometres (STKs) of unelectrified network the following is necessary:
 - an additional c. 11,300 STKs of electrification is required for long-distance high-speed passenger and freight services;
 - hydrogen train deployment over c. 900 STKs of infrastructure;
 - battery train deployment over c. 400 STKs of infrastructure; and
 - there are 2,400 STKs where a single technology choice is not immediately clear.

- 4.9 In addition Network Rail has identified the North of Scotland, Teesside and East Anglia as areas where hydrogen traction could be rolled out
- 4.10 Many private sector businesses including Porterbrook want to support the government's ambition for the UK to be a leader in low carbon rail and green jobs while aiding the post-Covid-19 economic recovery
- 4.11 We have long recognised the potential for hydrogen power to significantly extend clean operation on long-distance, non-electrified routes which led us to develop and launch HydroFLEX, the UK's first hydrogen-powered train

5 How Porterbrook is supporting rail decarbonisation

- 5.1 Porterbrook has been investing in new technologies such as battery powered trains, hybrid technology and hydrogen power. These innovations have the potential to improve air quality, reduce emissions, and increase network reliability and performance. Such complimentary traction has significant potential to help meet network, timetable and environmental challenges
- 5.2 A significant proportion of a train's whole life carbon footprint is generated in the initial manufacturing process. According to the findings of an independent study in 2011 by the RSSB, the manufacture of a new electric train produces the equivalent of 146 tonnes of CO₂, while its maintenance accounts for little more than 2.3 tonnes CO₂ per year. If rolling stock is used for its full service life (and not scrapped prematurely), the emissions associated with its manufacture are deferred significantly. It is therefore important that the service life of existing fleets is maximised to reduce unnecessary carbon emissions
- 5.3 In 2018 Porterbrook and the University of Birmingham partnered to develop and deliver HydroFLEX, the UK's first hydrogen powered train. The train can significantly extend clean operation on long distance and non-electrified routes for passengers and began mainline testing of the HydroFLEX in September 2020. (video link here)
- 5.4 In 2021 Porterbrook plans to provide our customer Chiltern Railway with trains fitted with Rolls Royce MTU Hybrid PowerPacks. These will allow diesel trains to switch between diesel only to hybrid electric operation. The technology combines the advantages of diesel and battery powered rail traction which fulfils future EU Stage V emissions regulations This enables very low noise, emissions free battery only electric operation in urban areas and around stations
- 5.5 Porterbrook is progressing plan to trial fitment of battery technology to two of our existing fleets (Class 377 and 350/2). This will expand the operation of electric trains onto routes currently served by diesel trains, resulting in improved air quality for passengers. This has the potential to eliminate diesel operations from termini such as London Bridge
- 5.6 Working with our partner Eminox we are fitting some of our older diesel trains with an after-treatment system to allow for quieter, cleaner operation. This technology reduces nitrous oxide emissions by over 80% and hydrocarbons and carbon monoxide by over 90%. Following the InnovateUK backed trial on a South Western Railway Class 159 unit, this technology will be rolled out on further fleets across the network. A second trial is also taking place on a more modern East Midlands Railway Class 170 fleet where we hope for similar benefits. More information can be found here <https://vimeo.com/398798092>

6 **Case study: HydroFLEX**

- 6.1 In 2018 Porterbrook and the University of Birmingham entered into a partnership to develop and deliver HydroFLEX, the UK's first hydrogen-powered train. The project has been a powerful collaboration between the private sector and academia to deliver innovation
- 6.2 Porterbrook provided the train, fuel cell and engineering staff while the University of Birmingham supplied staff and specialist research skills. With a challenging timescale to achieve, joint project directors from both the University and Porterbrook were appointed and integrated teams of management, engineering, research and supply chain contacts were put together
- 6.3 As an energy source, hydrogen is very lightweight but also requires a larger volume to have a similar range to diesel. This low energy density means that gas is not appropriate for long-distance high-speed intercity trains, or heavy freight trains. It is suitable for medium distance regional services or as a range extension for running from an electrified line up a branch line
- 6.4 HydroFLEX is fitted with a 100kW fuel cell with a 100kWh battery bank with which the train is self-propelled and can operate away from the overhead wires. The train is a working prototype, allowing both organisations to learn about the hydrogen powertrain and develop improvements. It was tested at Quinton Rail Technology Centre at Long Marston where speeds of 24mph have been achieved
- 6.5 With funding from Innovate UK, Porterbrook and the University of Birmingham HydroFLEX began testing onto the mainline network in September 2020 which made it the first hydrogen powered train to travel on Network Rail's network. We are looking at opportunities to demonstrate the train at the COP26 climate summit in Glasgow in November
- 6.6 Going forward, a feasibility study has been commissioned with the University of Birmingham examining the potential configuration and recommended design of a production unit of the train. A further collaborative research project is exploring concept design for the world's first bi-mode electric/hydrogen train and other projects, including new train production and design specifications
- 6.7 To date, Porterbrook has invested around £1m in the development of HydroFLEX. Our ambition is to invest more should the right commercial opportunity be brought forward underpinned by a clear regulatory framework. A video about the innovation can be found here <https://youtu.be/en1jTXWVr3s>

7 **Additional investment and innovation**

- 7.1 Our commitment to supporting public transport in the future can be seen from the £100m fleet modernisation programme of our 270 electric multiple units operated by Govia Thameslink Railway over the next five years which was announced in autumn 2020. The investment will include the installation of on-board performance monitoring and fault diagnosis, real-time passenger information screens and USB/power points. The trains will also be fitted with new energy-saving LED lighting, plus passenger-counting technology and forward-facing CCTV cameras. It reflects our commitment to helping GTR meet the needs of its travelling customers and supporting the railway achieve net zero by 2050

- 7.2 Porterbrook will take over the future direction and development of the extensive rail-connected Long Marston facility in Warwickshire in summer 2021. The site covers 135 acres and consists of 12 miles of storage sidings, a two-mile test-track loop, a short length of electrified line and several rail-served light maintenance structures
- 7.3 The company's vision is for the site to develop into a centre of excellence in both rail innovation and expertise. Through our partnership with the University of Birmingham and others we aspire for the facility to become an incubator of technology which supports rail supply chain SMEs as well as the skills and digital pillars of the rail sector deal. The decision to secure and invest in Long Marston also reflects our commitment to developing and supporting Britain's railway

8 Digital

- 8.1 Our digital and data analytics specialists are helping the railway unlock data to benefit both passengers and operators. We have developed real time passenger counting using Wi Fi data and vehicle loading information to improve the journey experience. We are also supporting Network Rail's seasonal rail adhesion preparedness by utilising data to identify slippage hotspots, helping to improve time keeping.
- 8.2 It has never been more important for rail to utilise and optimise the potential of digital technology both to improve performance and meet passenger expectations in the future. Resistance to change is a particular cultural and operational challenge for many parts of the transport industry and rail is no exception. It is a major challenge to be overcome
- 8.3 Our reliability taskforce in partnership with Wabtec and Unipart Rail, is supporting six train operators by developing tools that allow predictive maintenance and proactive interventions. Our target is to achieve a 60% reduction in engine related delays across seven Diesel Multiple Unit fleets. By ensuring remain in service, this will reduce disruption to passenger journeys
- 8.4 Working with GTR, we are also trialling the fitment of front facing CCTV to our Electrostars to facilitate data-driven infrastructure monitoring. We anticipate that this particular innovation could reduce delay minutes related to vegetation and low adhesion issues by 15%

9 Rail regulation

- 9.1 Robust rail regulation is critical to ensuring rail investment is delivered effectively and provides maximum impact for passengers and taxpayers. Going forward, it should be more clearly aligned with wider infrastructure planning and a long-term strategic investment plan for public transport. In the case of rail, this could include regulatory levers for achieving the net-zero by 2050. Rail also needs a regulatory framework which incentivises and benchmarks for improving efficiency and productivity

10 Skills and jobs

- 10.1 Porterbrook believes that the government and the industry need to work together to ensure rail maintains and develops the number of engineers, technicians, and operational staff it needs to function successfully in the future. The National Skills Academy for Rail (NSAR) has identified the industry's key skills areas include digital, software and systems engineering as well as leadership and management. It's also important to recognise the socio-economic value of the railway, so we welcome

NSAR's plan to target 20% of the industry's new recruits as coming from 'disadvantaged backgrounds'

- 10.2 Skills and innovation are key to driving productivity improvements so the rail industry's focus on this is essential for the future. A key emphasis is on more initial training for young people, more reskilling for people leaving other sectors as well as a requirement for digital skills at every level. It is vital that specific training targets are established for those workplace roles currently dependent on EU labour. At the higher level, more managerial skills and more training to support the implementation of innovation must be prioritised
- 10.3 NSAR's 2019 study into the economic value of HS2 indicates that the project will create 30,000 jobs of which just 13,000 are presently in the supply chain. It has been calculated that those jobs will generate an economic value of £6.3bn over the course of the project. If 10% of the jobs are undertaken by people from disadvantaged backgrounds the economic value increases to £8.3bn through reductions in welfare expenditure and productivity improvements. These numbers provide a compelling case for investing in rail
- 10.4 The recent report 'Back on Track' from NSAR and City and Guilds highlighted the critical skills shortages the industry soon faces. It stated that around 120,000 more people need to join the rail workforce in the next decade to meet the demand for skills. The provision of new infrastructure is a high priority for the government so having adequate capacity in the workforce as well as an appropriate level of training within it is vital to delivering this

11 **Conclusion**

- 11.1 Porterbrook appreciates the opportunity to contribute to this important inquiry
- 11.2 The railway can be a significant catalyst for moving towards net zero across the transport system through modal shift from road. Investment in rail is prominent within the government's infrastructure ambitions and can be an enabler of green economic growth by boosting jobs and skills on the road to net zero. In addition, private sector finance and expertise can play an important role in supporting the in delivery of these targets

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