

## Written evidence submitted by Porterbrook

### 1 Introduction

- 1.1 Porterbrook is pleased to provide updated evidence to the Transport Select Committee's Inquiry into Future Rolling Stock
- 1.2 The role of the railway in Britain's economic and social life has evolved over 180 years of history and it will do so again amid the current uncertainties and challenges. Rail has an important role both in the post-pandemic economic recovery but also in decarbonising wider transport. It's vital that there is a long-term strategy for rail investment into which the future planning around rolling stock can be considered

### 2 About Porterbrook

- 2.1 Porterbrook has been at the heart of Britain's railway for over 25 years and currently owns almost a third 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 almost 4,500 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 over £1bn in UK rail over coming years
- 2.3 Our role as asset managers 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 to help the government meet its decarbonisation targets. 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 £3m a week 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%<sup>1</sup>

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<sup>1</sup><https://womeninrail.org/wp-content/uploads/2014/04/WR-Industry-Survey-Report-December-2015.pdf>

## Key points in response to the inquiry

### 3 What role can rail decarbonisation play in delivering the government's wider commitments on air quality by 2040?

- 3.1 We recognise the UK government's commitment to making the UK the first global economy to set out a legal requirement for the country to achieve carbon neutrality by 2050. We further welcome the government's acknowledgement of the fact that rail is a relatively low-carbon form of transport, with passenger and freight services responsible for just 1.4% of the UK's domestic transport emissions in 2018
- 3.2 Rail is becoming less carbon intensive, both through new trains coming into service and longevity benefits arising from existing fleets being more sustainably maintained and refurbished. The Department for Transport's decarbonisation strategy points out that carbon emissions from both diesel trains and electricity generation per rail passenger kilometre in 2018-2019 fell by more than 10% year on year
- 3.3 Porterbrook acknowledges that rail decarbonisation will require a substantial amount of rail electrification in addition to zero carbon self-powered trains, such as battery and hydrogen, for those parts of the network unsuitable for electrification
- 3.4 Rail electrification is the best form of traction for an intensely used railway. About 40% of the UK rail network is electrified, much less than comparable railways in Europe which have average levels of around 60%. Electrification has many benefits including lower long-term costs, improved journey times, and provides substantial environmental benefits such as reduced carbon emissions and enhanced air quality
- 3.5 We support the calls by many stakeholders across the rail industry for a rolling programme of rail electrification. This will allow the industry to deliver schemes at significantly lower cost while boosting learning and skills in addition to encouraging investment
- 3.6 Support for rail is vital for the UK to achieve its carbon reduction targets by 2050. Outside of active travel, rail is the transport mode with the lowest carbon emissions in the UK. Rail decarbonisation can support emissions reductions in other transport modes through modal shift
- 3.7 To support this 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
- 3.8 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 CO<sub>2</sub>, while its maintenance accounts for little more than 2.3 tonnes CO<sub>2</sub> 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

- 3.9 Last year, Porterbrook launched HydroFLEX, the UK's first hydrogen-powered train. Developed in partnership with the University of Birmingham this unique collaboration between academia and the private sector is also the first train in the world to be retrofitted with hydrogen power. Mainline testing of the train took place in September 2020 and is continuing. Further details are set out below

## 4 Whether there is adequate financial and other support from the government for the development of alternatively fuelled rolling stock?

- 4.1 Porterbrook notes the commitment set out in the government's July 2020 UK Research and Development Roadmap to increase UK investment in R&D to 2.4% of GDP by 2027 and to increase public funding for R&D to £22 billion per year by 2024 to 2025. We welcome the pledge to 'increase our investment in research, unlocking new discoveries and applying research to solving our most pressing problems in government, industry and across society'
- 4.2 Support from Innovate UK and RSSB has allowed us to channel more than £4 million into projects which deliver decarbonisation across passenger and freight operations. This includes the projects cited above such as EminoX, HydroFLEX and the MTU Hybrid PowerPacks

## 5 How the industry is responding to the challenge of a carbon free transport future by 2040 and developing technologies to achieve that?

- 5.1 Porterbrook has developed a number of alternatively tractioned bi-mode trains and the UK's first tri-mode train fleet. We have converted an existing Class 319 unit into a Class 769 Flex train capable of operating under 25kV or using third rail electric power which is also capable of operating beyond electrified routes as a self-powered train. FLEX trains serving Northern and Transport for Wales have been configured for bi-mode operation (diesel and overhead wire) while on the Great Western Railway the vehicles will be able to operate as a tri-mode diesel, overhead wire and 3<sup>rd</sup> rail. The FLEX concept has been developed to reduce the number of diesel-only trains running across electrified routes. We are also supplying two FLEX trains to Rail Operations Group to support light rail logistics on rail, a £16bn sector which predominantly uses road
- 5.2 We have also been working with Rolls-Royce to develop and deliver MTU Hybrid PowerPacks which will allow diesel trains to switch between diesel-only to hybrid-electric operation. The technology is an environmentally friendly drive system which combines the advantages of diesel and battery-powered rail traction. The version for Porterbrook incorporates an MTU diesel engine 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
- 5.3 Porterbrook is trialling the fitment of battery technology to some of our existing Electrostar trains. This will enable the removal of diesel trains from some of our non-electrified routes south of the Thames. As well as improved air quality there are also operational benefits from standardising on the Electrostar platform – which with batteries fitted will be able to operate 'on' and 'off' the third rail network
- 5.4 Earlier this year we announced that we will take over the future direction and development of the extensive rail-connected Long Marston facility in Warwickshire. 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

- 5.5 Porterbrook'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

### Case study: HydroFLEX

- 5.6 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
- 5.7 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
- 5.8 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
- 5.9 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
- 5.10 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
- 5.11 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
- 5.12 To date, Porterbrook has invested around £1 million 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

## 6 What challenges are there to deploying alternatively fuelled rolling stock on the GB rail network, particularly given issues with standards and loading gauge?

- 6.1 Alternative traction has significant benefits for passengers such as improving air quality, reducing emissions, and increasing network reliability and performance. The range of complimentary traction has significant potential to help meet network, timetable and environmental challenges
- 6.2 Hydrogen fuel cell technology, for example, can help facilitate the electrification of sections of the rail network where there are currently no overhead wires. Such routes are likely to be regional, rural areas with fewer services, less demand and no fast or high-frequency trains. It is unlikely to be financially viable to electrify these routes. Yet, hydrogen trains could play an important part linking stretches of electrified line
- 6.3 Porterbrook has trialled fitting diesel trains with an after-treatment system to allow for quieter, cleaner operation in urban areas or 'greening the final mile.' The Eminox new emissions system can deliver reductions in pollution from nitrous oxide by over 80% and hydrocarbons and carbon monoxide by over 90%. This innovation has potential as many cities across the UK take steps to improve urban air quality

## 7 What passenger benefits alternatively fuelled rolling stock could provide?

- 7.1 As previously noted, passenger rolling stock on Britain's railway generally has an asset life of circa 35 years. Although the capital and operating costs of electric trains have materially reduced over the course of the last few years, the cost of self-powered trains is following a similar course. The rail supply chain requires a degree of future planning and stability to fully benefit from these reduced costs
- 7.2 Where rolling stock is displaced or made redundant over a shorter period than 35 years there are several negative environmental and cost consequences. We have calculated that every 'half-life' rail vehicle that we dispose of results in 77 tonnes of carbon dioxide being wasted. Similarly, where an asset's life is 'cut short', the procurement and finance cost of these vehicles will need to be recovered over a similar timeframe, resulting in an increase to annual leasing costs
- 7.3 The Railway Industry Association has concluded that a whole system approach to electrification would generate significant cost reductions. For example, adopting battery technology on certain routes would improve the business case for electrification for the lower cost/highest demand areas, without the need to electrify complex, expensive or low usage parts of the routes. Similarly, the case is stronger for adopting hydrogen technology rather than electrifying certain lower capacity routes

## 8 What the train interior of the future needs to have to ensure continued growth in rail travel, particularly amongst young people and future generations and to be fully accessible to all?

- 8.1 Porterbrook worked closely with Transport Focus to determine passenger priorities for a mid-life upgrade to over a thousand of our Electrostar vehicles in service with Govia Thameslink Railway (GTR). The passenger watchdog clearly identified that passengers require improved on-train passenger information, plug or USB sockets as well as Wi-Fi as standard
- 8.2 Following this consultation, we have agreed a £55 million fleet modernisation programme of our 270 electric multiple units operated by GTR over the next five years. 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
- 8.3 Many of the connected systems expected by society today need the infrastructure on board to deliver this connectivity. Three years ago, Porterbrook decided to invest in the installation of a high capacity Ethernet Backbone on several of its fleets. These backbones allow systems such as passenger Wi-Fi, passenger counting, information systems and CCTV to all be connected in a robust, cyber secure way at a reduced cost
- 8.4 We deliberately over-specified the capacity of the network to allow for future growth internet enabled devices on board and a digital train that would serve future generations. This Ethernet architecture is now installed on many of our trains and is allowing (and will continue to allow) more digitally enabled services for passengers
- 8.5 Porterbrook is also working with an accessibility specialist to see how our rolling stock can meet the needs of the widest possible range of actual or potential rail travellers. Whilst the PRM regulations were drawn up to meet the needs of those with physical disabilities, those with 'hidden disabilities' are not as well catered for. To address this, we are developing to create an 'Inclusivity Train' with one of our train operating customers which is designed to meet the needs of those with hidden disabilities, such as autism and dementia as well as those with cognitive impairments

## 9 Skills

- 9.1 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.'
- 9.2 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's 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

- 9.3 The National Skills Academy for Rail has a clear picture that the industry will need much more focus on technical skills at level 4 and 5. The new management of the National College for Advanced Transportation and Infrastructure (NCAT) is vital for delivering the core skills priorities in rail in the short-term then wider transport in the longer-term

## 10 Conclusion

- 10.1 Porterbrook is pleased to respond to this important inquiry. It is critical that the railway continues to support the economic and social life of Britain. We look forward to a long-term plan for rail against which a strategy for future rolling stock can be set out

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