THE UK ROLLING STOCK INDUSTRY

MAKING 2023 THE YEAR OF OPPORTUNITY NOT CRISIS

July 2023

Rail Decarb 23
Getting rail decarbonisation on track

Railway Industry Association
The voice of the UK rail supply community

Contents

1.0 Executive Summary

In this paper we set out decisions which, if taken this year, would improve passenger experience and likely revenue, reduce carbon immediately and mitigate the imminent risk of major job and capability losses in the rolling stock sector. We also set out medium term proposals which we believe are affordable and place the rolling stock industry in a sustainable position for the long term whilst maintaining competition.

Decisions are needed now to avoid major job losses

There have been no significant rolling stock orders for new build or upgrade/ refurbishment in the UK since the HS2 order was announced in December 2021. Prior to that the last order for a mainline fleet was in December 2019[1], that is three and half years ago.

These orders will soon be complete, and factories and upgrade facilities will be empty putting at risk thousands of jobs. The HS2 order is good news but not a panacea as there will be production gaps before it comes on stream and, even then, will not fill the two factories involved. A number of companies are actively pursuing export opportunities but success will be helpful rather than a panacea to the lack of domestic orders.

For at least 30 years the UK rolling stock industry has been characterised by 'boom and bust' (Figure 1, Page 6). There are many precedents for factory closures in the UK for example, Washwood Heath on the completion of the Pendolino programme, York soon after privatisation and the recent downsizing in the UK upgrade capability, for example in Scotland, Doncaster and Loughborough.

In 2011 there was only one new build factory in the UK. There are now five which is positive and reflects the previous demand for trains which has now dried up. The owners of these factories and the major upgrade/ refurbishment facilities are global businesses and will make unsentimental and rational decisions based on their confidence in the pipeline of opportunities. At present there is no visible pipeline and therefore the only rational decision must be to reduce cost and ultimately close the facility.

RIA is calling for decisions in 2023 as, without pipeline visibility this year, suppliers will need to start downsizing operations. (See Recommendation 1)

Serious consequences of indecision

The most immediate negative consequence will be job losses which are almost certain unless decisions are taken soon. This is an industry which employs over 30,000 people and is contributing at least £1.8bn GVA to the economy annually. This may be an underestimate as one company alone employs 17,000 people and contributes £1bn per annum to the economy.

As damaging will be the loss of skills which will be difficult to replace when they are inevitably needed again. These are high skilled jobs, UK rolling stock is a high productivity industry with the average employee generating almost £105,000 of GVA in 2019. This compares to an average of £65,000 of GVA per worker in the manufacturing sector in 2018, and it is more than double than the UK average for the same year.

The likely job losses and closure of upgrade and new build facilities will increase costs in the long-run. This is because the lack of continuity in production will lose efficiency gains and there will be less competition in the market. The skills loss will also reduce productivity and the trains which, are not upgraded or replaced, will become more expensive to operate and maintain.

Not upgrading or replacing trains will pass up the opportunity to reduce carbon and address air quality concerns. It is also likely that the passenger experience will get worse as trains are kept running beyond their optimum life.

Decisions are needed right now

It is less than 12 months until major factories start to run out of work. We will not be able to upgrade or renew trains cost effectively in the future if the factories and people are no longer there.

Running major parts of the passenger network on 40 year old trains is not sustainable. Running costs will be higher, reliability and passenger experience will be poorer and this will impact on revenue.

The benefits of these decisions manifest now and we avoid higher costs in the longer term.

1 https://www.hitachirail.com/press/#/pressreleases/firsttrenitalia-chooses-hitachi-rail-to-build-new-intercity-trains-for-avanti-west-coast-2951184

There is an immediate opportunity to improve air quality and reduce carbon without waiting for large scale electrification. Upgrading or replacing the oldest diesels immediately with low/zero carbon technology saves much more carbon than waiting as the saving is cumulative.

These are easy and no-regrets decisions

RIA have identified (see Section 4.1) a set of decisions which would upgrade or replace the oldest diesel trains on the network, as well as other rolling stock, which is already at or approaching 35 years old.

These decisions do not need large upfront public investment, there is a well used private sector route to deliver upgraded or new rolling stock – costs are spread over time and repaid through Train Operating Companies (TOC) lease costs. This could include any lineside infrastructure to support low/zero carbon trains.

As upgraded or new rolling stock is commissioned, the potentially higher lease costs are likely to be offset by preserving competition in the market, UK skills and domestic production capability, and by better passenger experience supporting revenue growth.

Taking this forward will require leadership from Government clients (Department for Transport, His Majesty's Treasury, Devolved Bodies) to commission the decisions, most likely via TOCs. If this is done right, and swiftly, there is the potential to not only avoid the destruction of industry capability, but also to position the UK as a global leader in commissioning trains using new low/zero carbon technologies.

Long term industry sustainability and cost efficiency

Following these immediate decisions and to prevent a recurrence of the current hiatus in orders, it is proposed that client bodies work with RIA and its members to develop a long-term industry strategy which creates a smoother order profile for upgrade and new build, whilst maintaining competition. This would give industry the confidence to invest in the people, plant and process which will drive further productivity improvement and reduce whole life cost.

Some principles to consider in developing a long-term strategy are set out in Section 4.2.

To support a smoother and more cost-effective order profile it is also proposed that the variability in high level specifications should be minimised and discussed with the supply chain to ensure they can be delivered affordably and future cascades of trains are simplified.

It is also proposed that the focus should shift from an ambition to remove all diesel only passenger trains by 2040 to a focus on maximising cumulative carbon reduction and air quality improvement. Together with a client willingness to facilitate cascade of mid-life rolling stock, this will bring flexibility into planning to optimise both whole life cost/asset life and carbon/air quality improvement. However no new diesel only trains should be procured.

The remainder of this report provides the evidence base for our proposals. The report is structured as follows.

Section 2.0 – Recommendations

Section 3.0 – Background

Section 4.0 – A strategy for a sustainable rolling stock industry

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2.0 Recommendations

To address the risk of major job and capability losses in the rolling stock industry and to deliver a sustainable rolling stock strategy RIA makes the following recommendations:

IMMEDIATE RECOMMENDATION

1. Government clients (Department for Transport, His Majesty's Treasury, Devolved Bodies) to make decisions in 2023 to allow the procurement and private financing of rolling stock upgrade or replacement of c2600 vehicles by 2030 to improve passenger services, reduce carbon and improve air quality now, and avoid an imminent existential risk to the UK supply chain. For the same reasons, consideration should also be given to upgrading/renewing the c1650 DMUs which become 35 years old after 2030. (See Section 4.1)

MEDIUM TERM RECOMMENDATIONS

As an input to the Long Term Plan for Rail, RIA proposes:

2. Government clients to work with RIA to develop a long-term rolling stock and decarbonisation strategy, which has the ambition to consider equally passenger experience, carbon reductions, air quality improvement and sustainability of the supply chain. The strategy should aim to smooth out 'boom and bust' to create the conditions for increased productivity and reduced whole life cost. (See Section 4.2)
3. Government clients and TOCs to collaborate on high level specifications for the different types of train (A to G) including any requirements for functional interoperability. These specifications should be consulted on with the supply chain to ensure they are deliverable affordably. (See Section 4.2.2)
4. The ambition to remove all diesel-only trains (passenger and freight) from the network by 2040 to be replaced by an ambition to maximise the cumulative reduction of carbon (and improvement of air quality) by the most appropriate means through both direct decarbonisation of rail and through modal shift. However no new diesel only trains should be bought. (See Section 4.2.3)

3.0 Background

No significant rolling stock orders for new build or refurbishment have been placed in the UK since the HS2 order was announced in December 2021. Prior to that the last order for a mainline fleet was in December 2019[2], that is three and half years ago. These orders will soon be complete, and factories will be empty.

This follows a period when over half the national fleet was replaced in a period of seven years continuing the cycle of boom and bust, or feast and famine, that has characterised the UK rolling stock industry for 35+ years as shown in Figure 1.

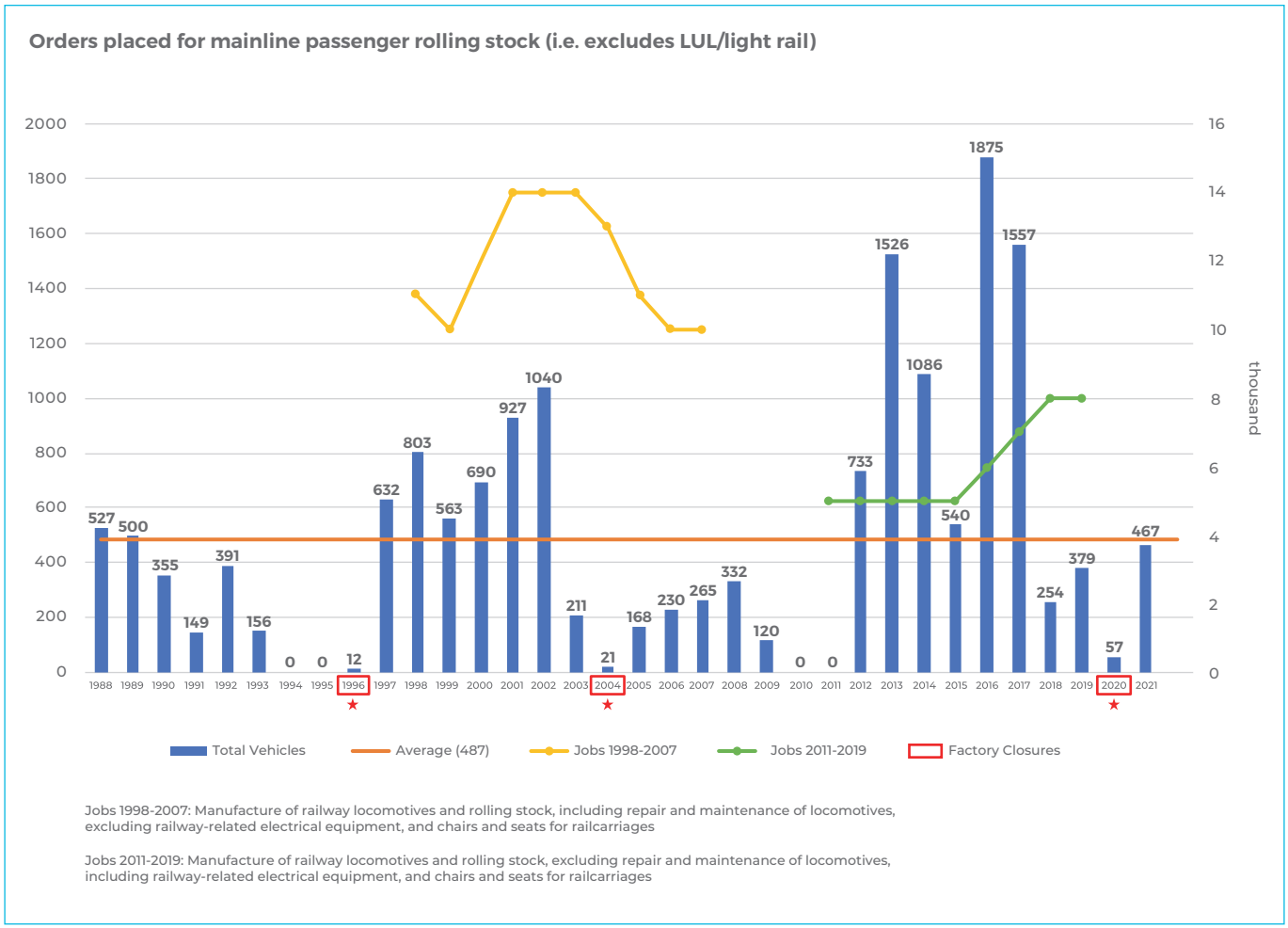

Figure 1 ***Orders placed for mainline passenger rolling stock 1988 to 2022***

Without any action, this pattern is set to be repeated with continuing detrimental effects. It is RIA's view that this 'boom and bust' cycle is unnecessary and drives up industry costs. This is due to the uncertainty of workload and consequent inability to confidently plan investment in people, plant and process. Figure 1 does not show an efficient order pipeline for a major manufacturing plant and industrialists in other sectors would be horrified by this profile. This report will propose a viable alternative to 'boom and bust' which would create confidence and an incentive to invest.

3.1 A looming industry crisis

Although passenger numbers have recovered, we understand that rail revenue has not yet returned to pre-COVID levels (being around 90% at the time of writing) and that the Government has public spending challenges. However, most rolling stock in the UK is privately financed and there is significant capital available in the market to

2 https://www.hitachirail.com/press/#/pressreleases/firsttrenitalia-chooses-hitachi-rail-to-build-new-intercity-trains-for-avanti-west-coast-2951184

invest in long life assets like trains. It is the view of RIA and our members, that we are now in a period when, unless decisions are taken very soon, there will be a significant loss of capability and jobs. This conclusion is borne out by history – as illustrated by the job losses shown in Figure 1.

According to an analysis by Roger Ford in the May 2023 edition of Modern Railways (Figure 2), all the UK rolling stock factories will run out of work between 2024 and 2026. A similar situation applies to refurbishment facilities. It is therefore essential that decisions on potential rolling stock orders are made very soon to avoid the risk of redundancies and factory closures. The fact that procurement can take several years underlines the importance of early decisions. However, as set out in Section 4.1 there are decisions, which could be made quickly, which would benefit both customers and industry and mitigate a looming crisis.

CURRENT WORKLOADS					
Current Orders (Excludes HS2 Rolling Stock)					
Company	Location	Cost of facility	Employment	Outstanding deliveries (vehicles)	Last delivery
Alstom	Derby	n/a	2,000	560	June 2024
Hitachi	Newton Aycliffe	£110 million	700	300	May 2025
Siemens	Goole	Up to £200 million	700	564	2026
CAF	Newport	£30 million plus grant	200	18	June 2023
Alstom	Widnes	£21 million	80	31 Class 390 sets (refurbishment)	May 2024

Figure 2 ***Modern Railways Analysis of current rolling stock factory workloads (May 2023)***

3.2 UK Rolling Stock Manufacturing and Refurbishment Capability

Rolling stock maintenance, refurbishment and renewal is a significant industry in the UK. In 2019 Oxera assessed that the UK rolling stock industry contributed £1.7bn to £1.8bn GVA to the economy and employment represented 26,000 to 27,000 UK jobs[3]. This is likely to be an underestimate given more recent data discussed below. Significantly, Oxera also found that UK rolling stock is a high productivity industry with the average employee generating almost £105,000 of GVA in 2019. This compares to an average of £65,000 of GVA per worker in the manufacturing sector in 2018, and it is more than double than the UK average for the same year.

This is a large and strategically important industry making a major contribution to the UK economy.

In 2010 the rolling stock manufacturing industry had declined to a point where only one factory (Derby) remained, since then the level of new orders resulted in new facilities being built in Newton Aycliffe, Newport and Goole. In the same period, however, the increase in new build resulted in a decline in refurbishment activity leading to the closure of several facilities. The remaining major refurbishment facilities include, Doncaster and Wolverton with smaller facilities around the UK. All of these factories, facilities and jobs are, again, at risk.

Work undertaken by Oxford Economics for RIA in 2021 shows (below) that for every £100m invested in purchasing from a UK based rolling stock manufacturer another £127m of wider benefit and £105m of GVA is generated alongside 1735 jobs. This is underpinned by data from one manufacturer which reports contributing £1bn and 17,000 jobs to the economy in 2022/23[4].

3 https://www.midlandsrail.co.uk/wp-content/uploads/2022/01/How-can-the-rolling-stock-supply-chain-create-greater-value-for-the-UK.pdf

4 https://www.alstom.com/press-releases-news/2023/7/alstom-supports-contibution-near-ps1bn-uk-and-ireland-gdp-economic-impact-report-finds

Impact of purchasing £100 million of equipment from a UK-based rolling stock manufacturer

	Output	GVA	Jobs	Taxes
	£m	£m	Headcount	£m
'First round' of supplies:				
Rolling stock manufacturing	100.0	43.0	507	10.1
Their UK supply chain:				
All other manufacturing	25.4	10.8	211	4.1
Utilities & construction	5.2	1.6	16	0.5
Services	37.4	20.4	393	7.1
Total supply chain impact	**168.0**	**75.8**	**1,127**	**21.9**
Induced impacts	59.7	29.4	608	9.9
Total of all impacts	**227.7**	**105.3**	**1,735**	**31.8**

The corollary of this is that if the industry contracts these benefits and jobs are lost to the economy in the same proportion.

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4.0 A strategy for a sustainable rolling stock industry

4.1 Recommended immediate decisions

This section considers the decisions needed to alleviate the current hiatus of future workload for the supply chain without which there is a real risk that factories will close, capability will be lost and trains will be more expensive when orders do start to be placed again.

The following stock (see Figure 5, Section 4.2.4) will be 35 or more years old by 2030 and therefore it is appropriate to make decisions now.

- Decision Block 1 – rolling stock which is already 35 years old (235 DMU, 147 EMU, 203 LHCS, 252 Tube)
- Decision Block 2 – rolling stock which will be 35 years old by 2030 (852 DMU, 819 EMU, 110 LHCS, 20 Tube)
- Total to 2030 = 2638 (1087 DMU, 966 EMU, 313 LHCS, 272 Tube)
- Over 6 years averages 439 per annum

Recommendations for immediate decision

In line with the strategy approach set out in Section 4.2 five specific decisions are recommended

Type	Recommended Decision	Considerations
A & B	Initiate a programme to replace/ refurbish 1087 (Type A and B) DMUs with zero or low carbon alternatives. Consider bringing forward the 443 Type B DMUs from Decision Block 3). It is understood some TOCs have well developed strategies for DMU replacement which could support early procurement. In addition consider the 655 Type B DMUs with the longest life (see Decision Block 4) for upgrade to lower carbon and/or multi-mode.	· **No new diesels** but upgrade to lower carbon and/or multi-mode is an option. · Order a **fleet of zero-carbon self powered vehicles** now to stimulate this new market and deliver early benefits. · Where appropriate deploy refurbished or new EMU. · Consider cascade opportunities. · Consider allowance for growth.
C	There are 555 longer distance Type C diesels which will be 35 years old by 2040 (see Decision Block 3) – request market proposals for upgrades this decade.	· Aim to reduce carbon and improve AQ immediately. · Allows time for roll out of decarbonisation plan on the relevant routes and reduces diesel 'under the wires'.
D & E	Restart the procurement to replace the 588 South Eastern EMUs and consider options for at least 500 more.	· Existing procurement would be quick to restart.
LHCS	Consider progressing the LNER procurement and review the case for refurbishment or replacement of the balance of the 313 loco hauled coaching stock.	· Existing procurement would be quick to restart.
Tube	Confirm the existing option for replacing Bakerloo Line stock.	· The 1972 stock is the oldest still in use.

This c2600 vehicle programme represents approximately five years work for industry and so would mitigate the risk of factory closures and loss of jobs and capability cited earlier.

There is also the option to consider upgrading/renewing the c1650 DMUs which become 35 years old after 2030 to reduce their carbon and improve air quality immediately.

These would be 'no-regrets' decisions as the affected rolling stock will provide immediate benefits and will be required in the long-term. These decisions would also 'buy time' to develop a cross-industry strategy for a smoother and more efficient profile for younger vehicles (35 years old after 2030) using the approach outlined in the following section (4.2).

Recommendation 1: Government clients (Department for Transport, His Majesty's Treasury, Devolved Bodies) to make decisions in 2023 to allow the procurement and private financing of rolling stock upgrade or replacement of c2600 vehicles by 2030 to improve passenger services, reduce carbon and improve air quality now, and avoid an imminent existential risk to the UK supply chain. For the same reasons consideration should also be given to upgrading/ renewing the c1650 DMUs which become 35 years old after 2030.

4.2 Developing a long term rolling stock strategy

To support the proposed Long Term Plan for Rail, RIA sets out in the following section its view on the factors to consider in developing a long term rolling stock plan. Further to the background in Section 3.0, RIA believes there are four major considerations in making decisions around the existing rolling stock fleet:

1. Age and Condition (see Section 4.2.1).
2. Addressing growth and changing customer requirements (see Section 4.2.2).
3. Decarbonisation and air quality improvement (see Section 4.2.3).
4. Avoiding 'boom and bust' to reduce costs (see Section 4.2.4).

Each of these will be considered in turn in the following sections which leads to the following recommendation.

Recommendation 2: Government clients to work with RIA to develop a long-term rolling stock and decarbonisation strategy which has the ambition to consider equally passenger experience, carbon reductions, air quality improvement and sustainability of the supply chain. The strategy should aim to smooth out 'boom and bust' to create the conditions for increased productivity and reduced whole life cost.

In the longer term this could be the responsibility of Great British Railways when/if established.

4.2.1 Influence of age and condition

Rolling stock is a valuable asset and is expected to deliver a reliable and attractive customer service and a return on investment for its owner. It is therefore important that rolling stock is meeting customer needs and remains affordable to maintain and operate. This is also a competitive market and so there is pressure for whole life efficiency. As a result of these issues asset owners, manufacturers and users are mindful to optimise the life of rolling stock. When making decisions for a fleet there are a number of options including:

- Upgrade or refurbish to extend asset life and functionality.
- Replace by cascade. For example, replacing the oldest trains with midlife trains perhaps with a mid-life refurbishment. Surveys show that the public often think a refurbished train is new.
- Replace with a new train (either directly or to facilitate the cascade).

For planning purposes, this document assumes that a final decision on the future of a vehicle will be made when it is around 35 years old (40 years for Tube stock) on average. It is also assumed that a vehicle will have a major refurbishment on average at around half that age at, say, 15 to 20 years old.

We have used this criteria to establish the potential minimum demand for rolling stock refurbishment or replacement. Using the RIA rolling stock database we have plotted the profile of when vehicles in the national fleet (mainline) become 35 years old (40 years for Tube stock) and this is shown in Figure 3a below. This assumes the fleet size is constant with any requirement to accommodate growth being additional.

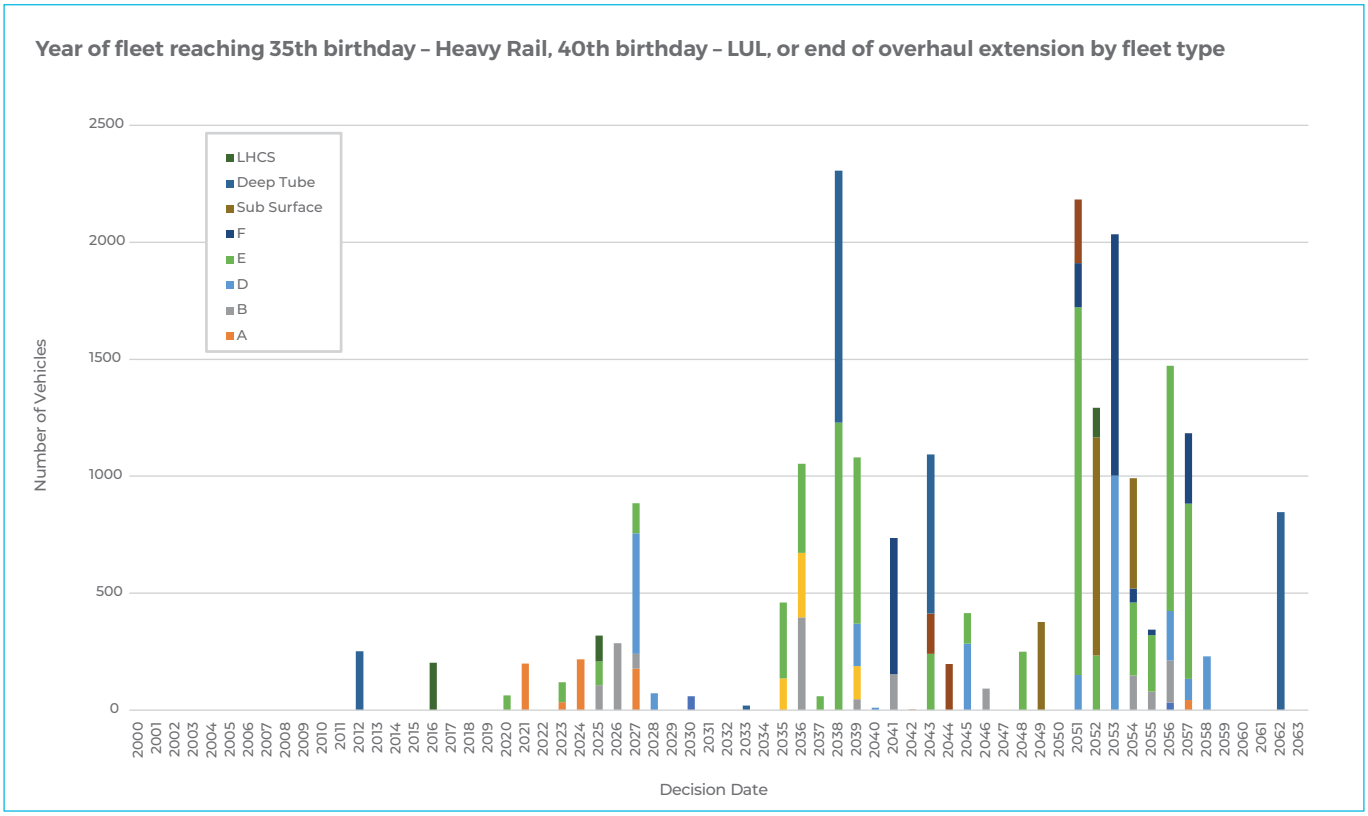

***Figure 3a** Mainline (and TfL) passenger rolling stock – 35 years of life (assumed latest decision point) – by Type of Vehicle as listed below:*

- *A – Shorter Distance Self-Powered (e.g. diesel[5], generally with 75 mph maximum speed)*
- *B – Middle Distance Self-Powered (e.g. diesel, with 90 or 100 mph capability)*
- *C – Long Distance Self-Powered (e.g. diesel, with 100 or 125 mph capability)*
- *D – Shorter Distance Electric (generally with 75 mph maximum speed)*
- *E – Middle Distance Electric (with 90/ 100/ 110 mph capability)*
- *F – Long Distance Electric (with 100/ 125/ 140 mph capability)*
- *G – Very High-Speed Electric (140 mph and above)*
- *Deep Tube, Sub-surface – London Underground (TfL) Stock (at 40 years life)*
- *LHCS – Loco Hauled Coaching Stock*

As would be expected, given the profile of Figure 1, Figure 3a continues to show an inefficient 'boom and bust' cycle. In Section 4.2.4 we will propose an approach to smooth this profile.

4.2.2 Addressing growth and changing customer requirements

Given the immediate need to address the current hiatus in rolling stock orders this document considers only the replacement or refurbishment of existing trains. RIA envisages further work to establish a reasonable planning assumption for growth.

Surveys[6] tell us that comfortable, reliable trains are a key factor in attracting and retaining rail passengers. An attractive customer proposition will support modal shift and revenue growth. Older trains can have as good an ambience as new trains if well refurbished but, like any machine, trains eventually become uneconomic to maintain and must be replaced.

5 For the purposes of this paper Types A, B and C are diesel-only vehicles. Other self-powered vehicles eg Battery EMU are identified by Power Source – see Figure 3b.

6 https://www.transportfocus.org.uk/news/back-to-basics-what-passengers-want-from-rail-services

With regard to customer requirements, it is proposed that the client and end user bodies collaborate to develop more consistent high-level requirements that the market can respond to effectively and affordably.

Although perhaps not a direct customer requirement it is also important to consider railway system requirements such as the roll out of digital in cab signalling (ETCS).

Recommendation 3: Government clients and TOCs to collaborate on high level specifications for the different types of train (A to G) including any requirements for functional interoperability. These specifications should be consulted on with the supply chain to ensure they are deliverable affordably.

4.2.3 A strategy for decarbonisation and air quality improvement

The decarbonisation and air quality challenge for rail

Rail is already a low carbon mode however to contribute to the UK net-zero 2050 target and to sustain its competitive position versus other modes it is essential that rail decarbonises. Therefore, decarbonisation and air quality are key considerations for the future of any given fleet. This is reflected in the commitments in the government's 2021 Transport Decarbonisation Plan. In the case of rail this plan includes the following key commitments:

1. ***We will deliver a net zero rail network by 2050, with sustained carbon reductions in rail along the way. Our ambition is to remove all diesel-only trains (passenger and freight) from the network by 2040.***
2. ***We will deliver an ambitious, sustainable, and cost effective programme of electrification guided by Network Rail's Transport Decarbonisation Network Strategy (TDNS).***
3. ***We are supporting the development of battery and hydrogen trains and will deploy them on the network as we decarbonise. We will also use technology to clean up diesel trains until they can be removed altogether.***

RIA and its members strongly support this policy position and welcomed it when it was published. RIA have analysed progress against this plan after two years and found rail is significantly falling behind in its decarbonisation progress[7] compared to other modes. This lack of progress has also been noted by the Transport Select Committee in their March 2023 Fuels of the Future report[8]. Most concerning there is no visibility of the plans for either infrastructure or rolling stock decarbonisation.

RailDecarb23

RIA are calling for these commitments to be met through our RailDecarb23[9] campaign:

Our four-point plan for RailDecarb23:

1. Immediately implement a rolling programme of cost-effective electrification on intensively used lines.

2. Ramp-up fleet orders of low carbon rolling stock using new traction methods on less intensively used parts of the network, including hydrogen and battery.

3. Government, Network Rail and other rail clients to work with suppliers so they never lose out for offering lower carbon solutions, but are incentivised to reduce emissions.

4. Planning for cost efficient delivery.

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Getting rail decarbonisation on track

It is increasingly clear that **air quality** will be a significant additional consideration in prioritising the replacement or improvement of diesel trains in order to improve particulate matter and NOx pollution at air quality 'hot spots'.

7 https://riagb.org.uk/RIA/Newsroom/Press_Releases/New_report_reveals_Government_falling_behind_on_rail_decarbonisation_targets.aspx
8 https://committees.parliament.uk/work/1711/fuelling-the-future-motive-power-and-connectivity/news/
9 https://riagb.org.uk/RIA/Newsroom/Stories/Rail_Decarb_23.aspx

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There is ongoing work by RSSB on behalf of DfT which will lead to new targets and Air Quality Improvement Plans which will need to be considered as part of rolling stock strategy.

The scale of the challenge

The challenge to decarbonise and improve air quality can be understood by considering the proportion of diesel-powered trains in the national fleet as illustrated in Figure 3b below.

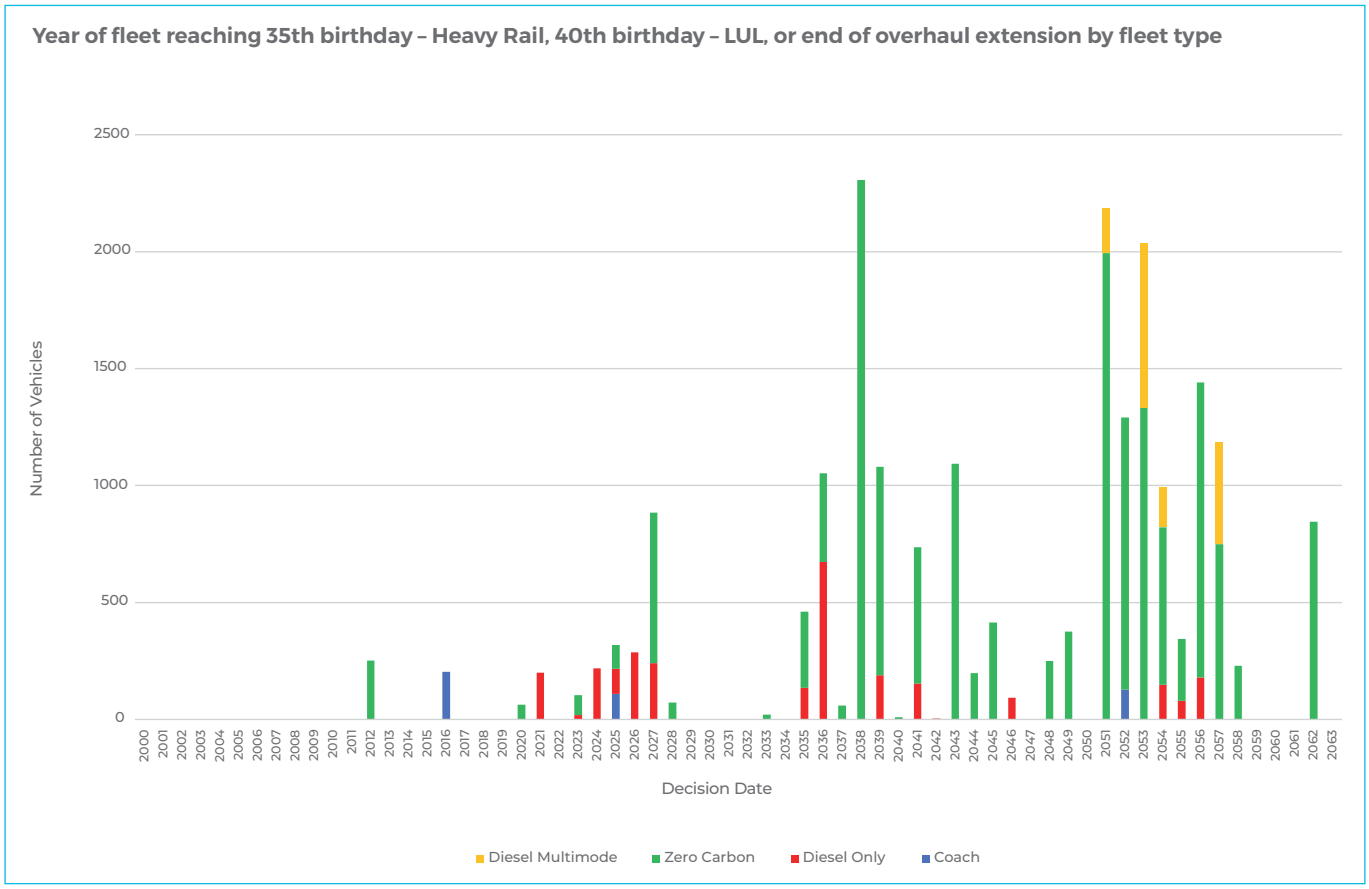

Figure 3b ***Mainline (and TfL) passenger rolling stock – 35 years of life (assumed latest decision point) – by Power Source***

It can readily be seen from Figure 3b that there is an immediate opportunity to decarbonise a large number of diesel trains which are or will soon be 35 years old. On the other hand there are 655 diesel only trains which will only be mid-life by 2040 when the aspiration is that all diesel only fleets will be removed. This can be more clearly seen in Figure 3c which considers the diesel only rolling stock separately.

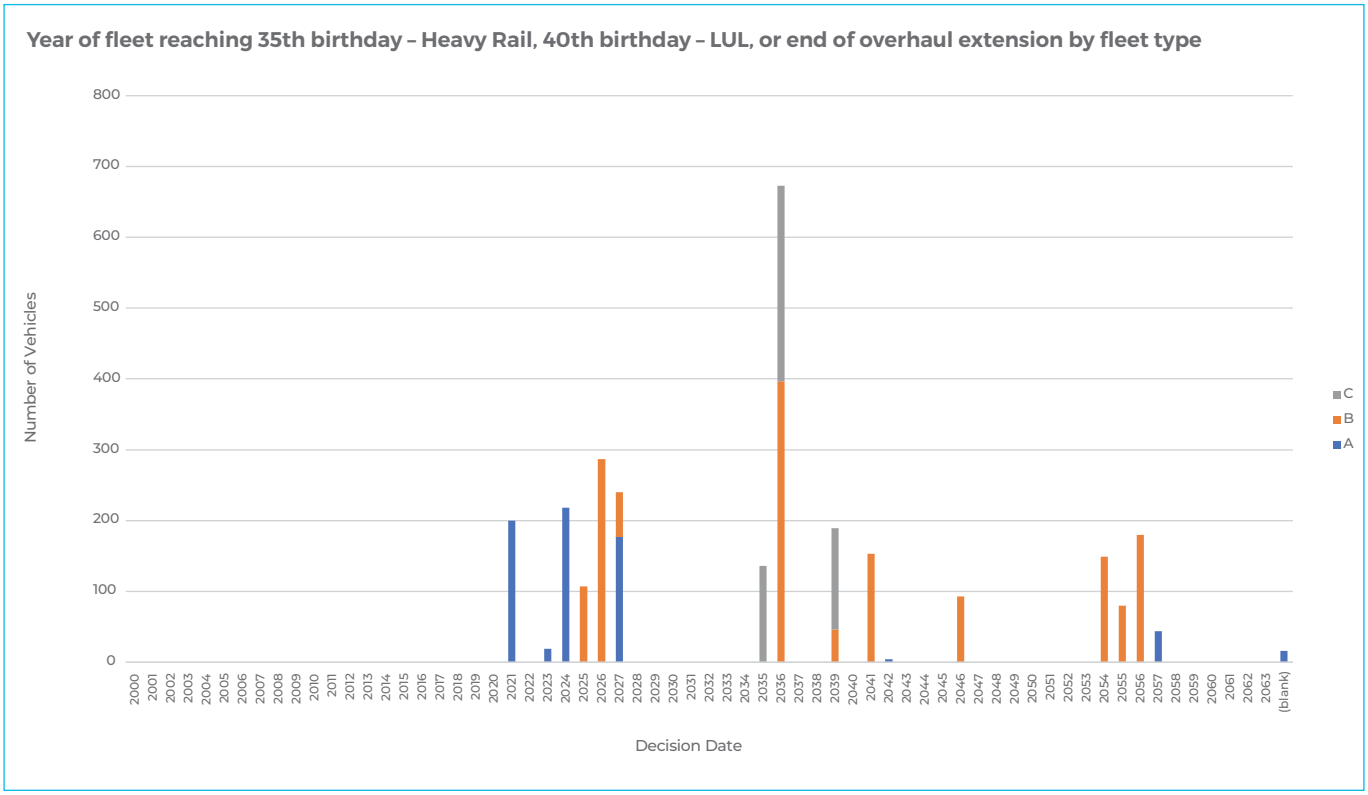

Figure 3c ***Mainline diesel-only passenger rolling stock – 35 years of life (assumed latest decision point)***

Unlike other modes such as aviation and, to a lesser extent road haulage, rail has the advantage of having proven means of decarbonisation both electrification and zero carbon rolling stock including battery and hydrogen. There are also options to reduce the carbon of existing diesel vehicles. Attractive rail services can also contribute to decarbonisation by encouraging modal shift.

The contribution of electrification

In this document we are focussing on the immediate decisions that are needed for trains to be introduced by 2030. Therefore we will assume no new electrification beyond that already committed (Transpennine, Cardiff, Valleys) or under consideration (Midland Main Line, Scottish Decarbonisation Programme). However, to optimise this programme and achieve net-zero by 2050 it will be necessary to make some assumptions about what will be electrified and by when and this will be a future phase of RIA's work. **In the absence of a phased map of electrification roll out it is not practicable for rolling stock owners or buyers to make rational decisions.**

At this point however it is important to recognise that electrification is the only decarbonisation technology suitable for long distance freight trains and faster passenger trains (above 100mph). This is explained in previous RIA publications 'Why Rail Electrification'[10] and 'Rail Electrification – The Facts'[11]. Therefore it is the RIA view that that electrification is the only viable solution for the core network of intensively used lines. However it may not be necessary to electrify all of the 13,000 km proposed in the 2020 Traction Decarbonisation Network Strategy[12] and RIA will be doing more work on this.

10 https://riagb.org.uk/RIA/Newsroom/Publications%20Folder/Why_Rail_Electrification_Report.aspx

11 https://riagb.org.uk/RIA/Newsroom/Publications%20Folder/Rail_Electrification_The_Facts.aspx

12 https://www.networkrail.co.uk/wp-content/uploads/2020/09/Traction-Decarbonisation-Network-Strategy-Interim-Programme-Business-Case.pdf

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The role of low and zero carbon technologies

However, RIA also recognise that electrification will not be practical or affordable everywhere and note that fleets of zero-carbon self-powered rolling stock are being rolled out in other countries and so suppliers have strong relevant experience. The first Battery EMUs (BEMU) have been deployed in the UK and there are UK Hydrogen Train prototypes. Hence RIA has confidence in calling for fleet orders of zero-carbon self-powered rolling stock.

Indeed significant fleet orders of new zero-carbon self-powered rolling stock and associated infrastructure (which could be delivered and privately financed as a package with the rolling stock) would stimulate a new industrial sector. This would create and retain jobs and intellectual property in the UK whilst accelerating the decarbonisation of the network and supporting future exports. There is an opportunity for UK rail to become a global leader in battery and hydrogen technologies, with rail demand helping to create the UK market necessary to stimulate growth and kick start the zero-carbon economy.

Based on this RIA propose the following principles to guide the decarbonisation considerations of a rolling stock strategy:

Proposed overall principles for rail decarbonisation and air quality improvement

- Where electric trains already operate, they will be replaced by electric trains.
- Where diesel only trains already operate **no new diesel trains** should be bought and early carbon reduction should be maximised by a judicious mix of:
  - Early introduction of zero carbon self-powered rolling stock if the route is never likely to be electrified or will be a low priority for electrification. Or use bi-mode/multi-mode rolling stock if the route is partially electrified.
  - Diesel only trains with a useful remaining life should be considered for early carbon reduction and air quality improvement upgrades eg stop-start, hybridisation, drop-in fuels etc. These units have the potential to perform a useful function through cascade as further routes are electrified. For this reason and to avoid the embodied carbon and financial cost of retiring mid-life DMUs at 2040 it is proposed that the ambition to remove all diesel-only trains by 2040 should be changed to focus on maximising cumulative carbon reduction and air quality improvement.
  - However, the intention to remove diesels (or at least diesel fuel) should be reinforced by a decision not to buy any more diesel only trains the lease costs of which are likely to become uncompetitive compared to zero carbon alternatives.
  - Consideration of air quality improvement plans for specific locations and the potential impact of changes to rolling stock.
  - This approach is illustrated in **Figure 5 – Diesel only decision tree**.
- As routes are electrified, fleet cascade, early upgrades and new build should minimise and preferably eliminate ‘diesel under the wires’. Bi-mode/multi-mode trains have a key role in exploiting the wires wherever they are available.
- In the longer term where diesel bi-modes operate the objective should be to reduce their carbon output by a combination of
  - The electrification programme increasing the proportion of the journey ‘under the wires’.
  - Technical improvements to reduce carbon for example conversion to battery bi-mode where the duty cycle allows or the use of low carbon ‘drop in fuels’ or other carbon reduction approaches for Internal Combustion Engines.

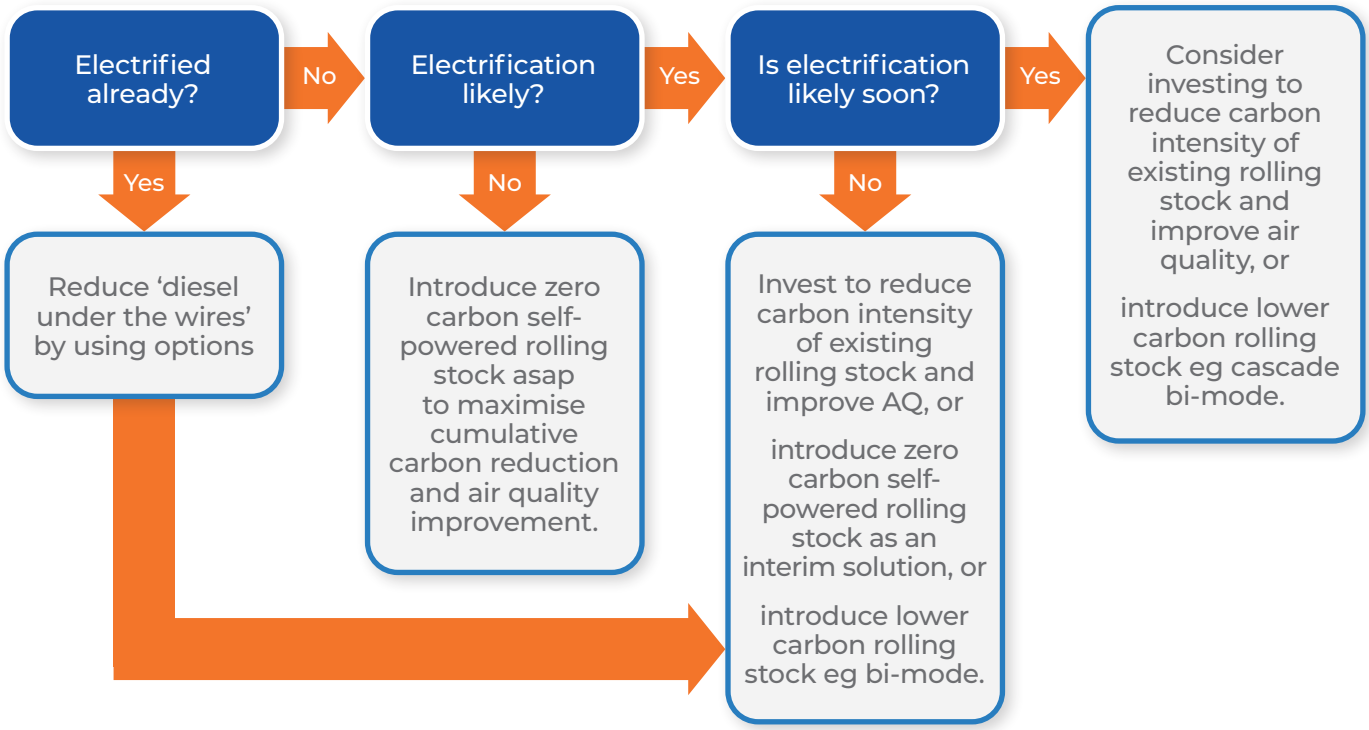

Figure 5 ***Diesel only decision tree***

Recommendation 4: The ambition to remove all diesel-only trains (passenger and freight) from the network by 2040 to be replaced by an ambition to maximise the cumulative reduction of carbon (and improvement of air quality) by the most appropriate means through both direct decarbonisation of rail and through modal shift. However no new diesel only trains should be bought.

4.2.4 A strategy to avoid 'boom and bust' and reduce costs

Other strategic manufacturing sectors supplying low (compared to say automotive) volumes of complex assets from small number of major suppliers (eg aviation, defence and some EU rail operators) have recognised the importance of supply chain sustainability. In these sectors there are examples of long-term strategic relationships, capacity management, orders with options for extension amongst other measures. In the UK the Deep Tube programme is a relatively rare example of an order with options for further orders. There is the opportunity to exercise options strategically to deliver supply chain and purchase price benefits.

How could these approaches be applied to UK rail?

To illustrate a potential approach, consider the following assumptions;

- 500-600 Vehicles need to be upgraded/renewed per annum to maintain the existing fleet (ignoring any growth) – based on a national fleet of in-service/being introduced passenger of c21300 vehicles (16650 Heavy Rail, 4650 Tube) and 35 year notional life/decision point (40 years for Tube stock).
- The same number of vehicles need to be refurbished per annum if we assume one mid-life refurbishment.
- An order takes 3 to 4 years to complete.
- So an order every 3 to 4 years for 600 vehicles would represent an activity level of 150 to 200 vehicles per annum per facility.
- Equally 3 orders per annum for say 200 vehicles would achieve the same.
- Similar metrics would apply to refurbishment.
- Normal competition would apply and so the opportunity is for every facility to have a base level of activity of 150-200 vehicles per annum, but competitive tension remains.

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How would this be achieved?

- RIA would collaborate with Government clients (Department for Transport, His Majesty's Treasury, Devolved Bodies) to develop a rolling stock strategy and a forward look pipeline with the objective that the pipeline averages 500-600 vehicles per annum plus any growth requirement. (See Recommendation 2)
- Government clients then compete as normal or draw down from previously contracted options.
- RIA would envisage basing the strategy on consideration of the 'decision blocks' as illustrated in Figure 5 below plus an allowance for growth. This approach was used to examine the immediate decisions detailed in Section 4.1. Considering the fleet in 10-year blocks facilitates thinking about smoothing.

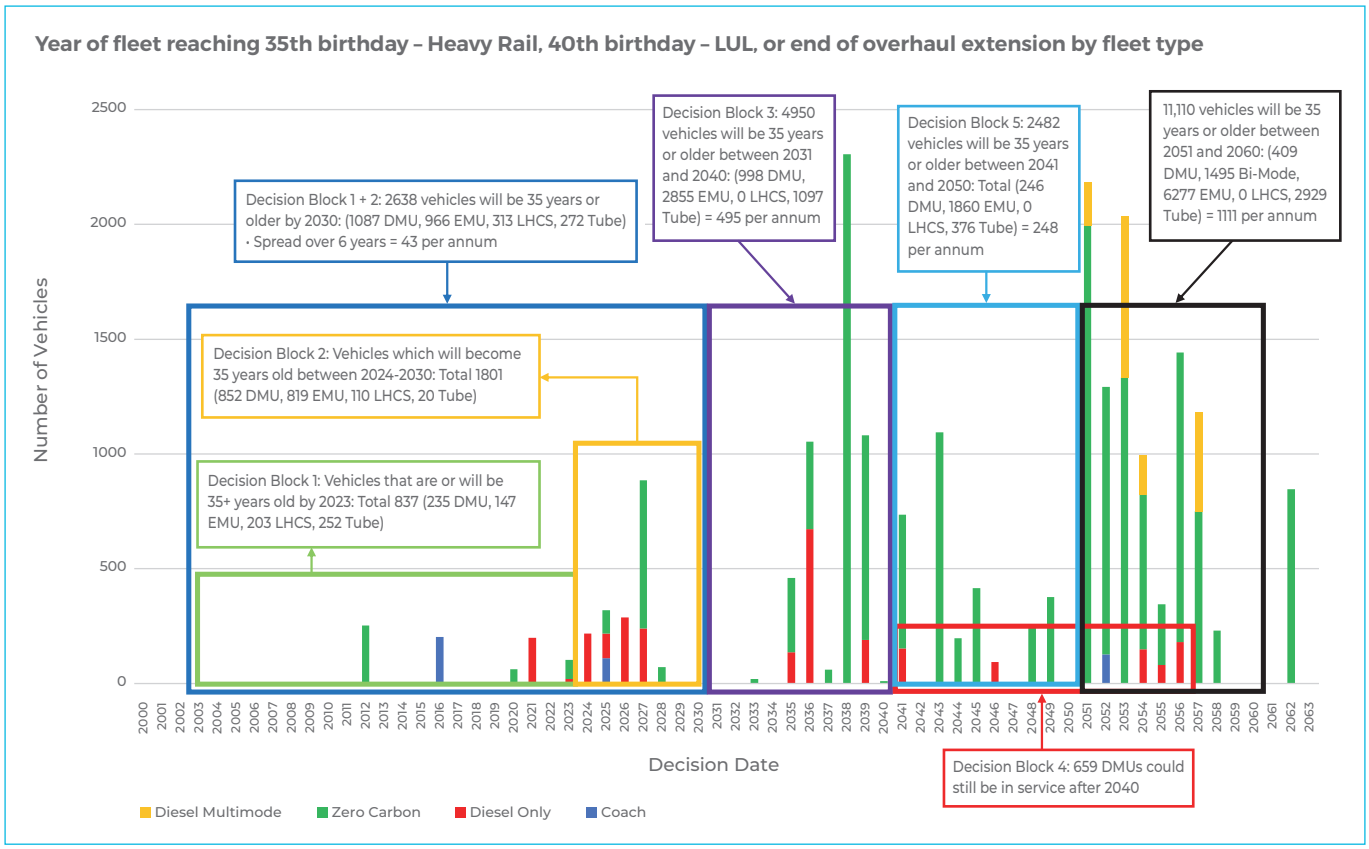

Figure 5 ***Mainline (and TfL) passenger rolling stock – 35 years of life – decision blocks***

What would the benefits be?

- Reasonable confidence of a baseload for each major facility would incentivise investment in people, plant and process which would improve productivity and thus reduce cost.
- A more consistent and smoother order profile would reduce waste and downtime and thus reduce cost.
- The risk of significant redundancies and factory closures would be largely mitigated.
- Competition would be sustained.
- The counterfactual is that without an approach of this sort and/or without orders being placed in the next 12 months, it is likely that several facilities could close.
- If the order drought is extended, it is certain that trains from the remaining facilities are likely to be more expensive and if most of the facilities have been lost, it is likely that the UK would become increasingly dependent on imports of rolling stock and the indigenous design and manufacturing capability would be diminished or even lost.

Railway Industry Association

The voice of the UK rail supply community