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Rolling Stock Strategy

Market Engagement Exercise 30/01/2023

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Introduction

Phil Denson
Senior Procurement Manager, Major Projects

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Welcome & Objective of Today's Session

- *Welcome to the first day of our train replacement Programme*
- *Introduce opportunity to Market*
- *Share and test our ideas*
- *Seek your participation in helping refine our potential strategy and documentation*
- *High-level overview of our Programme*
- *Introductions to NTL team as we go through the Agenda*

Housekeeping

- *Please ensure microphones are muted, and cameras are switched off.*
- *This Market Engagement exercise is entirely independent of any procurement exercise that may or may not be undertaken by Northern, and participation will not influence the outcome of any procurement activity.*
- *As per invite, session is being recorded and will serve as the record of the session and be made available on NTL website.*
- *List of attending organisations will also be made available on our website.*
- *If you need to contact us, please do so only by email at ntl.procurementfleet@northernrailway.co.uk and do not make direct contact with any of the NTL team or advisors.*

Q&A Process

- *Hold all questions until the Q&A section at the end of the presentation*
- *Do not post questions in 'chat' - difficult to monitor in such a large group*
- *If you have questions during the Q&A section at the end of the presentation, raise virtual hand and we'll come to you*
- *There will be opportunity to ask detailed questions when we issue questionnaire, and during 1-2-1s.*

Agenda

Item	Who	Time
Introduction	**Phil Denson** Senior Procurement Manager, Major Projects	5 Mins
Opportunity and Vision	**Rob Warnes** Strategic Development Director	10 Mins
Technical Requirements Overview	**Steve Rowell** Director of New Rolling Stock Programmes	25 Mins
Procurement	**Neil Bowen** Head of Procurement	10 Mins
Contractual Structure	**Jenny Henderson** Head of Legal	10 Mins
Q&A, Next steps, and Close	**Phil Denson** Senior Procurement Manager, Major Projects	30 Mins

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Opportunity and Vision

Rob Warnes
Strategic Development Director

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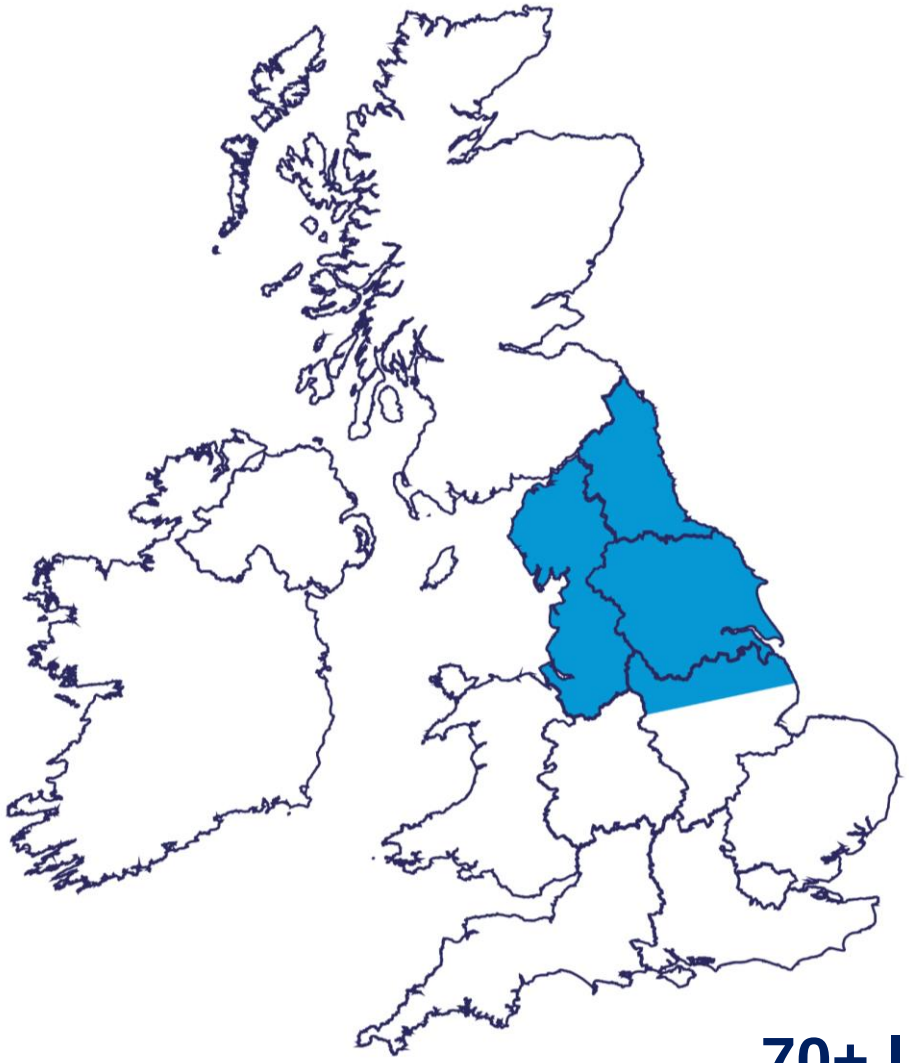
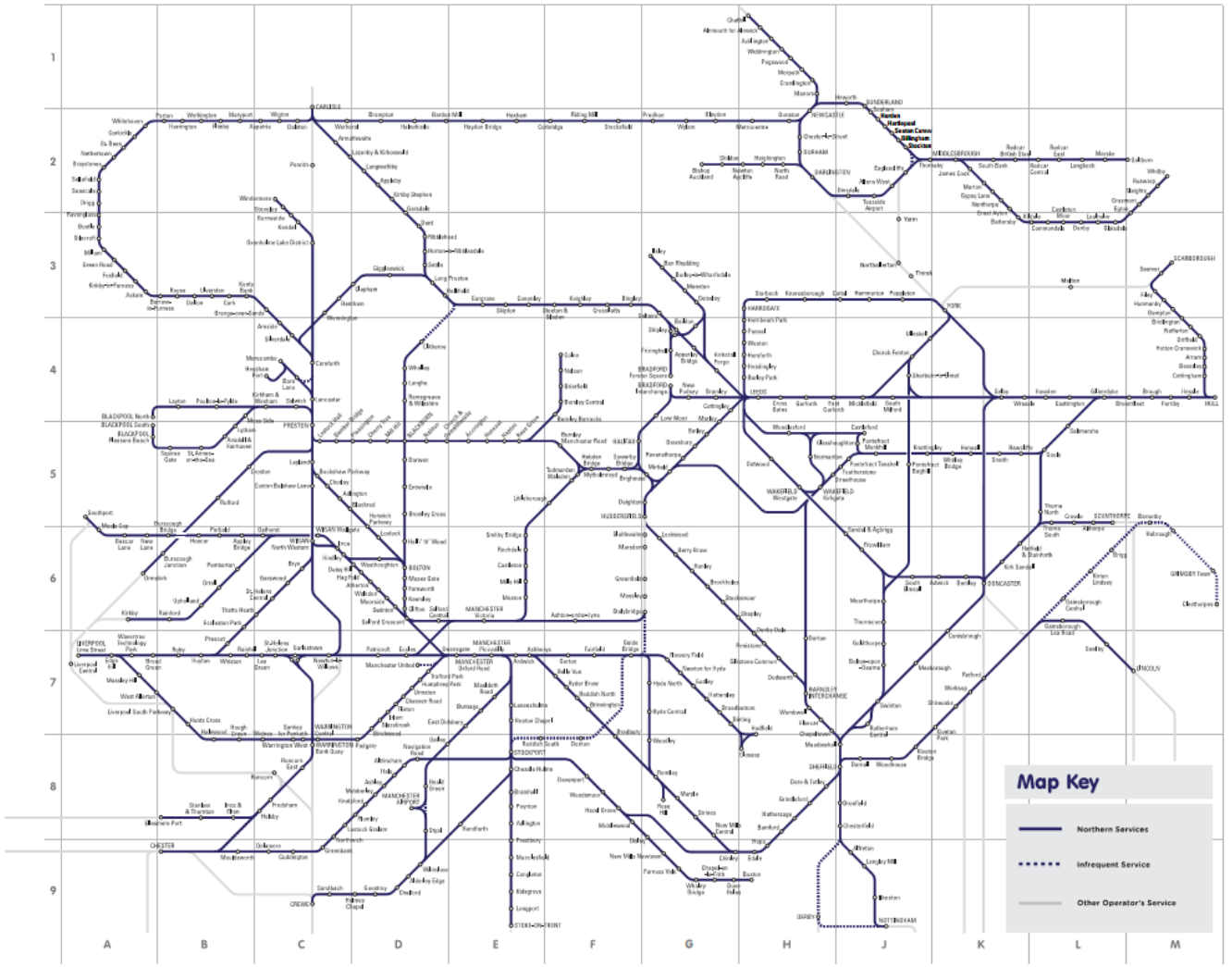
Our vision:

“Make a positive impact for the North in all we do and for all we serve”

Where we operate





70+ lines of route & 63 million train Km/annum

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2600 services per day (pre covid)

Call at **500+** stations

175

Parliamentary constituencies

7,000 employees

24% of Northern routes electrified

Share network with **9** other operators

c85-90 million
Customer journeys per annum

2/3 of rail journeys in the north are on Northern services

10

maintenance locations

50 stabling locations

11 different types of train

6 diesel fleets

4 electric fleets

1 bi-mode fleet

367 Trains

947 Vehicles

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Social and economic value of Northern

Rail in the North matters

- Operation attracts high government subsidy
- Employs c7,000 people plus
- Supporting the supply chain with c4,300 jobs
- Connecting people with employment, education and leisure
- Every £1 (subsidy) invested in Northern generates around £2.50 of economic activity

Serving communities

75%

of rail journeys in the North are on our services

For **25%**

of households in the North we're the sole provider of services

We work with our stakeholders and customers

20 Community Rail Partnerships

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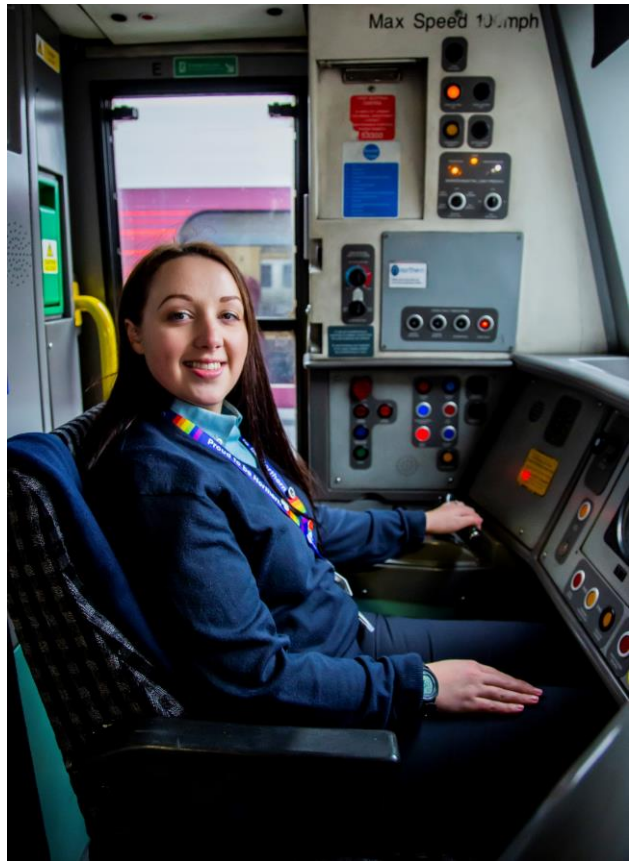
Northern as an employer

c7,000 employees



c1,900 Drivers

c1,400 Conductors

c850 Station Staff

c1,700 Engineering Staff

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Northern Rolling Stock Strategy

- Phased approach to life expired fleet replacement
- Initial phase: 15X replacement
- Simplification through reduction in fleet types - Homogenisation
- Diesel is likely to continue to play a role beyond 2040
- Northern's electrification priorities published

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The Case for Change

DfT aims and Policy:

- 2040 not primarily Diesel ambition, 2050 Net Zero requirement

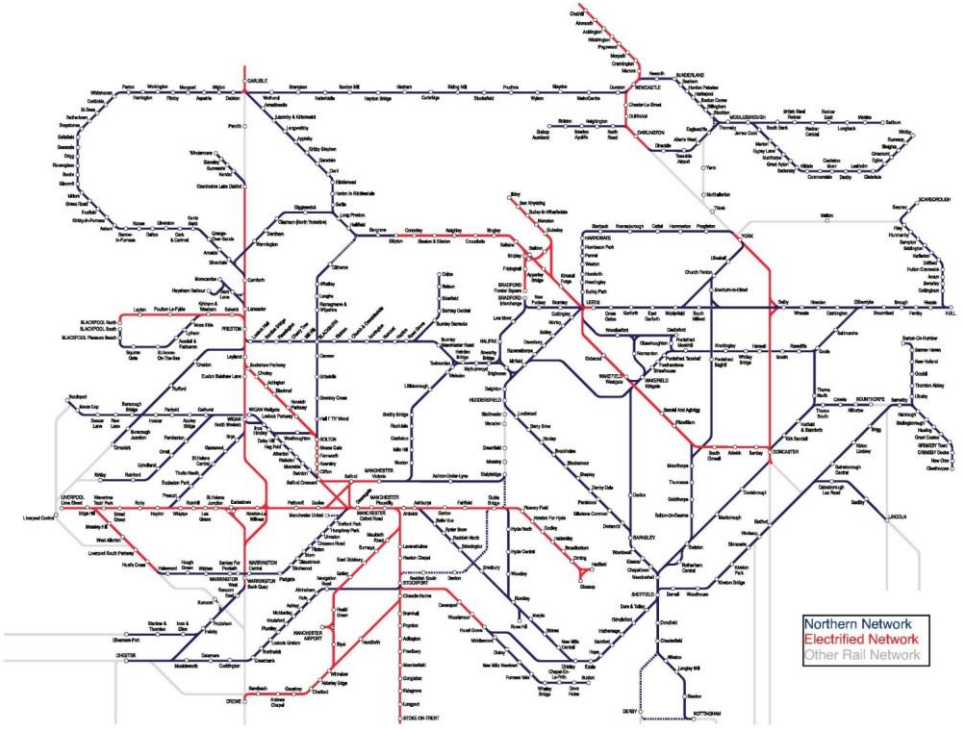
Current position:

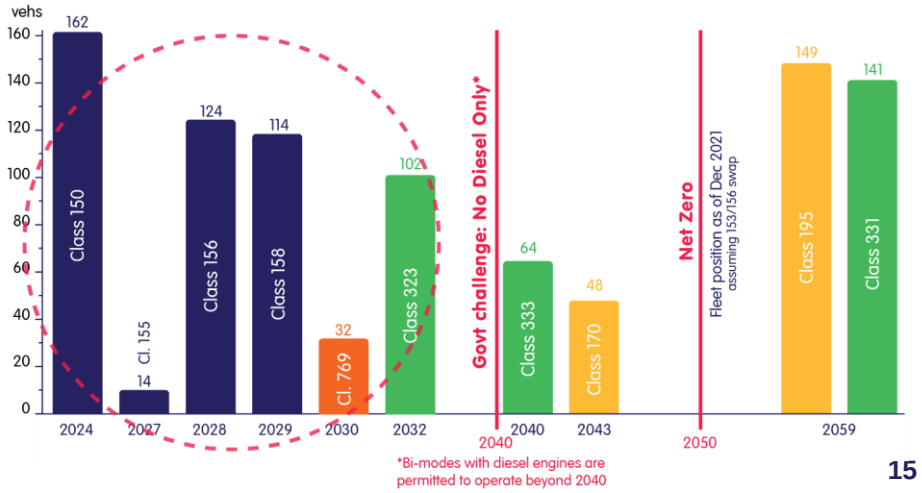
Network: 73% of NTL operation is Diesel, 24% of the NTL network is electrified; nothing approved for the north beyond Wigan-Bolton, Man Vic - Stalybridge and TRU.

- Fleet: The total number of vehicles to be replaced before 2040 constitutes just over 83% of NTL's current fleet (excl cl195 which will need traction modifications)

Why now?

- New build lead time – c4/5 years
- Insufficient appropriate cascade in the market at scale required
- Life expired Fleet condition





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Technical Requirement Overview

Steve Rowell
Director of New Rolling Stock Programmes

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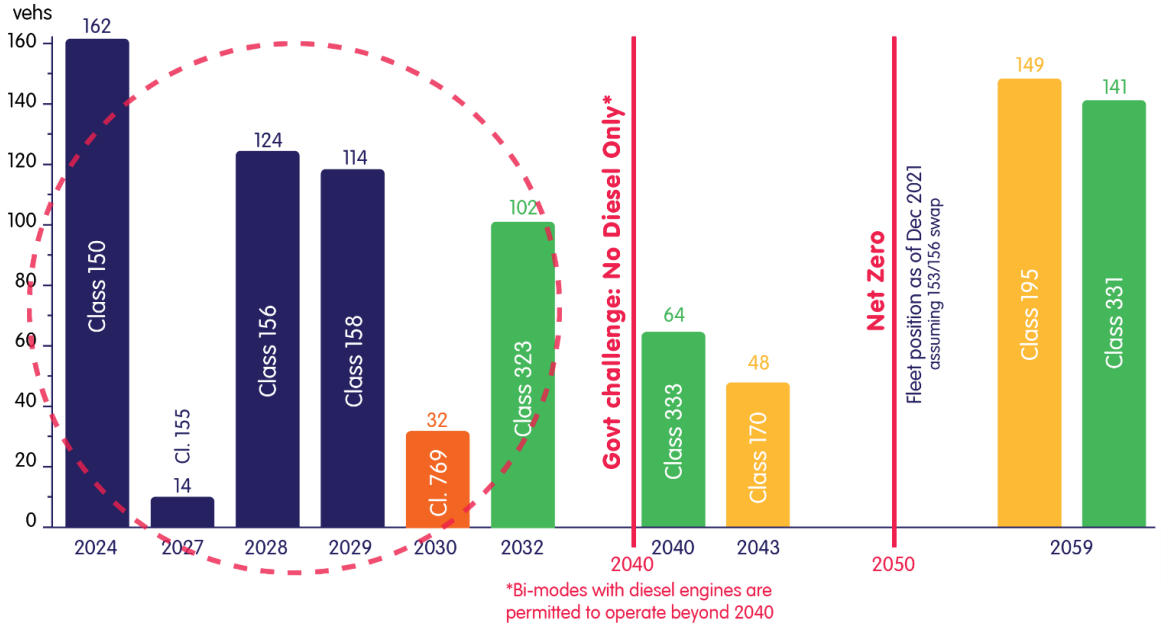
Background – current fleet

- Ageing fleet of DMU and EMU vehicles
- Current fleet size 947
- Replacement over the period up to 2040
- c550 vehicles to be replaced by 2032
- Start of entry into service by 2027



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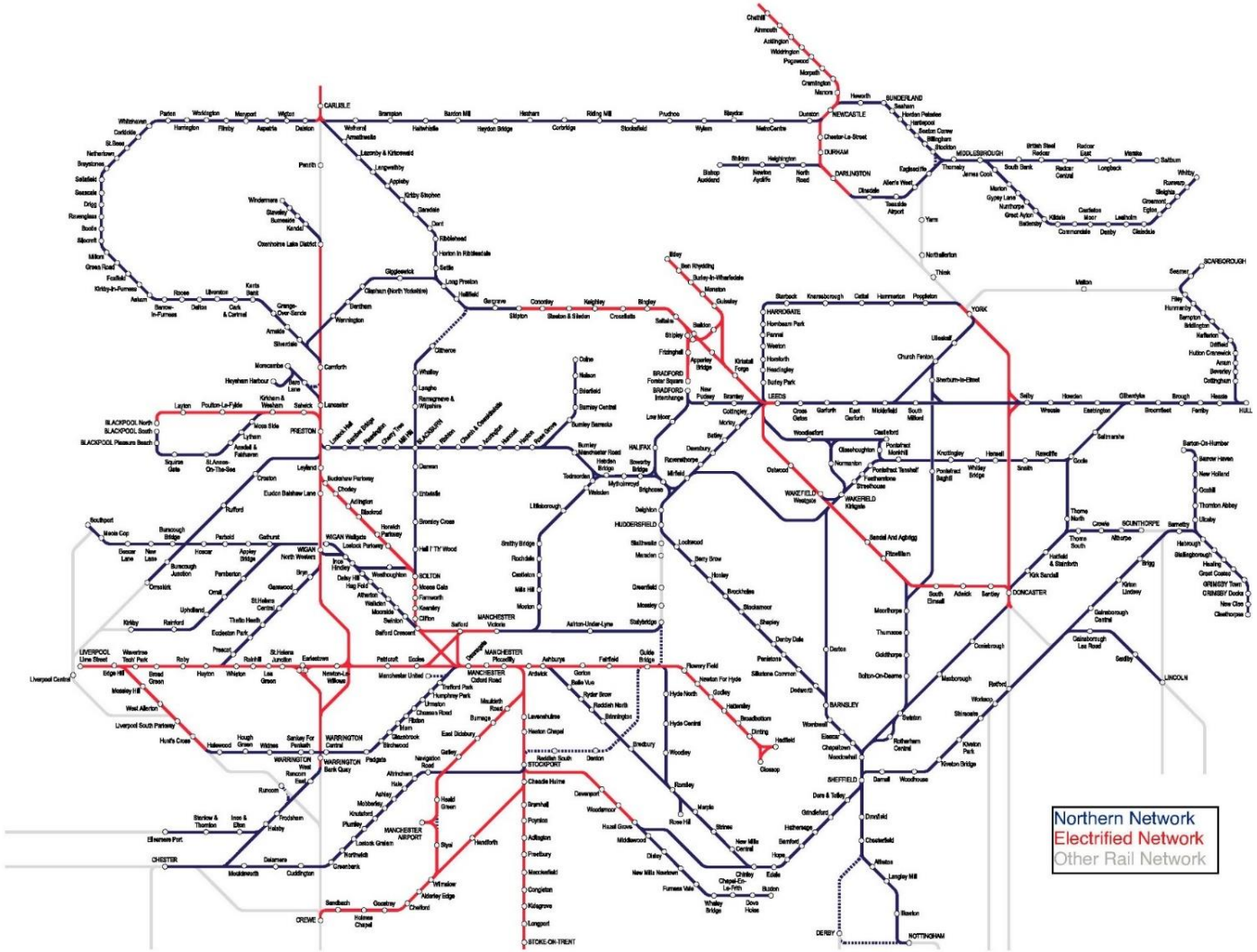
Government carbon-neutral aim for Railway by 2050



Considerations for propulsion options:

- Only 24% of Northerns route network electrified => pure EMU fleet no option
- Working towards net zero
- Hydrogen currently uneconomic due to lack of UK hydrogen supply base
- Battery propulsion currently has great promise for shorter unelectrified routes, but insufficient capacity on existing 25kV infrastructure to support battery operation

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Potential Propulsion Solution - reconfigurable to EMU or BEMU in future

Multi-mode unit

- operating on-wire as conventional 25kV EMU and
- off-wire under diesel-electric propulsion,

- Traction battery for emission-free station operation
- Regenerative energy capture in diesel mode
- Fully convertible to EMU or BEMU status at later stage

‘Future-proof’ Northern’s operations:

- continuity of operation over today’s infrastructure
- taking advantage of future electrification schemes
- Reduce diesel operation over time

Batches can be different – MMUs, EMUs, BEMUs

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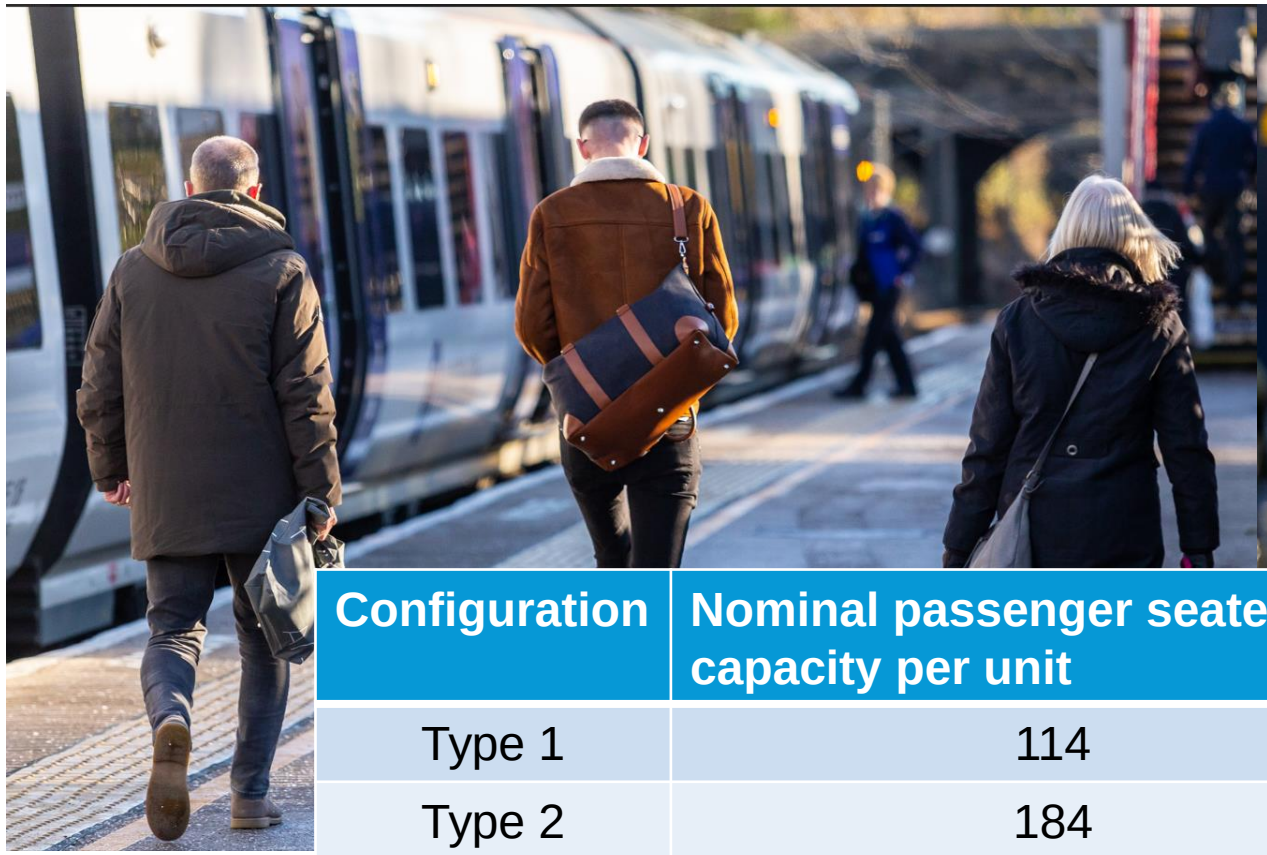
Passenger Capacity



Configuration	Nominal passenger seated capacity per unit	Nominal standee capacity per unit
Type 1	114	105
Type 2	184	155
Type 3	260	205

Three basic unit configurations (all based on 2.22 standees per m^2)

Seating capacities are for fixed seating only and do not include perch seats etc

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Passenger Environment and Facilities

In addition to RVAR / PRM -mandated facilities, required features include:

- A mix of table and airline seating, with additional seating provided by perch seats.
- All seating to be 2+2 format,
- Adequate storage for luggage, bicycles and pushchairs/buggies,
- Adequate provision of toilet facilities,
- At-seat charging facilities for mobile devices,
- Good WiFi connectivity,
- High-quality audio-visual passenger information systems.

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Passenger Environment and Facilities (continued)

- Connection between vehicles by a wide gangway without intermediate doors,
- A comprehensive CCTV system for improved safety and security,
- A comprehensive climate control (HVAC) system fitted to passenger saloons & driving cabs,
- Interiors designed to high presentational standards:
  - easy to clean,
  - hard wearing and
  - resistant to fading and marking (natural wear, vandalism)

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Accessibility

High-floor vehicles pose significant barrier to some of our passengers:

- Improved accessibility over and above those mandated under PRM legislation.
- Compatibility with the 915mm ARL standard platform height specified by Network Rail for new construction.
- Automatically-deployed gap-fillers to eliminate lateral gap between platform and train (especially at curved platforms).
- Potential enhancements such as
  - Possibility of power-deployed wheelchair ramps
  - Inductive hearing-loop systems
  - Braille signage.

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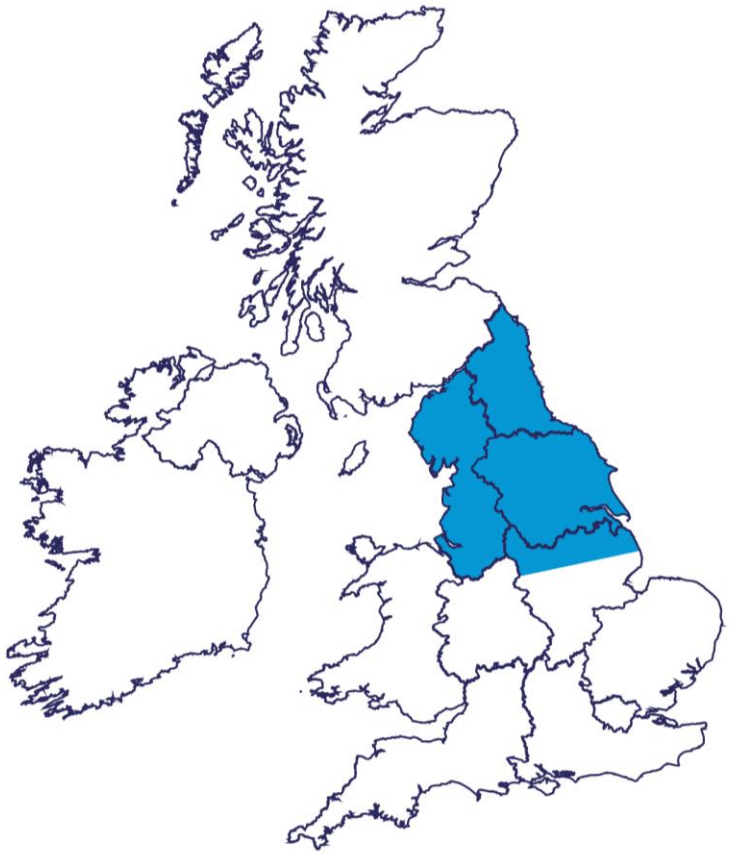
Route Compatibility across the Northern network



Train fit the route, rather than route be made to fit the train!

- Gauge clearance compatibility to avoid costly infrastructure changes;
- Unit length is important - Northern services operate into short terminal platforms and sidings,
- Compatible with all existing signalling and communications systems found across the Northern network.
- TCA equipment required for non-electrified Northern routes that use low-voltage track circuits,
- Fully-homologated ETCS L2 signalling system,
- ASDO equipment to enable safe operation at stations with sub-standard platform lengths.

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Train Performance

- 100 mph capability is required in both electric and diesel (battery) modes.
- Performance in electric mode to be comparable with that of a modern 25kV EMU,
- Performance in diesel mode to be comparable with that of a modern DMU,
- Automatic transition between electric and diesel modes under the control of APCO balises,
- Sufficient fuel capacity to give a diesel-mode range of 1,700 miles,
- Units must be able to run in passenger service in consists of up to three units operating in multiple, in both diesel and electric modes,
- Operation over an ambient temperature range of -20 to +40 ºC.

Maximise Energy Efficiency

Energy Efficiency is important for environmental performance and control of energy-related operating costs.

The train design should incorporate the following measures :

- Minimisation of drivetrain power losses,
- Brake energy recuperation,
- Vehicle weight optimisation,
- Use of energy-efficient HVAC systems, making use of waste heat, where possible,
- Use of energy-efficient lighting systems, with outputs controllable according to ambient lighting levels,
- Active engine & battery management in diesel mode, as well as switching off to match output to the required load.

Maintenance Considerations

Maintenance of Northern's current fleets largely time or mileage-based

→ over or under-provision of maintenance possible

Design for maintenance:

- Complete all routine inspection and maintenance work within a typical depot environment,
- Define all assets needed to enable maintenance (Infrastructure, Depot, Rolling Stock),
- Conversion programmes of diesel to battery must be fully understood, and the requirements for charging assets,
- Comprehensive training provision,
- Minimise staff hours required to undertake each task,
- Maximise overhaul intervals for major components to minimise overall lifecycle cost (engines, traction motors, wheelsets, bogies, traction batteries etc),
- TSA and TSSSA-based maintenance arrangements to be determined.

Software Integrity and Cyber Security

- Development and verification of software-enabled control systems using a rigorous methodology
- Thorough test-bench evaluation using representative train system hardware prior to deployment
- Upload of data to vehicles and physical security of control system access points policed via comprehensive and rigorous cyber-security policy
- Any third-party embedded systems employed:
  - Supplier must ensure absence of vulnerabilities / malicious access to train control systems

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Procurement Process

Neil Bowen
Head of Procurement

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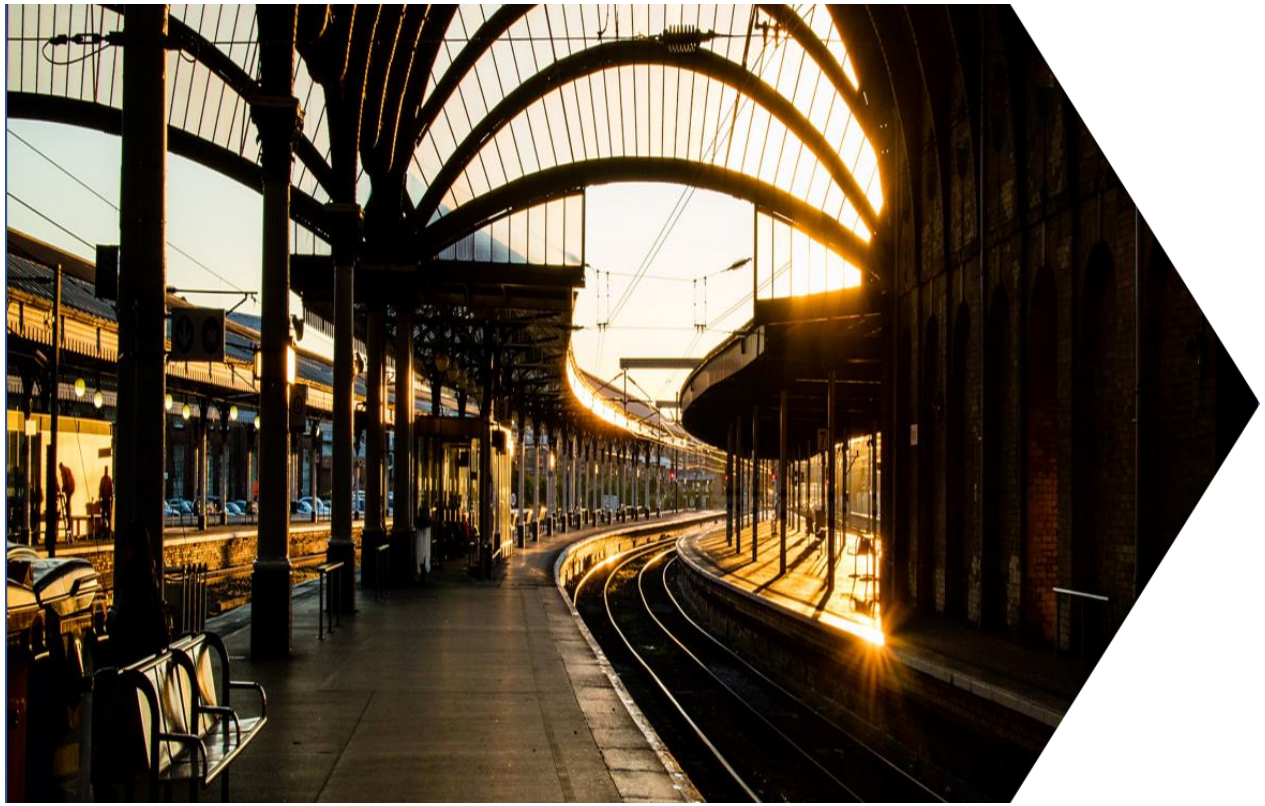
Topics

1. *Pre-Tender Market Engagement Process*
2. *Procurement Aims and Possible Procedure*
3. *Procurement Steps and Timeline (Indicative)*



Pre-Tender Market Engagement Process – Five Stages

Stage	Action / Activity
Awareness	Your Expression of Interest to attend this session.
Tell	This plenary session, with the opportunity for you to ask questions here, on the day.
Ask	We'll follow this session by issuing standard questionnaires to seek your (non-binding) answers to high-level questions; questionnaire will also give you the opportunity to ask questions of NTL. Issue and response expected to be February/March 2023
Discuss	Responses to questionnaires will form the basis of bespoke 1:1 discussions via Teams. Discussions anticipated to be March/April 2023
Disseminate	We'll consider questionnaire responses and subsequent discussions and feed into the development of the Tender process and documentation.

Procurement Aims and Possible Procedure

Aim	Possible Procedure	
To conduct a transparent procurement process under the Utilities Contracts Regulations 2016. Initial aim is to establish a single supplier (or consortium) framework, with first order committed at point of contract award, and subsequent requirements called-off as needed. This can be refined during Market Engagement and prior to commencement of formal Tender process.	We will utilise a 'talking' route to enable mutual clarification discussions and negotiations throughout the Tender Process., and conduct and streamline process to minimise both your, and our resource, time, and costs.	We are considering two procedures: Competitive Dialogue Procedure (CD): and Competitive Procedure with Negotiation (CPN). Both are effectively two-stage processes: 'Qualification' stage, followed by the 'Tender' Stage.

Next slide presents a high-level view of indicative timelines and general activities/steps regardless of CD or CPN route.

High Level Procurement Steps and Indicative Timeline

Activity/Step	Timeline/ Period
Contract Notice (CN) Published; and Selection Questionnaire (SQ), and Descriptive Document (DD) Issued	Q2/Q3 2023
SQ Responses Evaluated, and Tenderers Shortlisted	Q4 2023
Invitation to Negotiate (ITN) / Invitation to Participate in Dialogue (ITPD) Issued* *(dependant on chosen procurement process)	Q4 2023
Negotiation/Dialogue Sessions and associated Interim Proposals/Tenders from Tenderers	Q1/Q2 2024
Final Tenders Submitted and Evaluated	Q2/Q3 2024
Contract Award and Mobilisation	Q3/Q4 2024

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Contractual Structure

Jenny Henderson
Head of Legal

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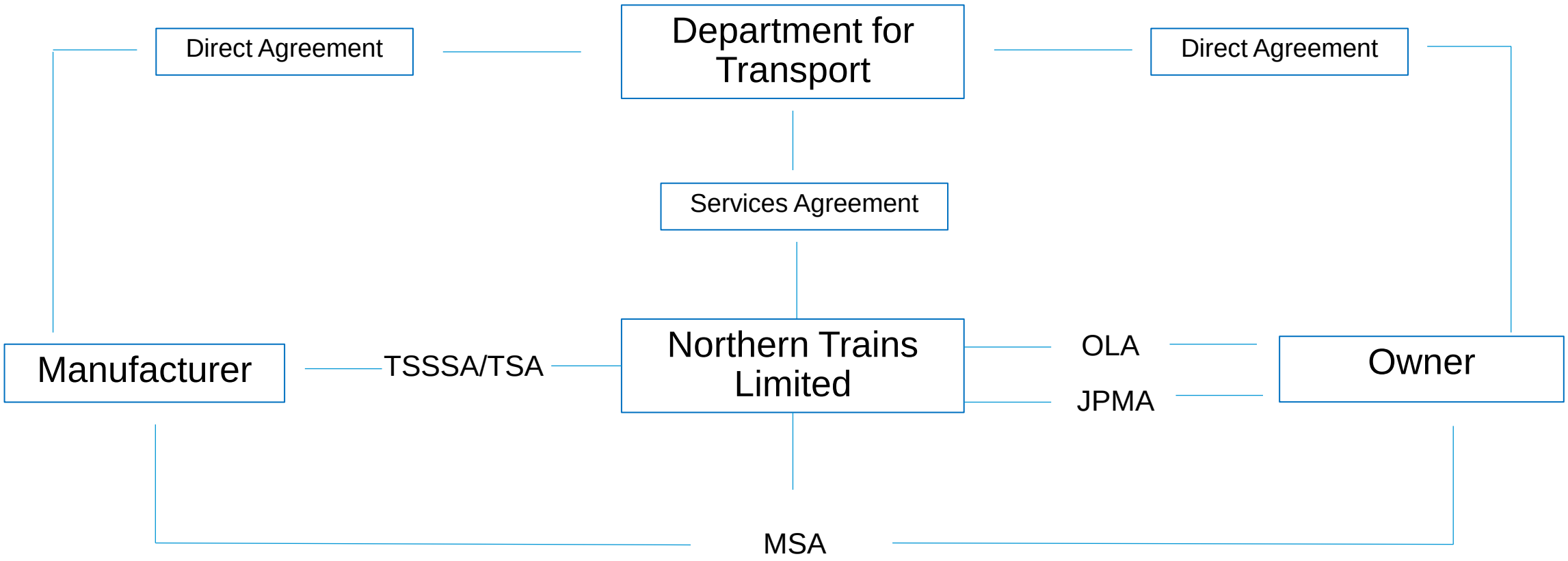
Contracting Strategy - Indicative Overview



TSSSA – Technical Support and Spares Supply Agreement

JPMA – Joint Project Management Agreement

TSA – Train Services Agreement

OLA – Operating Lease Agreement

MSA – Manufacture and Supply Agreement

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Q&A

Phil Denson
Senior Procurement Manager, Major Projects

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Any Questions?

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Next Steps and Close

Phil Denson
Senior Procurement Manager, Major Projects

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How to remain engaged

We will email the primary contacts who responded to the advert, and ask if you wish to participate in the next market engagement stages outlined earlier outlined by Neil Bowen:

- *Questionnaire issued by Northern, with opportunity for you to ask more detailed questions in your response;*

  followed by

- *1:1 Teams sessions to garner your input, helping us refine our potential strategy and Tender documentation*

Thank you

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Supplementary Technical Background Information

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Background

- Northern has an ageing fleet of DMU and EMU vehicles,
- A large proportion will require replacement over the next decade,
- Around 550 vehicles require replacement by 2032,
- Only a quarter of the Northern route network is electrified. Therefore, the majority of replacement vehicles will require a self-powered capability,
- Required entry into service is from 2027 in order to eliminate the oldest DMU classes as quickly as possible.

Options for Self-Powered Operation

- Government wishes to see rail operations become carbon-neutral by 2050, making conventional DMU solutions unacceptable,
- Whilst hydrogen may be an option for the future, the lack of a developed UK hydrogen supply base rules it out for near-term fleet procurements on economic grounds,
- Battery propulsion shows great promise for shorter unelectrified routes, but places a significant additional load on the existing electrification infrastructure.
- Studies conducted by Northern, supported by Network Rail, show insufficient capacity on the existing 25kV infrastructure to support battery operation at this time. Even if funding were to be made immediately available for upgrades to electrification system capacity, completion of this work would be too late to support Northern's fleet replacement programme.

The Chosen Propulsion Solution

- The required solution is a multi-mode unit, capable of operating on-wire as a conventional 25kV EMU and off-wire under diesel-electric propulsion,
- A traction battery will provide emission-free station operation and regenerative energy capture in diesel mode,
- The design should be capable of full conversion to EMU status by removal of diesel equipment, or to BEMU status by replacement of diesel equipment with extra batteries and associated equipment at a later date, should future electrification schemes support fully electric or battery-electric operation,
- This approach is intended to ‘future-proof’ Northern’s operations, enabling continuity of operation over today’s infrastructure, whilst taking advantage of any further electrification schemes; as the proportion of electrified routes increases, diesel operation will decline.
- Some future batches may be ordered as EMUs, without the diesel element, in order to replace existing EMU fleets or to provide services on newly-electrified routes.

Passenger Capacity

Three basic unit configurations have been identified:

- Type 1: Nominal passenger seated capacity 114 per unit, nominal standee capacity 105 per unit, based on 2.22 standees per square metre,
- Type 2: Nominal passenger seated capacity 184 per unit, nominal standee capacity 155 per unit, based on 2.22 standees per square metre,
- Type 3: Nominal passenger seated capacity 260 per unit, nominal standee capacity 205 per unit, based on 2.22 standees per square metre.

Seating capacities are for fixed seating only and do not include perch seats etc.

Passenger Environment and Facilities

Northern has consulted extensively with its customer base to determine the facilities necessary to meet the needs of its passengers and thus encourage patronage. In addition to RVAR / PRM - mandated facilities, required features include:

- A mix of table and airline seating, with additional seating provided by perch seats, rather than fold-down types. All seating to be 2+2 format,
- Adequate storage for luggage, bicycles and pushchairs/buggies,
- Adequate provision of toilet facilities,
- At-seat charging facilities for mobile devices, with good WiFi connectivity,
- High-quality audio-visual passenger information systems.

Passenger Environment and Facilities (continued)

- Connection between vehicles will be provided by a wide gangway without intermediate doors,
- A comprehensive CCTV system will improve passenger and staff safety and security,
- A comprehensive climate control (HVAC) system will be fitted to passenger saloons and driving cabs, capable of regulating the interior temperature across the full range of ambient external temperatures encountered in UK service,
- Interiors will be designed to enable Northern to maintain high presentational standards; this requires the use of fixtures and finishes which are easy to clean, hard wearing and resistant to fading and marking, both due to natural wear and vandalism.

Accessibility

- Improved accessibility has been raised as an important consideration amongst passengers, over and above those features mandated under PRM legislation.
- Traditional high-floor vehicles, with a step up from the platform, form a significant barrier to passengers with reduced mobility, as well as to children and those carrying heavy luggage.
- The new trains should therefore be compatible with the 915mm ARL standard platform height specified by Network Rail for new construction.
- Automatically-deployed gap-fillers are also to be fitted in order to eliminate the lateral gap between platform and train. This is particularly important at curved platforms.
- The possibility of power-deployed wheelchair ramps is to be explored, along with other potential enhancements such as inductive hearing-loop systems and braille signage.

Route Compatibility

- The new fleet will be deployed across Northern's operational network. Trains must therefore be compatible with this network in terms of gauge clearance, to avoid the need for costly infrastructure changes. It is required that the train fit the route, rather than the route be made to fit the train,
- Unit length is also important, since Northern services operate into a number of short terminal platforms and sidings,
- Trains must be compatible with all existing signalling and communications systems found across the Northern network. Since many non-electrified Northern routes use low-voltage track circuits, TCA equipment will be required,
- Trains will also incorporate a fully-homologated level 2 ETCS signalling system,
- Trains will be equipped with ASDO equipment to enable safe operation at stations with short platforms.

Train Performance

- 100 mph capability is required in both electric and diesel (battery) modes.
- Performance in electric mode to be comparable with that of a modern 25kV EMU,
- Performance in diesel mode to be comparable with that of a modern DMU,
- Trains must be capable of automatic transition between electric and diesel modes under the control of APCO balises,
- Units will include sufficient fuel capacity to give a diesel-mode range of 1,700 miles,
- Units must be able to run in passenger service in consists of up to three units operating in multiple, in both diesel and electric modes,
- Trains should be able to operate normally over an ambient temperature range of -20 to +40 ºC.

Energy Efficiency

Energy efficiency is of great importance, in terms of environmental performance and control of energy-related operating costs. The train design should incorporate measures to maximise energy efficiency, including the following:

- Minimisation of drivetrain power losses,
- Brake energy recuperation,
- Vehicle weight optimisation,
- Use of energy-efficient HVAC systems, making use of waste heat, where possible,
- Use of energy-efficient lighting systems, with outputs controllable according to ambient lighting levels,
- Active engine & battery management in diesel mode, as well as switching off to match output to the required load.

Maintenance Considerations

- Maintenance of Northern's current fleets is largely time or mileage-based, which can lead to over or under-provision of maintenance in certain areas,
- Northern wishes to move to a condition-based maintenance regime, requiring that the new trains be equipped with a comprehensive Remote Condition Monitoring (RCM) system,
- Maintainability should be at the heart of the vehicle design. As such, it should be possible to complete all routine inspection and maintenance work within a typical depot environment. Assets to enable maintenance of the new rolling stock should be identified.
- Similarly, requirements for conversion to EMU or BEMU format need to be understood fully, along with requirements for any additional equipment, such as battery charging systems.
- Training provision should be comprehensive.
- The design(s) should minimise the staff hours required to undertake each task,

Maintenance Considerations (continued)

- Overhaul intervals for major components (engines, traction motors, compressors, wheelsets, bogies, traction batteries etc) play a major part in determining overall lifecycle costs and should therefore be maximised,
- TSA and TSSSA-based maintenance arrangements to be determined.

Software Integrity and Cyber Security

- Given the dependence of modern rolling stock on complex software-enabled control systems, the development and verification of such software must be conducted using a rigorous methodology.
- This must be supported by thorough test-bench evaluation using representative train system hardware prior to deployment, minimising the likelihood of system malfunction or failure due to unforeseen process interactions or errors.
- The presence of software-enabled control systems also means that development of such systems, the means for upload of data to vehicles and physical security of control system access points must all be policed via a comprehensive and rigorous cyber-security policy.
- This also applies to any third-party embedded systems employed; the Supplier must ensure that the programming and data end-points of such systems are fully understood and that they do not incorporate any vulnerabilities which could enable malicious access to train control systems.