REVOLUTION VLR

REVOLUTION VERY LIGHT RAIL (RVLR)

The future is very light rail

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PRESENTATION STRUCTURE

- RVLR vehicle and programme overview
- Whole-system aspects
    - Ironbridge demonstration environment
    - Direct and indirect benefits of very light rail
- Summary

RVLR HISTORY AND KEY AIMS

RVLR is the industry response to a challenge set by RSSB on behalf of the DfT to employ innovative technologies to provide an alternative to traditional heavy rail rolling stock

Its primary aim was to stimulate line reopenings and achieve improved rail connectivity, particularly in rural areas

The team led by TDI won the RSSB competition and Eversholt Rail joined the team in 2018

Key aims were to deliver:

- A reliable, high-quality passenger experience to encourage modal shift from road to rail
- The lowest possible costs of whole-system implementation and operation

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RVLR DESIGN PHILOSOPHY

Lightweighting

- Minimises costs of operation
- Minimises infrastructure wear
- Cost-effective infrastructure extension and reinstatement

Balanced design

- Robustness and reliability
- Affordability and supportability
- Combination of innovation and proven railway systems
- Up to 40% mass reduction compared with C153

Modularity

- Simplified assembly and integration process
- Cost-effective development of variants
- Ease of support – no need for bespoke tools and equipment
- Simplifies through-life technology insertions and technology transfer

Sustainability

- High proportion of UK-sourced components and key systems
- Use of recyclable and biodegradable materials within the composite elements

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RVLR KEY AREAS OF INNOVATION

1. Bodyshell

- Welded steel chassis
- Interchangeable composite side panels
- Aluminium/composite cabs and roof

2. Modular propulsion system

- Low/zero emissions operation
- Hybrid and battery-only versions
- Simple, rapid exchange

3. Bogie suspension

- Passenger comfort and vehicle stability
- Proven robustness and durability
- Targeted mass reduction features
- All-electric braking

4. Bidirectional (two cabs)

- Maximised operational flexibility
- Excellent field of view to facilitate safe line-of-sight operation
- Simple, intuitive controls and displays

5. Reconfigurability

- Straightforward adaptation to other roles, including express logistics or mixed passenger/logistics

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RVLR PROPULSION SYSTEM

Propulsion systems optimised for role and duty cycle

- Demonstrator vehicle has hybrid diesel-electric propulsion.
- 2 x 2.8 litre Euro 6 turbocharged Cummins common rail diesel engines, generator and cooling group. 2 x lithium titanate battery packs.
- Zero-emissions operations and near-silent running in stations and built-up areas and at speeds up to 20mph.
- Acceleration comparable with a modern electric train; maximum speed of up to 65mph.
- Powerpacks and battery packs are mounted on sliding rails for ease of replacement and reconfiguration.
- Battery-only versions under development, combined with lineside battery rapid recharging.

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RVLR SUSPENSION

Key features

- RVLR has bogie suspension to provide good ride quality and vehicle stability. The bogies are a derivative of an existing Wabtec product developed initially for freight applications.
- Targeted mass reduction measures include the use of hollow axle Lucchini wheelsets, smaller-diameter wheels and carbon-fibre propshafts.
- Electric braking system eliminates the need for pneumatic and hydraulic systems.

RVLR PASSENGER ENVIRONMENT

1

1. Accessibility

PRM TSI compliant including one wheelchair space.

2

2. Passenger comfort

Full air conditioning, LED lighting and USB charging sockets for personal mobile devices.

3

3. Interior configuration

- Mix of airline and bay seating
- Alternative seating layouts, plus luggage stacks, bicycle storage, etc available.

4

4. Seating

Lightweight seating with armrests. Seat pitch of 770mm or greater.

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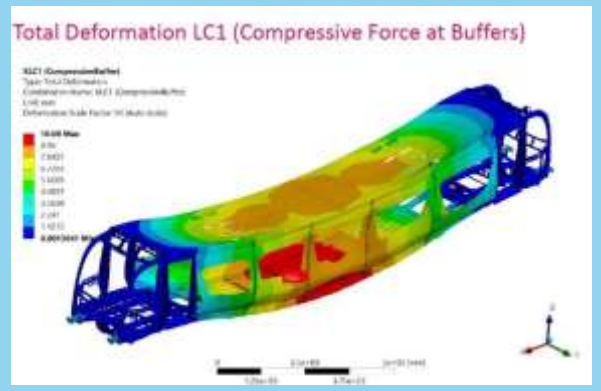

RVLR VALIDATION AND DEMONSTRATION

Extensive predictive modelling and simulation of RVLR performance and key system testing ahead of Demonstrator build, drawing on best practice from other industry sectors

Initial Demonstrator vehicle performance testing at Long Marston

Stakeholder demonstrations at former Ironbridge Power Station site

- A representative line reopening context
- Includes key infrastructure elements

Demonstrator returned to Long Marston for Rail Live in June 2022

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RVLR STAKEHOLDER NUMBERS AND FEEDBACK

Ironbridge

- 235 external stakeholders in 2021
- 172 external stakeholders in 2022
- 2023 demonstrations commenced in January

Rail Live

- Over 205 external stakeholders

Stakeholder feedback has been formally captured and is being used to inform the design and specification of future RVLR vehicles

*"The space is very open and not at all restricted, it is easy to turn in. I like the USB Ports in the wheelchair space because this isn't always a feature in other modes of transport. Revolution VLR is a lot more welcoming and brighter than other trains that I normally travel on."- **Phil, Group Leader and Wheelchair skills trainer at Back Up***

*"RVLR is certainly an impressive, innovative piece of kit which I can see having a big impact on local transport systems in the not-too-distant future." – **Mike Cliffe, Lancashire County Council***

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RVLR TAKING THE PROGRAMME FORWARD

Building on the knowledge base and experience already gained, the RVLR team's focus will be on:

- Completion of testing on the Demonstrator
- Achieving approvals and certification for passenger-carrying service
- Continuing to work with industry partners to optimise whole-system implementation and operating costs

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RVLR IS / IS NOT / FUTURE

Is

- Line of sight operation
- Low speed - up to 60 mph
- Ideal for short journeys – typically up to 32 miles
- Full electric braking
- Centralised maintenance philosophy
- Zero emissions operation - full battery traction

Is not

- Built to mainline standards
- No mainline signalling interface
- Multiple vehicle operation
- No toilet fitted

Futures

- **Unlikely** - different philosophy
- **Possible** - Operator appetite for functional separation
- **Possible** - but adds complexity
- **Possible** - but adds complexity

Additional considerations

- Range extendable - battery
- Tailored passenger environment

Pre series

Production series

RVLR PRODUCTION TRANSITION PLAN

- Substantial further investment by Eversholt Rail and TDI
- Commitment to a dedicated RVLR build facility in the Midlands
- Build of three pre-series RVLR vehicles for operator-led passenger-carrying trials
- Continuing engagement with stakeholders and potential customers in the UK and overseas

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Whole-system aspects

IRONBRIDGE DEMONSTRATION ENVIRONMENT

- Describe the experience we have gained in creating our Demonstration centre in Ironbridge, Telford
- Explain how we came to be there, the activities undertaken and associated timescales that we went through to create the centre
- Outline how our Ironbridge experience can be an example of how any line reopening and or extension can also be implemented

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Harworth Developments scheme plans involve the creation of over 1000 residential dwellings plus commercial and retail properties

WHY IRONBRIDGE?

We selected Ironbridge for three main reasons.

- Offered suitable sections of disused railway
- Existing seasonal tourism within the area
- Major substantial residential development underway

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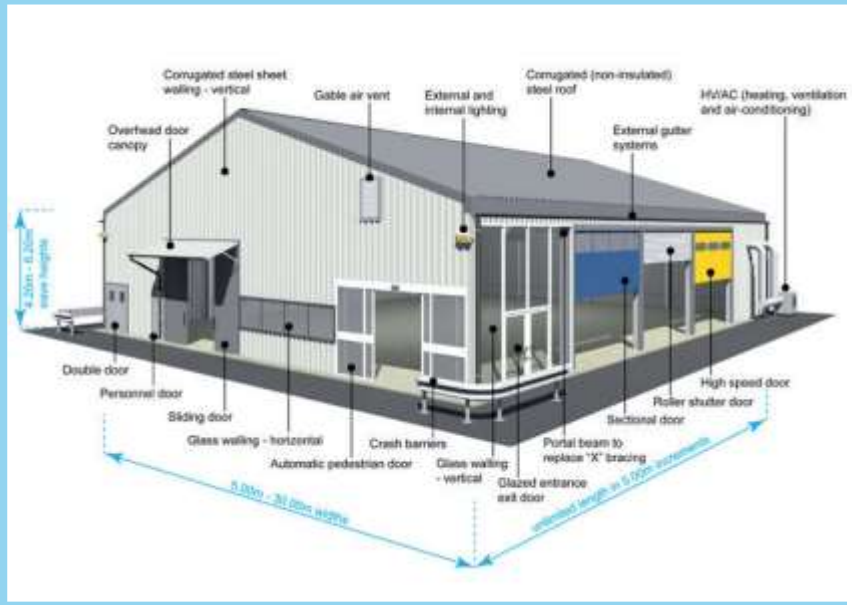

INITIAL CONCEPT

Our proposal was to:

- Recommence train operation on 0.7 km of the track which had been unused since 1963
- Site new platform and maintenance depot facilities
- Create a Marketing Suite capable of hosting stakeholder visits to showcase the vehicle and infrastructure

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TRACK & PLATFORM

Following a period of planning application and site design work during the second half of 2020 the initial site work included:

- February 2021 track inspection and remedial works which were completed August 2021
- In March 2021, the initial groundworks to house both buildings were started and completed within 4 weeks
- Platform ordered and installed in 6 weeks

BUILDINGS & SYSTEMS

- **March 2021:** Marketing Suite and Maintenance buildings ordered
- **June 2021:** Platform and buildings completed
- **August 2021:** Operational Safety Management System (SMS) completed
- **September 2021:** First external guests, including Minister of State at the Department for Transport, Chris Heaton-Harris MP

Total cost of demonstration facility set up was less than £400k.

RESULTS & ACHIEVEMENTS

- Format of stakeholder events proven and positive feedback received from attendees
- Over 400 stakeholder visits

Implemented further innovation product testing such as:

- Rapid lineside charging
- Other cost-effective infrastructure technologies in collaboration with Innovate UK and commercial partners such as LB Foster
- This continuing development will further enhance the life cycle cost benefits offered by RVLR-based whole-system solutions

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WHAT IS NEXT?

- Feasibility study to determine whether a route from the Harworth development site into Telford central is a viable possibility for commuter traffic.
- The RVLR team is providing input and support to the feasibility study team

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RVLR BUILD AND THROUGH-LIFE SUPPORT BENEFITS

- Benefits both the national UK economy and regional economies
- Purpose-built manufacturing facilities in the UK
- 70+% UK-sourced content from suppliers across England, Scotland and Wales
- Designed with technology transfer in mind
- Long-term support activities – running maintenance and inspection, cleaning, etc - over a vehicle operational life of up to 35 years
- Inherent nature of rail encourages permanence
- Successful reopenings can stimulate further growth of local support as demand rises and service frequencies increase

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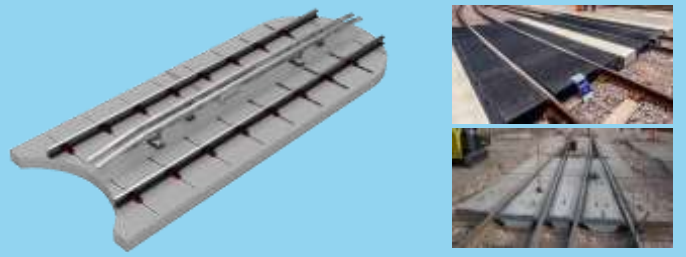
RVLR WHOLE-SYSTEM OPERATIONAL BENEFITS

Existing railway lines and line extensions

- Reduces all aspects of operating costs compared with heavy rail vehicles
- Potential to optimise infrastructure and maintenance regime for RVLR-only operations
- For route extensions and new lines RVLR can operate on lightweight modular slab track where this is the most appropriate operational solution
- Significant air quality improvements over existing rolling stock
- RVLR can provide:
    - More frequent, faster journeys
    - Improved service reliability
    - A high-quality, desirable journey experience



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RVLR INDIRECT BENEFITS

- Reduced road traffic congestion and emissions
  - Increased economic efficiency
  - Improved quality of life

- Jobs and skills creation and retention
  - Within the railway
  - In associated sectors

- Stimulates ribbon development along the route
  - Increased potential local job creation
  - Increased e-commerce

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RVLR SUMMARY OF BENEFITS

The right product at the right time

- RVLR addresses key national and regional challenges
- Well-received by key UK stakeholders and railway experts
- It can contribute to reducing the operational costs of the railway
- High-quality passenger experience can stimulate modal shift to rail
- RVLR can enhance the business cases for line reopenings and/or more frequent rail services
    - Improves rail and wider public transport connectivity
    - Assists in levelling-up
- Successful public and private sector investment and partnership
- Supporting UK jobs and skills, both in the rail sector and more widely

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THANK YOU

We hope you've found this short presentation interesting and informative.

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