VERY LIGHT RAIL: TRANSPORT SOLUTIONS FOR THE FUTURE

Thursday 28th November 2019
9am - 4pm
The Slate, the University of Warwick, CV4 7AL
### Very Light Rail: Transport Solutions for the Future

**AGENDA**

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THE VERY LIGHT RAIL: TRANSPORT SOLUTIONS FOR THE FUTURE

The Very Light Rail National Innovation Centre Dudley

Alan Lunt
Deputy Chief Executive - Dudley Metropolitan Borough Council

28th November 2019
The Slate, the University of Warwick
Presentation Content

• Background to the Very Light Rail Innovation Centre (VLRNIC) proposition
  – Why Dudley and the Black Country?
  – Why an Innovation Centre?

• Key features of the VLRNIC

• Features of the business case and business plan for the VLRNIC

• Anticipated next steps
Black Country Context

• Rail is an important sector for the Black Country economy

• Strategic interest to identify job creation and safeguarding opportunities for new and emerging sectors that have alignment with:
  – Black Country engineering SMEs that are at the heart of the areas economic makeup
  – Apprenticeship training initiatives of Dudley College

• Familiarity with what VLR offers based on Black Country having a working Very Light Rail system
Why Dudley and Rail Innovation

- Dudley has a location within its regeneration zone that is well suited to host a rail Innovation Centre
- Test Track for rail on the mothballed South Staffordshire line, running from Stourbridge to Walsall
The Castle Hill Location
The VLRNIC Proposition
Why an Innovation Centre for VLR

Need for an innovation initiative to support a fledgling industry by:

- Creating neutral space
- Lobbying
- Coordination
- Facilities
- Open access
- Supporting education
- SME support initiatives
- Hosting conferences and exhibitions
- Conducting feasibility studies
VLRNIC Governance

Industry Advisory Group

Black Country Innovative Manufacturing Organisation

Local Regional Business Group

VLRNIC Research and Development Group
- VLRNIC
- WMG/University of Warwick
- University of Huddersfield
- University of Southampton
- University of Wolverhampton
- Network Rail
Hub and Spoke Model for the VLRNIC

**Network Rail Areas of capability**
- Test Track Operation
- Rail Infrastructure and Rolling Stock Requirements

**Warwick University Areas of capability**
- Energy Storage and Advanced Powertrain
- Vehicle light-weighting
- Connected and Automated Mobility
- Digital engineering for vehicle design and manufacture
- Cyber security

**Huddersfield University Areas of capability**
- VLR Dynamics

**Dudley College Areas of capability**
- Apprenticeships and life-long learning for SME (Tier 2/3) engineering

**Southampton Areas of capability**
- Civil and infrastructure (inc. track design for low noise/vibration)

**Wolverhampton Areas of capability**
- Vehicle structures and electronics
- Command, Control, Communications

**VLRFNCA Areas of capability**
- Leadership and Coordination inc. roadmaps, securing funding
- Digital engineering for operational system design and business case analysis for new VLR scheme deployment
- Whole vehicle testing
- SME business support (VLR focused)
- Modal shift (inc. smart ticketing)
## Timing Plan

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<th>2019</th>
<th>2020</th>
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- Funds secured for build phase
- Soft launch phase with recruitment of staff about to commence
Conclusions

• At Dudley MBC we have developed the Very Light Rail National Innovation Centre (VLRNIC) proposition

• Key features include:
  – A rail test track
  – An innovation centre staffed by a team committed to working in partnership with others to help build a new industrial sector
  – A Hub and Spoke model to bring together the research expertise needed to address the product development challenges
  – Advisory groups to ensure a strong industry voice helping steer the priorities of the VLRNIC

• A call to arms
  – We want to work with you, as fellow pioneers of VLR, to help realise the potential of this exciting and affordable alternative to heavy rail, trams, buses and the passenger car
Thank you for listening

Alan Lunt, Deputy Chief Executive
Dudley Metropolitan Borough Council
email: Alan.lunt@dudley.gov.uk

Web Address: www.verylightrail.com/the-centre/
Very Light Rail: Transport Solutions for the Future

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The Revolution VLR and Coventry VLR programmes

Tim Burleigh
Head of External Relations, Eversholt Rail

Martin Pemberton
Managing Director, TDI
Revolution VLR – an overview
About Eversholt Rail

**GREAT TRAINS**

**GREAT PEOPLE**

**GREAT FUTURE**

Established in 1994 with over 25 years' experience in the rail industry and a proud history of innovation.

We own and maintain more than 3,600 passenger and freight vehicles with new passenger vehicles for the UK network on order.

£3.1 billion invested in new rolling stock.

Annual investment of over £100m in our existing fleets.

Cummins

Eversholt

PROSE

RDM Group

Engineering

Transport Design International

WMG

The University of Warwick
Key challenges for the UK railway

• Ensuring continued demand growth

• Delivering decarbonisation in step with or ahead of other transport modes
  • No ‘silver bullet’ that solves all the issues
  • A mix of further route electrification and innovative rolling stock solutions and propulsion technologies is required

• Providing better end to end journeys to encourage modal shift
  • Increasing importance of community rail in stimulating overall demand
  • Need for affordable extension of the network
UK Government decarbonisation commitments
Typical UK rural rolling stock

• Traditional rail diesel multiple units (DMUs), mostly around 30 years old
• Powerpacks pre-date even the earliest Euro emissions standards
• Dated interior environment
• Require heavy rail infrastructure, making network extension costly

Photo by mancunian1001 from “Know Your Sprinters: The Class 150 Series of DMUs”
Revolution VLR programme background

• Programme initiated by RSSB/DfT to apply relevant automotive industry technologies to deliver an innovative, affordable and attractive new rail vehicle design

• Targeted at rural service operations and potential line re-openings

• Eversholt Rail joined the consortium in 2018
Revolution VLR key characteristics: 1

• Low overall mass - 1 tonne per linear metre
  • Reduced energy consumption
  • Able to operate on lightweight modular slab track

• Self-powered
  • Modular hybrid powerpacks comprising Euro 6-compliant diesel engine, generator and batteries
  • Zero-emissions operation in stations and built-up areas
  • Regenerative braking
  • Low fuel consumption
Revolution VLR key characteristics: 2

- Spacious, modern and accessible interior
  - Air-conditioned
  - Charging sockets for personal devices
  - Aimed at encouraging modal shift
Revolution VLR programme status

• Demonstrator vehicle phase began in January 2018
• Design and procurement of major sub-systems underway
• Powerpack integration and testing well-advanced
• Vehicle build has commenced
• Vehicle testing begins in Q2 2020
Revolution VLR Summary

• Increased market focus on decarbonisation and system cost-effectiveness should favour VLR solutions for rural rail applications

• Revolution VLR design phase has confirmed that it can achieve the desired characteristics

• Programme is on target for testing of the Demonstrator vehicle by early 2020
Coventry VLR design evolution

Martin Pemberton
TDI is experienced in mainstream rail & tram projects around the world
Revolution VLR Euro 6, 18m diesel electric hybrid railcar
Revolution VLR Euro 6, 18m diesel electric hybrid railcar
Minitram concept model for ultra light, battery powered tram 1995
Minitram electronically guided, bi-directional electric vehicle 2000
Minitram trials in Althorp, Stratford, Bradford and Coventry
Minitram trial & ‘ultra light rail’ proposal for Coventry City Council 2003/4
Personal rapid transport (PRT) development begun 2003
Vectus ‘SkyCube’ fully autonomous PRT system opens in S Korea 2014
Midland Metro industrial design, ergonomics & branding by TDI 2005
Curving analysis to establish optimal wheelbase & vehicle geometry

Considerations:
• 15m curve radius
• Single axles versus bogies
• Car size
• Passenger capacity
• Articulated or separate cars
‘Train set’ options

2 car - 61 passengers

3 car - 106 passengers

5 car - 196 passengers

6 car – 212 passengers
Early vehicle architecture concepts
Early design concepts

Concept 7

Concept 8

Concept 9

Concept 10

Concept 11

Concept 12
Early design concepts
Early design concepts
45 Seats + 3 Perch Seats
104 Standing (5/Msq.)
Total passengers = 149
171 standing @crush (8/m sq.)
Total passengers = 216 (crush load)
Vehicle gross weight = 38384kg
Early design concepts
GRT LIGHT WEIGHT BODY SHELL

36 Seats + 2 Perch Seats
33 Standing (5/Msq.)
Total passengers = 69
53 standing @crush (8/msq.)
Total passengers = 89 (crush load)
Vehicle gross weight = 1647kg
18 Seats + 2 Perch Seats
30 Standing (5/Msq.)
Total passengers = 50
48 standing @crush (8/msq.)
Total passengers = 68 (crush load)
Vehicle gross weight = 11600kg
Early design concepts
Selected design concept
Conceptualised VLR environment
Finalised design
Plan & elevation
General assembly

56 passengers at 4 per m²
75 passengers at 6 per m²
Cab both ends, for non-autonomous trials
Arriving 2021…

Thank you!
# Agenda

**Very Light Rail: Transport Solutions for the Future**

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Very Light Rail as part of the future West Midlands Transport Ecosystem

Mike Waters
Director of Policy, Strategy and Innovation
Transport for West Midlands
West Midlands Combined Authority Vision:
To drive inclusive economic growth in the West Midlands region and enable a healthier, happier, better connected and more prosperous population.
A growing region

Source: ONS April 2019
Trade surpluses

£1.02bn  
(2018)

£2.7bn  
(2018)

Source: DIT 2018
Changing travel behaviour is critical

Car occupancy low, utilization high in West Midlands

Despite the longest urban bus network in Europe
Bus journey time to Birmingham City Centre

Rising journey times
- met area speeds fell 10% since end of recession
- bus speeds have fallen 1% on average every year since
- record-breaking traffic volumes in last two years
Bus journey time to Birmingham City Centre

Rising journey times

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2016 – 200,000 people no longer covered
Challenges

444,000 more people within 15 years

Population Growth

1,500 premature deaths

Safety & Air Quality

215,000 new homes by 2031

2664 Collisions

Infra-structure

150,000 new businesses by 2030

Congestion

£400m p.a. lost

Journey times 10% slower in last 10 yrs

2041 Zero Carbon!
The Strategic Response

**Improve effectiveness**

- **Increasing Capacity:** This involves providing more capacity on the public transport and road networks.

- **Improving Efficiency:** We aim to improve efficiency of local roads through better integration across modes, reducing roadwork delays, optimising traffic signals and improving responses to disruptive incidents.

- **Managing Demand:** Overall demand to move people and goods across the transport network will continue to grow. We can better manage this by influencing the choices by residents, businesses and visitors to make more sustainable journeys.

**Reduce the impact**

Ensuring the system is safe for all and we accelerate the use of clean energy and low carbon solutions.

**Enable inclusive growth**

Ensuring that all those who can benefit from access to opportunities and services can do so efficiently and fairly without needing to own a vehicle.
Mobility Innovation Cluster
The WMCA has the largest ECONOMY of any combined GVA of £92 billion.

The region is at the HEART of the UK, with 90% of the UK’s market within 4 hours drive.

In the last FIVE years, the WMCA area has attracted over 675 foreign Direct Investment projects, creating 35,000 jobs.

Global centres for engineering development and manufacturing across various sectors inc. Automotive and Aerospace.

World class facilities for R&D, manufacturing and study, inc. NAIC and BIC.

EVENTS

Transport for West Midlands
Costs of traditional urban tram lines

Total = approx. £40m per km (urban)
Very Light Rail could help (a lot)

**Target Cost:** £10m per km

Core routes for medium sized cities and larger towns

Feeer services to core mass transit corridors

Connecting sustainable urban extensions

Light freight e.g. Cologne

A post-Beeching renaissance?
Technical Challenges

- Road interfaces
- Stats under track form
- Compatibility with heavy rail
- Automated control
- Turning radii ‘v’ comfort
Business Case Challenges

- Volumes and efficiency
- Optimising frequency ‘v’
- Service level
- Vehicle size and cost
- Avoiding wider network disruption
VLR – making it real

- Addressing real world challenges
- Global potential, local application
- Transformative potential for our region
- Learning can optimise many aspects of rail based transit
Reinventing the West Midlands as the home of future mobility
Further Information

Mike Waters
Dir. Policy, Strategy & Innovation
Transport for West Midlands
mike.waters@tfwm.org.uk

https://www.tfwm.org.uk/strategy/innovation-future-mobility/
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VLR Approvals

What standards will apply to VLR systems and how will approval be achieved?

Bridget Eickhoff
Principal Infrastructure Engineer RSSB
Legal framework for approvals

- ROGS (The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended))
- Safety Verification
- SMS (Safety Management System)
- CSM RA (Common Safety Method for Risk Evaluation and Assessment)
- Essential requirements from TSIs (Technical Specifications for Interoperability): high level principles
  - Safety
  - Reliability & availability
  - Health
  - Environmental protection
  - Technical compatibility
  - Accessibility to persons with disabilities or reduced mobility
Scope of ROGS

- Exclusions
  - Track gauge below 350mm
  - Guided buses or trolley buses

- What is non-mainline (see ORR Approved List)
  - Metro / light rail system
  - Separated networks solely for local, urban or suburban services
  - Heritage, museum or tourist railways

- Differences for non-mainline railways, what does NOT apply:
  - Common Safety Targets
  - TSIs / NTRs (National Technical Rules)
### ROGS duties and scope of influence (ORR Guidance)

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<th>Entity in Charge of Maintenance</th>
<th>Duty of co-operation</th>
<th>Managing safety critical work</th>
<th>Risk Assessment</th>
<th>Safety Management Systems</th>
<th>Safety certificate / authorisation</th>
<th>Annual safety report</th>
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<td>Non-mainline railway &amp; light rail / metro &gt;40km/h</td>
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**Question:** Does VLR require a Safety Certificate / Authorisation?
- Assume not (unless mainline operation) but topic for discussion with ORR
VLR operation assumed not on the mainline railway
- CSM not required but still provides a useful framework – process is ‘scalable’
- Safety Verification requires:
  - A written process & Independent Competent Person (ICP)
- SMS Change Management would follow similar principles
Safety Management System

- Safety policy statement
- Safety targets
- Risk assessments and risk controls (especially any new risks)
- Procedures for meeting relevant standards (if appropriate)
- Clear responsibilities
- Safety verification process (if appropriate)
- Managing safety-related information
  - Including accidents and near misses
- Emergency planning
- Internal audits
Common Safety Methods: Risk Evaluation and Assessment

- CSM RA is not mandatory for non-mainline operation
  - But provides useful framework
- Risk Assessment is mandatory for ‘significant’ changes
  - CSM principles can help decide if ‘significant’ or not
- ROGS key requirements for risk assessment:
  - Be systematic in identifying hazards / consequences / risks / mitigations
  - Record keeping for process / findings / mitigations / monitoring / review
  - Cooperate with other related operators / parties
  - Covers rail specific risks (e.g. derailment) and non-specific risks (e.g. assaults)
- Risk evaluation / assessment can use:
  - Codes of practice (standards)
  - Comparison with existing (reference) system
  - Explicit risk estimation
- See RSSB Guidance Note GEGN8646
VLR Approvals – Key principles

- Understanding of the hazards and appropriate mitigation
- Safety Management Systems
  - Appropriate to control the risks from transport system
- Involvement of all involved parties in risk mitigation
  - Risks can be mitigated by application of appropriate standards
  - Some standards incorporate options depending on usage
- Safety Verification
  - Assume ORR safety certificate / authorisation NOT required
  - CSM RA can help determine if a change is ‘significant’
  - Use of Independent Competent Person (ICP)
    - Needs relevant skills / knowledge / experience & must be objective / unbiased
VLR Approvals – Some key technical areas to consider

- TSI main headings (as a checklist)
- Structural integrity of the vehicle and components
- Braking performance
- Fire safety
- Safety of electrical systems
- Facilities for mobility impaired passengers
- Adequate clearance to other vehicles and fixed structures
- Interfaces / intersections / level crossings / pedestrian crossings
- Appropriate audible and visible warnings
- Evacuation and control procedures in case of emergency
VLR Approvals – useful resources

LRSSB-LRG-1.0 : Tramway Principles and Guidance (TPG)
https://lrssb.com/lrssbportal/

The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended) SI 2006/599

The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended) - A guide to ROGS – April 2018

The Rail Vehicle Accessibility (Non-Interoperable Rail System) Regulations 2010 SI 2010/432

RSSB document T1049 Operating non-mainline vehicles on the mainline infrastructure: Guidance on the regulatory requirements Dec 2014
https://www.sparkrail.org/

GEGN8646 Guidance on the Common Safety Method for Risk Evaluation and Assessment
https://catalogues.rssb.co.uk/railway-group-standards
Thank you
# Very Light Rail: Transport Solutions for the Future

## Agenda

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<tr>
<th>Time</th>
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<tr>
<td>9:00</td>
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| 9:30 | Welcome and Opening Remarks | • Archie MacPherson, CEO WMG HVM Catapult  
• Cllr Jim O’Boyle, Cabinet Member for Jobs and Regeneration, Coventry City Council |
| 9:45 | Keynote Address – The need for change | • Steve Berry, Head, Highways Maintenance Branch, Local Transport Funding and Growth Division, Department for Transport |
| 10:05 | What is Very Light Rail and what does it offer? | • Nick Mallinson, Programme Manager VLR, WMG |
| 10:25 | Coventry Very Light Rail project | • Colin Knight, Director of Transportation and Highways, Coventry City Council  
• Nicola Small, Programme Manager for VLR, Coventry City Council  
• Grant McKelvie, Commercial Director, Coventry City Council  
• Cost of Urban Very Light Rail, Andy Stamps, Rider Levett Bucknall |
| 11:00 | Coffee and Networking |  |
| 11:05 | The Very Light Rail National Innovation Centre | • Alan Lunt, Strategic Director (Place) & Deputy Chief Executive, Dudley Metropolitan Borough Council |
| 11:30 | Very Light Rail Revolution project – the foundations for Coventry VLR | • Tim Burleigh, Head of External Relations, Eversholt Rail  
• Martin Pemberton, Managing Director, TDI |
| 11:50 | VLR as part of the future West Midlands transport ecosystem | • Mike Waters, Director of Policy, Strategy and Innovation, Transport for West Midlands |
| 12:15 | What standards will apply to VLR systems and how will approval be achieved? | • Bridget Eickhoff, Principal Infrastructure Engineer, RSSB |
| 12:45 | Lunch and Networking |  |
| 13:45 | What is best practice for delivery of a safe VLR system? | • Peter Howarth, Independent Competent Person for the Coventry Very Light Rail project |
| 14:00 | How VLR can inform and complement traditional rail | • Rory Dickerson, Senior Engineer for Traction & Rolling Stock, Network Rail |
| 14:15 | Accessible urban rail solutions and the UK housing gap | Robin Butler, Managing Director, Urban and Civic plc |
| 14:30 | Panel Q&A |  |
| 15:15 | Closing remarks | • Nick Mallinson, WMG |
| 15:20 | Coffee and Networking | • Tours of WMG and drop in sessions with experts |
| 16:00 | End |  |