

VERY LIGHT RAIL: TRANSPORT SOLUTIONS FOR THE FUTURE

Thursday 28th
November 2019
9am - 4pm

The Slate, the University
of Warwick, CV4 7AL

 **WVG**
THE UNIVERSITY OF WARWICK



CATAPULT
High Value Manufacturing

RLB Rider
Levett
Bucknall

Very Light Rail: Transport Solutions for the Future

AGENDA

9:00 REGISTRATION AND COFFEE

Session 1

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, Andrew Stamps, Rider Levett Bucknall

11:00 COFFEE AND NETWORKING

Session 2

11:30

The Very Light Rail National Innovation Centre

- Alan Lunt, Strategic Director (Place) & Deputy Chief Executive, Dudley Metropolitan Borough Council

11:50

Very Light Rail Revolution project – the foundations for Coventry VLR

- Tim Burleigh, Head of External Relations, Eversholt Rail
- Martin Pemberton, Managing Director, TDI

12:15

VLR as part of the future West Midlands transport ecosystem

- Mike Waters, Director of Policy, Strategy and Innovation, Transport for West Midlands

12:30

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

- Bridget Eickhoff, Principal Infrastructure Engineer, RSSB

12:45

LUNCH & NETWORKING DRINKS

Session 3

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

What Is Very Light Rail And What Does It Offer?



VLR Conference
28th November 2019



Dr Nick Mallinson
Programme Manager, WMG

First Let's Agree on Terminology

Heavy Rail – infrastructure and vehicles are heavy and expensive but capable of carrying large numbers of passengers in an energy efficient manner – also includes metro systems such as London Underground



Light Rail – typically urban rail transit systems with a "light" passenger capacity compared to heavy rail and metro systems – typically 250 passengers max. Vehicles run on rails laid into road surfaces and can operate amongst road traffic and pedestrians. Track and vehicles relatively heavy and expensive compared to heavy rail



Very Light Rail / Ultra Light Rail – the vehicles are designed to be significantly lighter than heavy or light rail equivalents and the associated track and infrastructure can be less substantial as a result. In general the term VLR is used to describe any rail vehicle that weighs less than 1 tonne per linear metre



Personal rapid transit (PRT) - a public transport mode featuring small automated vehicles operating on a network of specially built guideways. An example is the Heathrow Terminal 5 pod service



Traditional Rail & Trams

Can be categorised as:

- Providing effective mass transit solutions
- Energy efficient and potentially zero emission
- Facilitating modal shift from cars (e.g. light rail tram schemes)



But they are:

- Typically heavy (vehicles and infrastructure)
- Highly regulated, standards driven and risk averse
- Slow to innovate
- Expensive



Is there a way to retain, reinstate or build new branch line services and create new tram routes at a much lower cost?

Rail Infrastructure is Expensive

- Heavy rail vehicles cause wear and damage to track which requires frequent maintenance
- Maintenance costs can be supported on heavily utilised routes – not so easy on lightly used branch lines – hence track condition on such lines is often not optimum
- Lighter vehicles reduce track damage (reducing maintenance costs) and potentially allow less substantial (cheaper) track solutions to be used
- The reopening of former branch lines (Beeching closures) is often thwarted by infrastructure costs in the region of £12m per km (e.g. Bere Alston to Tavistock; Lewes to Uckfield)
- New tram routes typically cost around £50m per km
- Construction of branch or tram lines requires a cost-benefit ratio of typically 2:1, difficult to achieve for most proposed schemes



Potential Benefits of Very Light Rail Solutions

The premise underpinning VLR is to transfer proven (low cost) automotive technology to rail to accelerate innovation and reduce risks:

- Eco-friendly self-propulsion (including batteries) eliminates need and cost of overhead electrification
- Lighter vehicles achieved via lightweight multi-material structures allow the use of less-substantial track and infrastructure, potentially reducing costs
- Vehicles designed for low cost manufacture - allowing lower prices and bigger fleets
- Autonomy / collision avoidance will ultimately remove the cost of drivers
- Novel factory-manufactured track elements to enable faster installation and reduce the need to move underlying utility services for on-road tram running

A Potted History

- In late 2011 WMG became a member of the High Value Manufacturing Catapult with a specific focus on 'low carbon mobility'
- In 2013 Parry People Movers approached WMG to discuss possible collaboration on a larger version of the Class 139 vehicle operating at Stourbridge
- In 2014 RSSB ran the **Radical Train** funding competition - WMG became a consortium partner in the **Revolution VLR** project aimed at lower cost branch line services – **RSSB asked WMG to encourage disruptive innovation**
- Also in 2014 Dudley Metropolitan Borough Council expressed interest in bringing a proposed VLR Innovation Centre to Dudley
- In 2016 Coventry City Council asked whether a low cost tram solution could be developed using VLR technology
- In 2018 the **Coventry VLR** project commenced, funded by the West Midlands Combined Authority and the Coventry and Warwickshire LEP
- 2019 **VLRNIC** funding fully secured and construction commences



Revolution VLR Project Snapshot

- A very lightweight rail car (less than 1 tonne per linear metre) with novel hybrid propulsion system designed to provide lower cost vehicles for rural branch lines – a £5.5m project receiving £2.75m support from DfT - consortium led by TDI
- Vehicle demonstrator currently under construction at RDM – completion due in April 2020
- Eversholt Rail (one of the 3 large UK rolling stock companies) has made a significant investment and committed to take the vehicle to market



56 seats + 2 tip-ups; 1 wheelchair; 60 standees
18 tonnes tare (less than half the weight of traditional DMUs)
100kph top speed
All electric braking and launch from stations

Hear more about Revolution from Tim Burleigh later

Coventry Very Light Rail Project

- In 2016, facing increasing road congestion and emissions, Coventry City Council determined that the most appropriate means to achieve modal shift away from cars would be a tram system
- Traditional light rail tram systems cost in the region of £50m per kilometre, a cost that can only be justified by the very largest cities such as Birmingham
- Coventry City Council asked WMG and TDI if a VLR approach could create a 21st century tram solution for medium sized cities, costing in the region of £10m per kilometre
- Subsequently four parallel projects (vehicle, track, first route and operations) commenced in early 2018, with WMG leading the vehicle and track projects

Coventry VLR Shuttle Project Status

- Project commenced April 2018
- Concept design approved by CCC councillors at a 3D visualisation event in April 2019
- Detailed design frozen in September 2019
- Engineering drawings out to selected suppliers
- Components arriving at RDM over the next 4 months - assembly commences March 2020
- Demonstrator shuttle vehicle complete by October 2020



Assembly Facility at RDM,
Coventry

Hear more about the shuttle later from Martin Pemberton

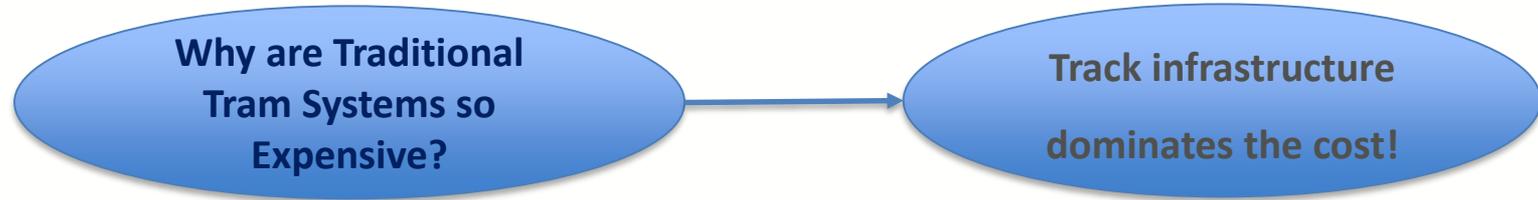
Coventry VLR – Autonomous Operation

- Coventry City Council want a ‘turn up and go’ service with 5 minute headway - this requires a larger fleet of vehicles than with traditional multi-car trams – too many drivers!!
- Drivers are the largest element of public transport operational costs
- Coventry City Council is seeking an autonomous control solution at the earliest opportunity
- WMG is building a project consortium to develop a suitable solution
- Efforts to secure project funding are underway
- Interest and involvement of West Midlands companies is welcome



Copyright by Sigge Villmann

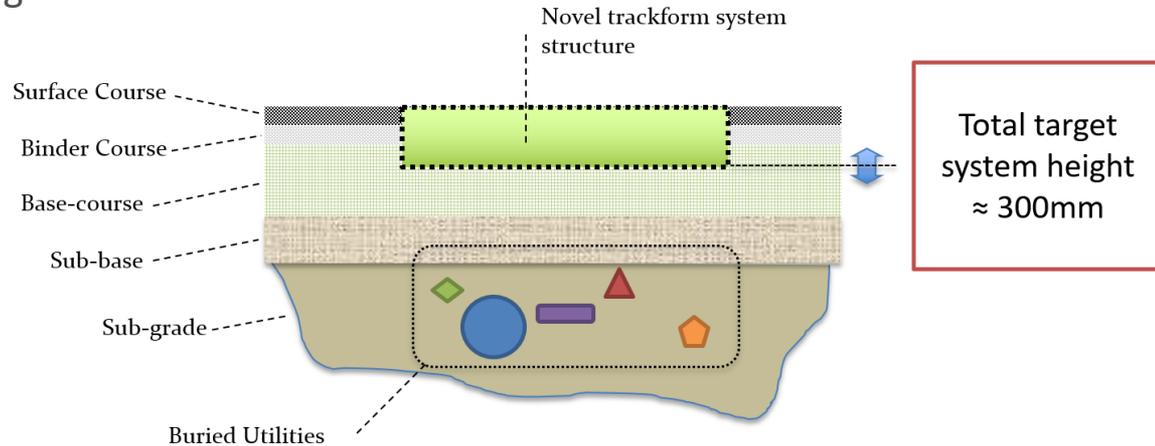
CVLR Track Work Stream



- No two schemes are the same
- Little learning transferred from previous projects
- Utilities demand their equipment be moved from under the track, adding significant costs
- Substantial civil engineering - construction based on steel reinforcements and wet concrete (up to 2m deep) on site
- Cost of overhead electrification

Requirements of Coventry's Novel Track Form.....

- Acceptance from utilities that relocation of their equipment is not generally required
- Modular construction, enabling rapid removal and reinstatement to cater for utilities' access
- Off-site manufacture for maximum quality - 6m to 8m long for easy transport
- A robust substrate that sits flush in a road with rails embedded; substrate no thicker than tarmac layer on surface of the road – minimising excavation and disturbance of sub-base
- Substrate capable of withstanding road traffic axle loads, especially HGVs



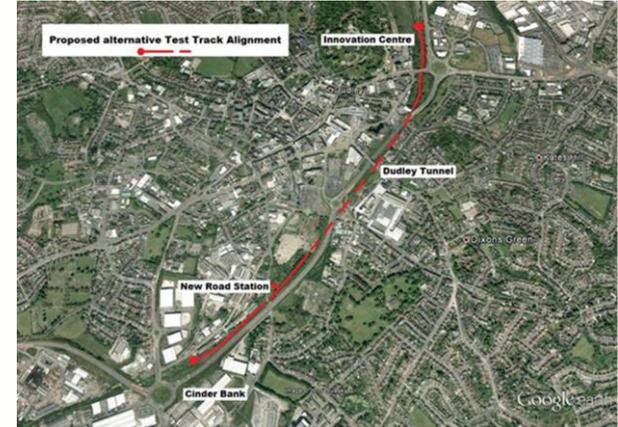
- Safe for pedestrians and cyclists

Coventry VLR Track Project Status

- WMG will work with an industrial 'Innovation Partner' over the next 18 months to develop novel track form concepts and conduct laboratory testing. This will be followed by the construction of a purpose designed test track which will allow the shuttle vehicle and novel track to be fully evaluated
- A Formal Invitation to Tender was released this summer and selection of the 'Innovation Partner' is expected to be concluded in early December 2019
- The test track will be implemented at the VLR National Innovation Centre which is under construction in Dudley

The Very Light Rail National Innovation Centre

Situated at Castle Hill, Dudley, on the site of the former Dudley Station



2.2km test track

£24m project, opens April 2021

1. Lightweight structures
2. Propulsion and energy storage
3. Vehicle dynamics
4. Low cost civils & infrastructure

Hear more about the Dudley VLR National Innovation Centre from Alan Lunt later

So What Does VLR Technology Offer?

- Affordable ways of expanding the ‘Twigs and Branches’ of the current national railway network and enabling more tram schemes
 - Reducing the costs of operating lightly used branch lines
 - Making it easier to justify the reopening of disused railway lines
 - Helping new rail alignments to be more affordable in large scale land developments
 - Allowing medium sized cities and large towns to implement ‘tram type’ public transport
- VLR routes will be ‘permanent ways’ that will encourage economic development – housing estates, commercial property and industrial parks along the route
- VLR solutions will be part of multi-mode public transport solutions, with buses, rail and autonomous pods providing end-to-end journeys as part of Mobility as a Service (MaaS) applications
- The opportunity to develop a new UK manufacturing sector – to sell into the domestic and international markets

Potential Opportunities

REVOLUTION
Branch Lines identified
by RSSB

Origin	Destination
Cromer	Sherringham
March	Wisbech
Saxmundum	Aldeburgh
Gobowen	Oswestry
Princes Risborough	Aylesbury
Brownhills	Lichfield city
Burton	Ashby de la Zouch
Coventry	Nuneaton
Bodmin	
Fowey	Lostwithiel
Frome	Radstock
Kidderminster	Stourport
Liskeard	Looe
Plymouth	Tavistock
St Erth	St Ives
Greenford	West Ealing
Henley	Twyford
Maidenhead	Marlow
Slough	Windsor and Eton
Truro	Falmouth
Watford	St Albans Abbey
Ashington	Blyth
Cleethorpes	Barton on Humber
Fleetwood	Poulton le Fylde
Hesby	Ellesmere Port
Madely	Stoke on Trent
Sheffield	Stocksbridge
Skelmersdale	Ormskirk
Borden	Bentley
Brixham	Paigton
Brockenhurst	Lymington
Folkestone	Folkestone Harbour
Hythe	Totton
Isle of Wight	
Ringwood	Brockenhurst

Coventry VLR

16+ medium sized cities across UK

Ecotowns (2009) currently being developed



Garden Villages and Towns (2016)



+ Eversholt Rail is seeking early routes for Revolution

Potential Questions and Issues to be Addressed

- **Pushback from traditional heavy/light rail and autonomous road vehicle advocates**
 - 'it's unproven'
 - 'it doesn't meet current standards – e.g. crashworthiness'
 - 'there's no established supply chain'
 - 'Councils / Transport Authorities will only commit to established proven solutions'
 - 'interoperability with other rail vehicles is problematic'
 - 'lifting track sections to facilitate utility access will disrupt passenger services'
 - 'what's the need for a track if autonomous vehicles can guide themselves along a road?'
- **VLR's response**
 - we are working with the DfT, RSSB and LRSSB to address any questions over standards and operational procedures – an Independent Competent Person is monitoring our projects
 - elements of the existing rail supply chain, working with the strong UK automotive supply chain, provide the foundations of a VLR supply chain
 - first rail routes will be selected where segregated operation is possible
 - crashworthiness of VLR 'tram' vehicle meets current requirements to operate in mixed road traffic
 - on a like-for-like basis, autonomous road vehicles running on tyres use more energy than rail vehicles **plus** tyre and tarmac particulates are now a health concern (Oslo effect)

Drop in Centre

- If you hear something of interest today and would like to learn more following the Q&A session after lunch, please come to meet our VLR experts at the 'drop-in' session after the closing remarks at 3.30pm – this will be in the exhibitors and refreshments room
- Alternatively, during the day you can sign-up to go on a tour of WMG's Energy Innovation Centre at 3.30pm – please sign up at the desk at the back of this room

Thank you!



Very Light Rail: Transport Solutions for the Future

AGENDA

9:00 REGISTRATION AND COFFEE

Session 1

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, Andrew Stamps, Rider Levett Bucknall

11:00 COFFEE AND NETWORKING

Session 2

11:30

The Very Light Rail National Innovation Centre

- Alan Lunt, Strategic Director (Place) & Deputy Chief Executive, Dudley Metropolitan Borough Council

11:50

Very Light Rail Revolution project – the foundations for Coventry VLR

- Tim Burleigh, Head of External Relations, Eversholt Rail
- Martin Pemberton, Managing Director, TDI

12:15

VLR as part of the future West Midlands transport ecosystem

- Mike Waters, Director of Policy, Strategy and Innovation, Transport for West Midlands

12:30

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

- Bridget Eickhoff, Principal Infrastructure Engineer, RSSB

12:45

LUNCH & NETWORKING DRINKS

Session 3

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



Very Light Rail

A solution for Coventry (and other small to medium size cities)



Very Light Rail

- Why VLR?
- Future cities and Integrated future transport systems
- Affordability of VLR
- Coventry First Route
- Phasing and Milestones
- Steps to Success
- Challenges
- Joint Venture



Why VLR?



- Climate Change Strategy
- Coventry Local Air Quality Action Plan



Modelled NO2 exceedances (2021- updated AQ modelling)

Do-Minimum 2021 Compliance Status

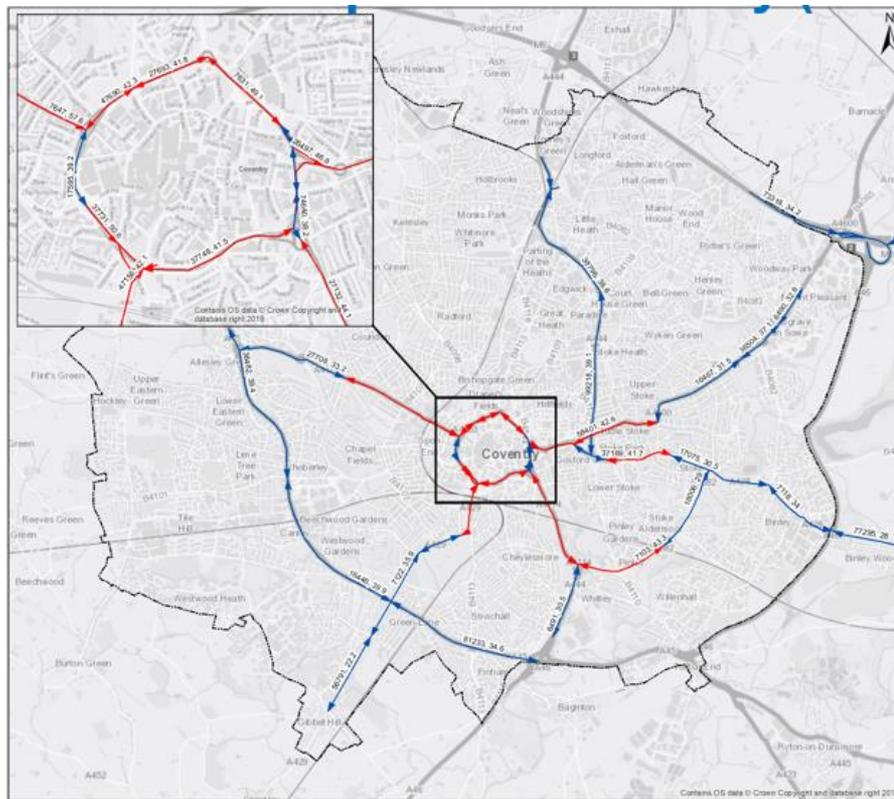
Key

Do-Minimum PCM Links

No Exceedance

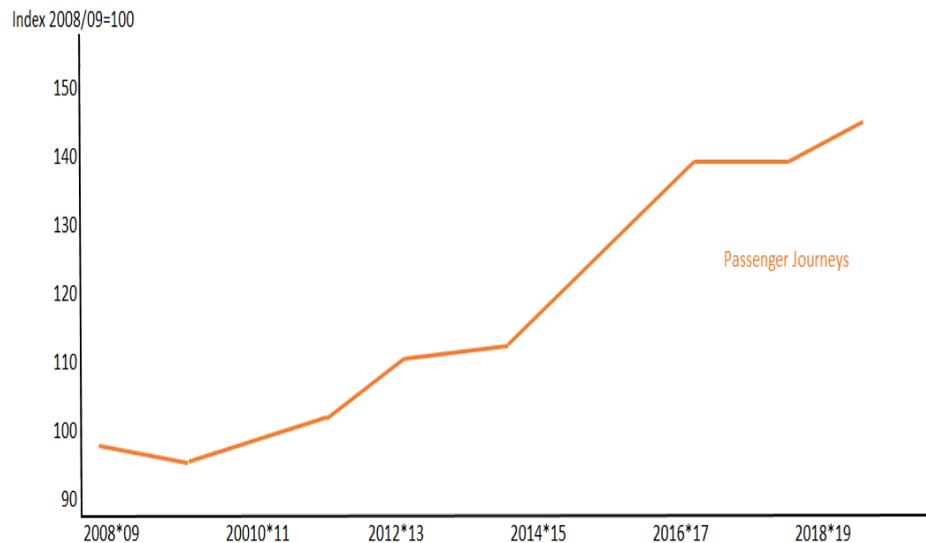
Exceedance

Local Authority Boundary



Why VLR?

Trams are hugely successful in getting people out of their car



Passenger journeys

 **272.4 million**
passenger journeys

 **15.6**
passenger journeys
per head

Passenger journeys increased by 1.9% in 2018/19.

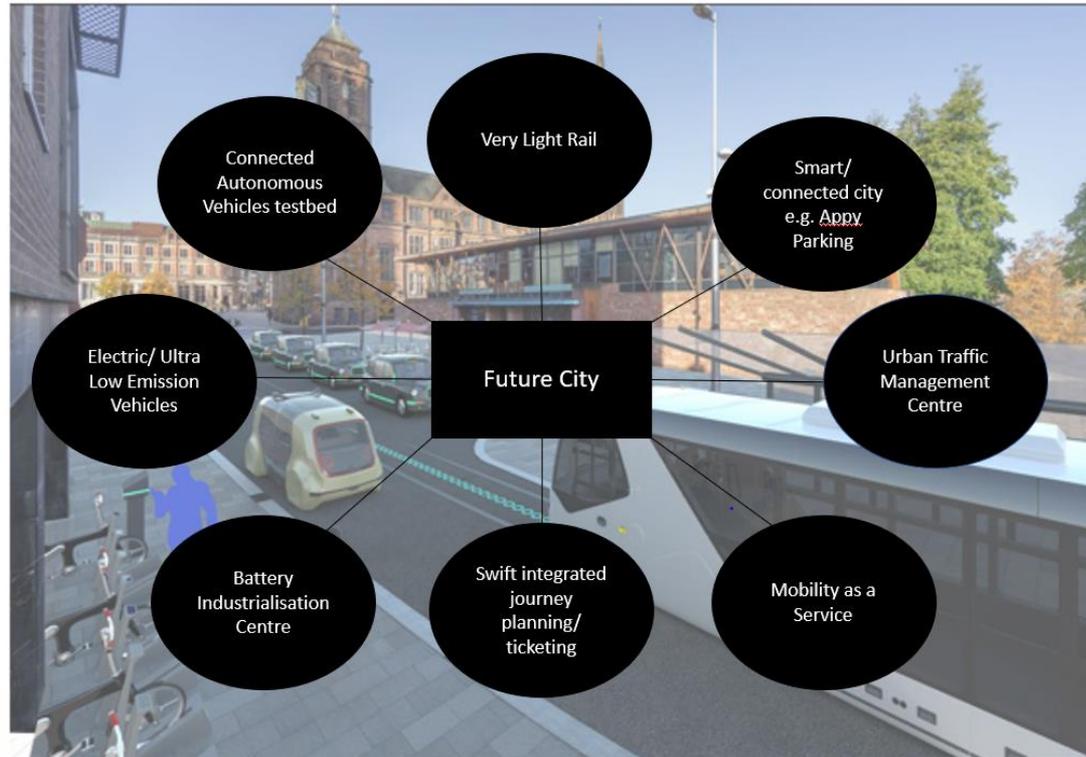
Source: DfT Light Rail and Tram Statistics 2018/19

Why VLR?



- Higher density development/sustainable urban development
- Economic development and the Industrial Strategy
- Future Mobility Programme
- Mobility as a Service (MaaS)

VLR -Part of an Integrated Transport Solution



Future Cities

Increasing Coventry's attractiveness as a place to live, work and study





Cost of Trams

Average £35m to £50m per km



**Theresa May announces £250 million for major
Midland Metro extension and more**

Nottingham's £570M tram extension opens

**Edinburgh's tram system opens -
£375m over budget and three years
late**

VLR target cost £10m per km



Coventry & Warwickshire
Local Enterprise Partnership



THE UNIVERSITY OF WARWICK



Metropolitan Borough Council



Mid Government



WEST MIDLANDS
COMBINED AUTHORITY



TDI TRANSPORT DESIGN
INTERNATIONAL



Rider
Levett
Bucknall

COST OF THE URBAN VERY LIGHT RAIL



Rider
Levett
Bucknall

BRINGING IMAGINATION TO LIFE

28 November 2019



ABOUT RLB UK

140

BIRMINGHAM STAFF

675

UK STAFF

10

UK OFFICES

123

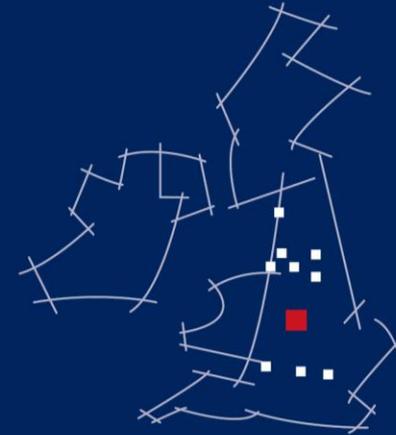
OFFICES WORLDWIDE

£2bn

OF SCHEMES DELIVERED IN
THE LAST 3 YEARS

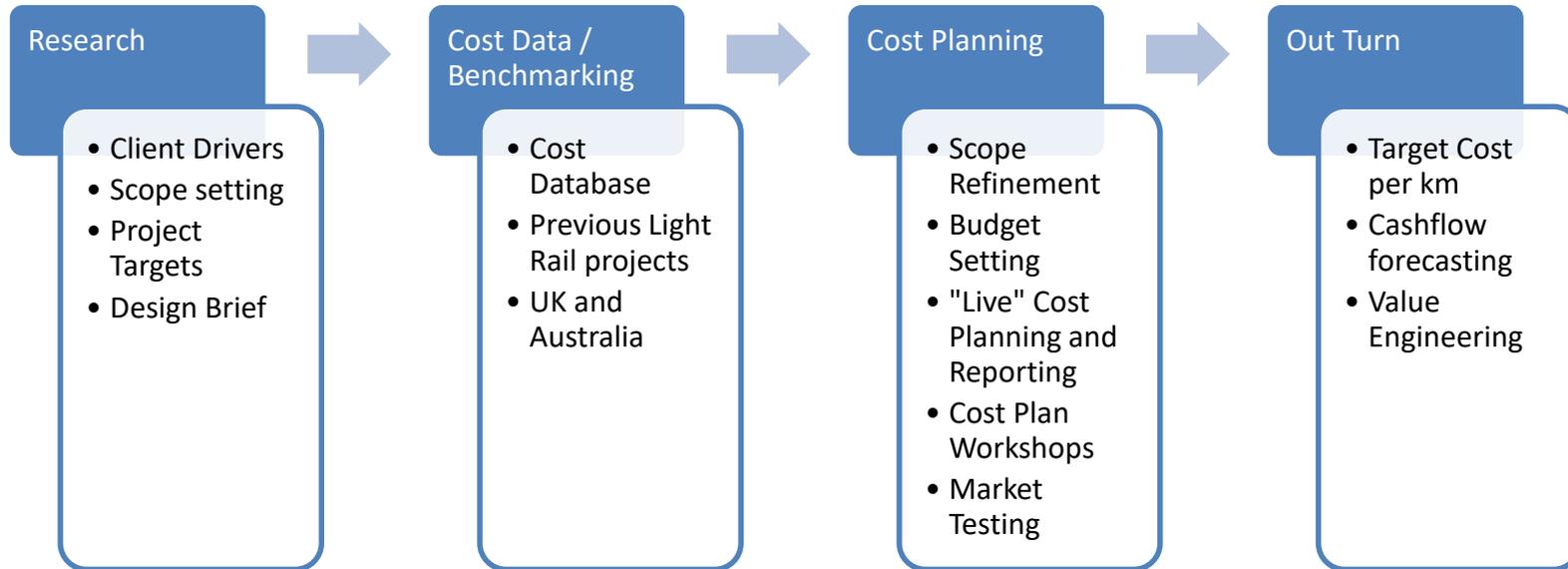
70+

YEARS OF DOING
BUSINESS IN THE REGION

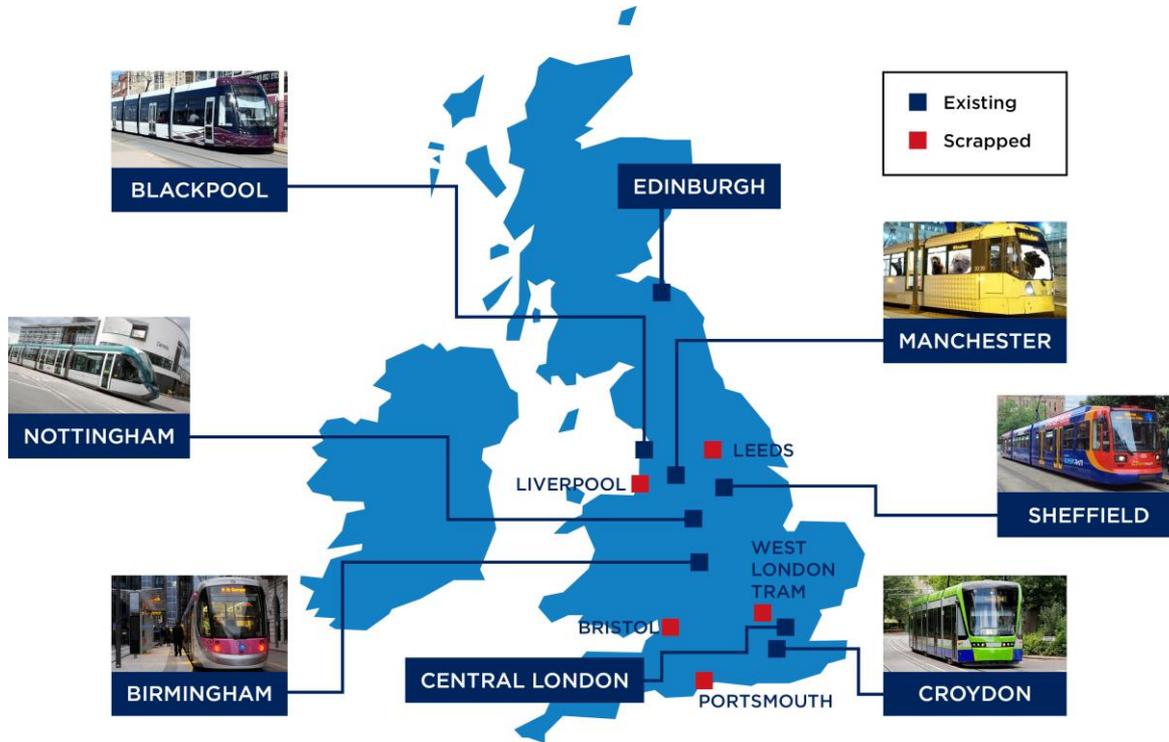


- **Birmingham**
- London
- Bristol
- Manchester
- Cumbria
- Sheffield
- Leeds
- Thames Valley
- Liverpool
- Warrington

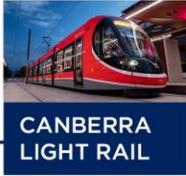
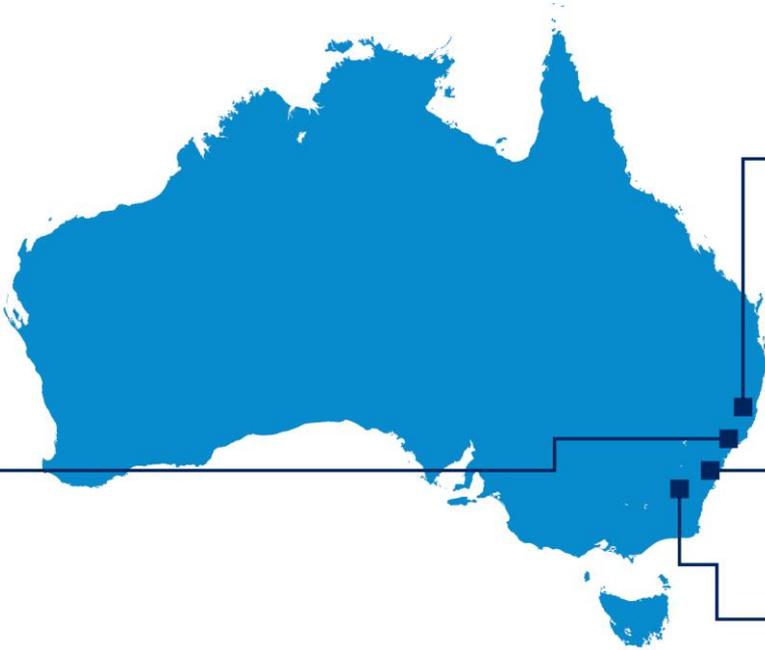
RLB CONTRIBUTION TO DUDLEY AND COVENTRY VLR



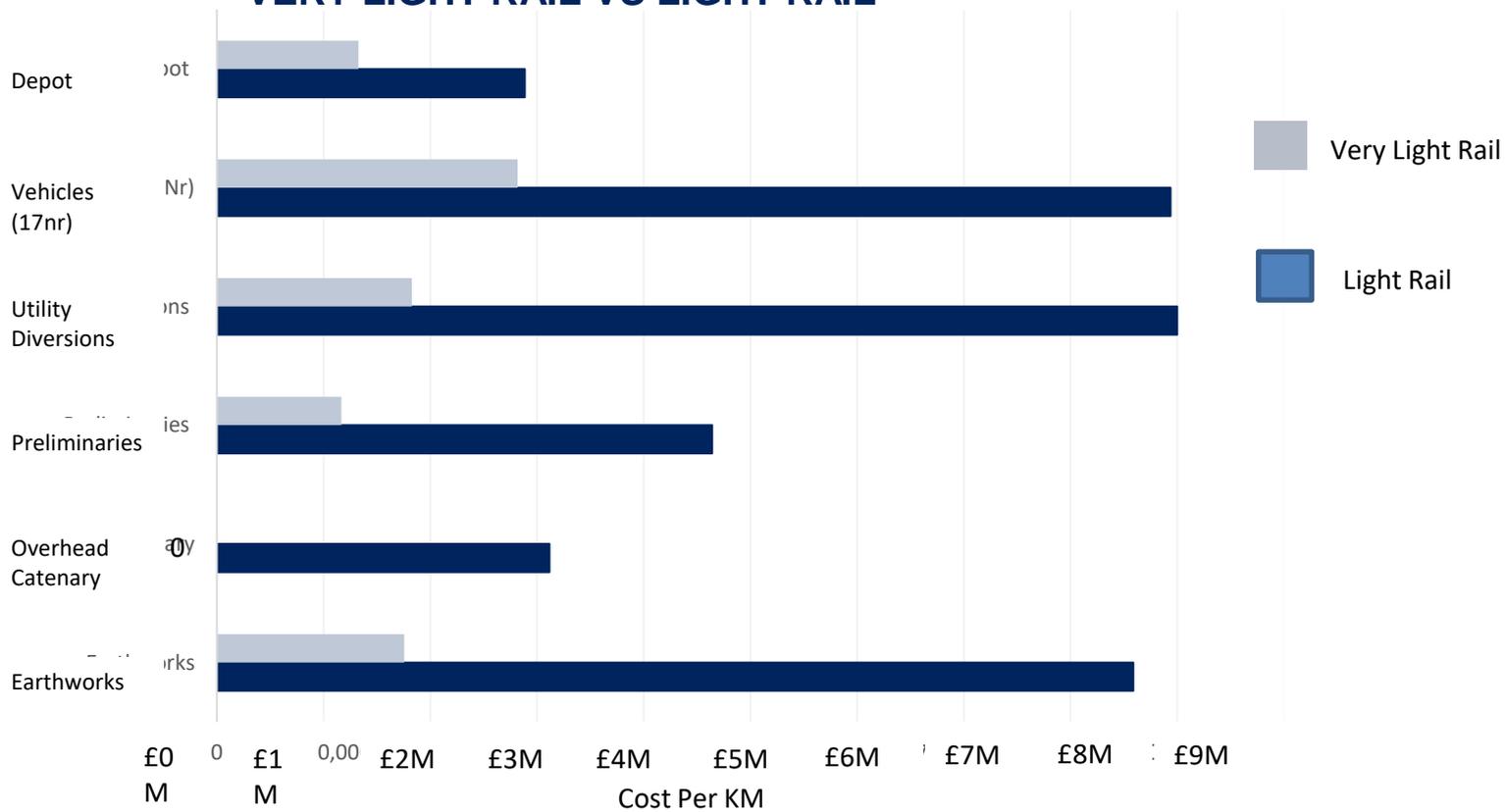
UK CITY LIGHT RAIL COST DATA



AUSTRALIA LIGHT RAIL COST DATA

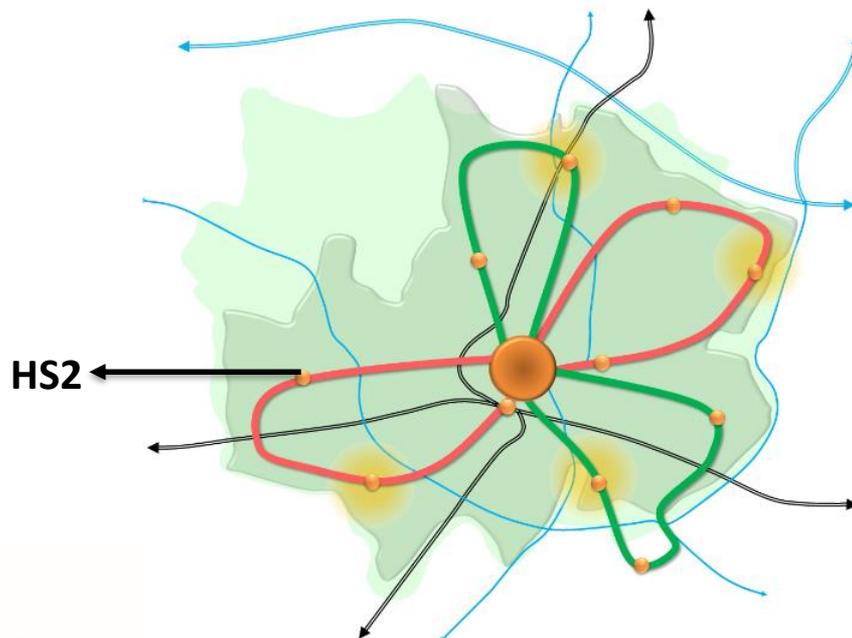


VERY LIGHT RAIL VS LIGHT RAIL



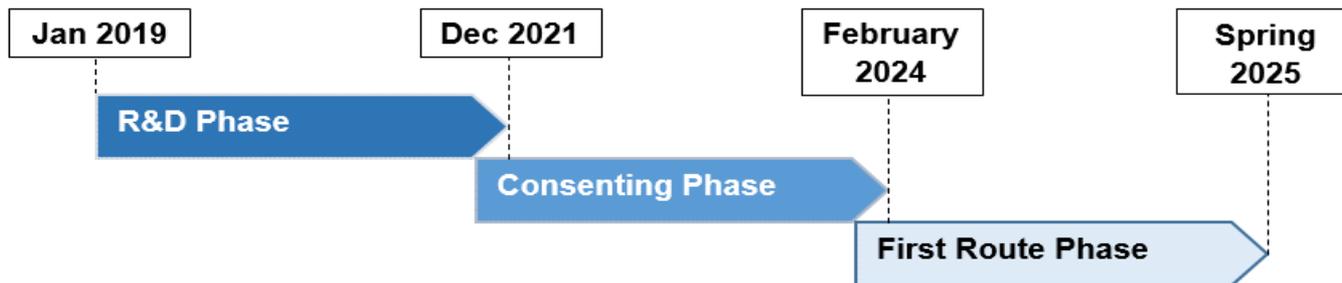
VLR First Route and Beyond

- First Route Rail Station to City Centre to UHCW
- Network to connect city centre to strategic locations
- Link to HS2



Phasing and Timeframe

- **Research & Development Phase** – all R&D to completion of the test track & vehicle proving
- **Consenting & Planning Phase** – all concept design, business case and Transport and Works Act Order application and determination
- **Construction of First Route** – detailed design and construction of the first route



2020 Milestones

- January 2020: Start construction of vehicle
- January 2020: Innovative Track design underway
- Summer 2020: Network Rail Test Track at Dudley VLRNIC site
- Autumn 2020: Demonstrator vehicle available for speed and endurance testing on the Network Rail Test Track



Steps to Success



Provide ICP and ongoing expert advice and guidance



Early engagement with utilities companies



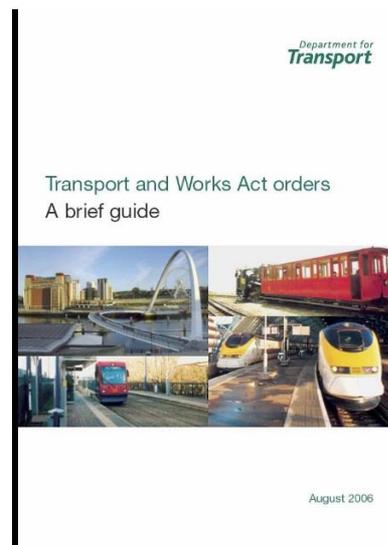
Lightweighting
Advanced Propulsion Systems
Intelligent Vehicles
Energy Storage and Management



Provide testing facilities at VLR Innovation Centre

Challenges

- Business Case
- TWAO
- Funding



Joint Venture and Its Purpose

Establish a corporate Joint Venture with one or more private sector partners who have the necessary skills, resource and expertise to achieve the shared vision to deliver VLR and mobilise the sector in the West Midlands Region.



Market Testing Outcomes

- 22 Cross-sector organisations
- Clearer JV opportunity
- Keen market interest
- Possible collaborations
- Showcase investment returns
- Gateway approach needed
- Intellectual Property Rights important but not vital
- JV exit strategy
- Procurement strategy and programme is critical



Anticipated Next Steps

November / December 2019:
JV procurement design

December 19/ January 20:
Further market testing with collaborative teams by invite

February 2020 OJEU / SSQ:
Sufficient time to establish partnerships / collaboration

2020

January	February	March	April
Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
May	June	July	August
Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
September	October	November	December
Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

<https://www.veva42.com/calendars/printable-calendars.html>

Printable Yearly Calendar © 2010 by Veva42.com. Free to Print.

Thank you for Listening

- Cllr O'Boyle, Cabinet Member for Jobs and Regeneration
Jim.O'Boyle@coventry.gov.uk
- Colin Knight, Director Transport and Highways, CCC
colin.knight@coventry.gov.uk
- Nicola Small, VLR Programme Manager, CCC
nicola.small@coventry.gov.uk
- Grant McKelvie, Commercial Director, CCC
grant.mckelvie@coventry.gov.uk
- Andy Stamps, Head of Infrastructure, RLB
andy.stamps@uk.rlb.com