Light Rail (UK) Group

Auchenshuggle Junction, 8 Beechmore,
Moore, Warrington, Cheshire,
England, United Kingdom.
WA4 6UE
Tel (+44) (0)1925 740675 (0) 07721378223
www.lightrailuk.co.uk email JimH@jimmyharkins.com

03 Apr 2023

Coventry is leading the charge on a new type of lightweight rail system that could shake up public transport in the UK and beyond. Andrew Wade, The Engineer, reports.

Coventry's newly designed shuttle will run on a lightweight track system - *CVLR*

The automotive industry looms large over the Midlands. A sprawling web of motorways and A roads stretches around Britain's belly, linking the metropolis of Birmingham with its smaller city neighbours of Wolverhampton and Coventry, as well as connecting the north and south of England. The West Midlands is also the UK's leading region for automotive manufacturing, home to OEMs like Aston Martin and Jaguar Land Rover, alongside countless vital links in the sector's supply chain. With the car such a visible, dominant force, it's perhaps no surprise that other modalities have often played second fiddle.

"Our public transport system in the region, it's not joined up in the way it should be, it's not integrated the way it should be," Jim O'Boyle, Coventry City Council's Cabinet Member for Jobs, Regeneration and Climate Change, told The Engineer.

The nature of the regional conurbation has played its part in this disjointedness. Transport for West Midlands - part of the West Midlands Combined Authority (WMCA) – has an overarching role, but

places like Solihull, Dudley and Walsall inevitably have their own priorities, as do the region's cities. There is, however, widespread agreement that a sustainable future for the region demands less private car journeys and more low carbon public transport. According to O'Boyle, trams have a fundamental role to play.

The first planned track segment will link the city's bus and train stations - *CVLR*.
"Once you put tracks down, people know where it's going, so it then has modal shift," he said. "It moves people from their cars because they know it's going to go where they want it to go. It's not going to be changed overnight. And secondly that then attracts investment."
According to multiple studies, trams are viewed as more reliable and more convenient than buses, as well as a more pleasant way to travel. These perceptions are essential when it comes to utilisation, prising people out of their private vehicles and onto public transport. But traditional light rail comes with a price tag to match those lofty public perceptions, as recent tram projects in Nottingham, Edinburgh and the West Midlands itself have demonstrated.
"Midland Metro, currently having an extension, it's costing £100m per kilometre," said O'Boyle. "It's not sustainable, that sort of cost."
For larger cities like London, spending these types of figures might make sense. Dense populations and high utilisation provide a stronger case when seeking funds from central government, as those living

outside the M25 are all too aware. For smaller cities like Coventry, whose own infamous ring road is testament to the car's primacy, £50m-£100m per km of new tram track is simply not an option. This conundrum is what led Coventry City Council to approach Warwick Manufacturing Group in 2016.
"They said 'we're looking for a tram, but we can't afford it'," explained Darren Hughes, Associate Professor in Materials and Manufacturing at WMG. "£50 million per kilometre is not viable, and essentially posed the question: Could you do it for 10? Could you build a tram system that's affordable, coming in at £10m per kilometre?"
What WMG came up with was a very light rail (VLR) solution. Hughes and colleagues carried out feasibility studies looking at new track and vehicle technologies, securing funding from Coventry City Council to advance the concept. Coventry Very Light Rail (CVLR) is now at demonstrator phase, with test track installed at multiple locations including the Warwick campus and a refuse depot, where it will be exposed to HGV loads.
This testing is crucial due to the novel nature of the track, which lies at the very heart of CVLR. Rather than reinvent the wheel, the system borrows heavily from existing technology, ensuring interoperability and supply chain security. Innovation comes in the form of the precast underpinning slab, which is made from Ultra High Performance Fibre Reinforced Concrete (UHPFRC). The material contains no aggregate, strengthened instead by embedded steel fibres.
As the name implies, UHPFRC's mechanical performance far exceeds traditional concrete. This enables thinner slabs to support the track, which in turn means that roads don't need to be dug up as deep during track installation. And that ultimately means that the rats' nest of subterranean utilities buried beneath the roads remains undisturbed, allowing enormous cost savings versus traditional tram systems.
"We only dig what is essentially 30 centimetres deep," said Hughes. "We have a very shallow track...which doesn't interact with services. And that was essentially what we realised we had to do to meet the £10 million per kilometre target.
"If there is a problem with the services, so if there's let's say a gas leak, you can turn off the gas and very quickly access the track. Remove a section, fix the leak, refit the track and get the system running again within a day."

A section of the lightweight test track - *CVLR*

Developed in partnership with Randel, the lightweight track system is the secret sauce at the heart of CVLR. It not only avoids rerouting of gas, water, electricity and telecom cables, it also means the track can be laid down in double quick time, minimising disruption and reaping additional financial savings as a result. And when it comes to public perception, the only thing better than a brand new tram system is one that gets installed rapidly, with minimal fuss.

"The way it works is a road planer comes in and planes out a groove in the road. You then bring the slab system in which is pre-manufactured," Hughes explained. "A lightweight concrete is poured around them and then they're black topped on top of after the rail has been placed."

Such is the faith in this new track system to shake up the light rail sector, Coventry City Council has applied for several patents to protect the intellectual property underpinning it. CVLR will also feature a new vehicle, a single carriage tram-like shuttle, developed by WMG in collaboration with Transport Design International (TDI). Carrying 50 passengers, 20 of whom can be seated, the battery-powered shuttles will be rapidly charged in short bursts at the end of each line throughout the day, then receive a deep charge overnight at a depot.

According to Hughes, it is envisaged the shuttles will run without a core timetable, passengers instead able to rely on an arrive-and-ride type service with Tube-like frequency. Though perhaps not as game changing as the track system, the vehicle has been informed by the automotive lightweighting the Midlands is synonymous with, and is capable of navigating the winding, narrow streets of Coventry's historic city centre.

"It can do very tight turns in cities," said Hughes. "One of the requirements for Coventry is a very tight 15 metre radius curve, which is quite difficult."

That agility is currently being put to the test at the newly opened Very Light Rail National Innovation Centre (VLRNIC) in Dudley, where a demonstrator vehicle and charging setup are already in situ. Part of the Black Country Innovative Manufacturing Organisation (BCIMO), the facility features a 2.2km test track, a 15-metre radius loop, an 870m curved tunnel, and a bespoke overhead electric charging system, commissioned to recharge the CVLR shuttle in under four minutes.

Steering things at the new centre is Nick Mallinson, director of Business and Innovation at BCIMO. An electrical engineer by trade, Mallinson formerly worked at WMG where he helped develop Revolution, a VLR vehicle project that was something of a precursor to Coventry VLR but aimed primarily at line extensions and reopening rather than entirely new tram systems.

"We're based in Dudley on the site of the old Dudley railway station and we have a test track that uses the old railway line," Mallinson told The Engineer.

Courtesy: Andrew Wade

THE ENGINEER

A test vehicle at the VLRNIC - *BCIMO*

Although the centre's remit extends well beyond CVLR, the Coventry project is a substantial part of its current workload and helped make the case for establishing the VLRNIC in the first place. Success with Coventry could act as a catalyst for wider adoption of very light rail, helping to spur a whole new transport ecosystem around it. This could help put the Centre at the forefront of technological development across several fundamental areas, including signalling and even autonomy, as well as the core functions of track and vehicle development.

"We are looking at being quite radical, so we don't want signals along railway tracks," said Mallinson. "We want it all digital. Whether it's using 5G, 6G, satellite communication, we don't really mind as long as it's wireless.

"We hope that by the end of 2023, what I would call proof of concept will be completed for the vehicle and slab track. I don't want to minimise what's being done on the vehicle, but all the innovation really is around making a very low-cost slab track that can be easily inserted into the road."

The newly opened Innovation Centre is based at the old Dudley rail station - *BCIMO.*

As well as interest from across the West Midlands and other parts of the UK, very light rail and its potential cost savings have also attracted enquiries from overseas. The interest is certainly welcome, but Mallinson is painfully aware that the UK must move fast in order to push home its current technological advantage. Too often, quality R&D work fails to reach commercial viability in the UK, something Mallinson has seen happen frequently throughout his engineering career.

"We're getting interest from around the world in very light rail," he said. "I had some visitors from the Philippines earlier this week who want to create what they call a 21st century tram solution, and they see very light rail as a way of doing it.

"What we have to be careful of, is that if we don't move at a reasonable pace, somebody else will basically take it and end up selling it to us, as has happened with many other technologies."

The prize on offer is potentially huge – a modality shift that could help reshape public transport in cities in the UK and beyond, accompanied by jobs and growth opportunities across the Midlands. Ensuring the benefits of very light rail - both on track and off - are felt across the region is paramount for Councillor Jim O'Boyle. Having seen other transport systems outsource procurement abroad, he is keen to tap into the wealth of manufacturing expertise that sits on his political doorstep.

"This isn't just a transport scheme, this is an economic opportunity as well," said O'Boyle. "We need to build things in this country. We need to create jobs in this country. So, we built the vehicle in Coventry. We're building and making the track in this region.

"When you consider that, for example, Midland Metro - which is one of the Black Country's tram systems - that's made in Spain. We're missing a trick here. We've used automotive lightweighting technology that we're world class at in this city. And to adapt that – which is one of the big challenges but also one of the big innovations – into rail-based systems, I think that's what will set this apart."

It's been a long haul to get CVLR to this point, but all the pieces are now in place for the project to deliver. Once the track and the vehicle have been certified, the next major milestone will see a 2km stretch laid down in the centre of Coventry, linking the city's bus and rail stations. This mini route will not operate a regular service, acting instead as a pathfinder, allowing the stakeholders to iron out any kinks while also appraising how the city reacts to its latest transport addition.

If successful, this will then enable Coventry City Council to apply for central government funding to build out a sequence of full routes over the coming years. The 2km demo stretch will be incorporated into the first of those routes, set to link Coventry rail station with the University Hospital via the city centre. In parallel, the council will seek to commercialise the intellectual property it has developed alongside WMG, with Coventry acting as a showroom for VLR.

"No other city anywhere in the country is doing anything like this," said O'Boyle. "It's very rare for a council to front up on, if you like, an R&D project.

"Absolutely the plan is that we would want to sell this on as a product to other cities and countries, hence why we've got interest around the country, interest around the world. But until we have the demonstrator up and running, technically we have an R&D project, we don't have a system. We'll have a system within 12 months and then I think it will take on a life of its own."