TRAMS: A SOLUTION TO POOR AIR QUALITY

James Harkins looks at the public health issues surrounding our increasingly pollution-choked cities, and how trams and light rail can save lives - and money

▲▼ **Cities such as Los Angeles (seen above) are choking under the weight of fossil fuel-based industry and combustion-engined vehicle traffic. Sadly this situation is not unique, with other areas around the world even having to recommend residents stay indoors on days where pollution levels reach dangerous levels.**
Above: trekandshoot / shutterstock – Below: Paolo Bona / shutterstock.com

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An important new dimension in light rail/tram vehicle development is the development of onboard hydrogen fuel cells, offering another attractive emissions-free alternative to traction power and catenary-free operation.

In 2015, Foshan, a city of some eight million people in southern China, rolled out the first of many CSR Sifang low-floor trams that will be powered by hydrogen. Similar vehicles have recently entered service in Qingdao, a city of nine million inhabitants in eastern China. Each can carry up to 380 passengers, has a range of 100km (over 60 miles), and offers a maximum operational speed of 70km/h (43mph). Refuelling will take a claimed three minutes. Best of all, as hydrogen fuel cells generate electricity through a chemical reaction of hydrogen and oxygen, the 'exhaust' from the vehicles will be nothing but water vapour.

China has impressive wider light rail ambitions and has really put its weight behind the mode in supporting urban growth while reducing congestion and pollution. As part of a major demographic rebalancing over the past three decades, China now has over 170 cities with more than one million inhabitants; currently over 50% of the population live in such cities, and following global trends this is expected to rise to 70% by 2030. With a potential population of 1.5 billion by this time, the issues are obvious to all.

In addressing these challenges, plans exist to build and equip more than 2000km (1250 mile) of new lines by 2020 and up to 4000km (2500 miles) by 2050. This forward-thinking development of even more environmentally-friendly tram power systems – as well as others from smaller streetcar manufacturers such TIG/m operating in Aruba and Dubai – is significant in the fight to secure clean air in the world's towns and cities.

Air pollution has well-proven links to coronary artery and respiratory disease and strokes, with studies showing that traffic-related pollution can seriously affect lung function, particularly in both children and older people. It is also well known that diesel vehicles emit more of these dangerous pollutants than petrol models.

In the UK, 16 cities and regions, including London, Manchester, Leeds, Birmingham and Glasgow, have levels of air pollution that exceed European Union limits – long after they were obliged to comply with agreed boundaries.

Increasingly, air quality has moved up the political agenda: campaigners have repeatedly challenged the UK Government's plans, and in March this year the country's official opposition party (Labour) strongly criticised the government's record.

Labour leader Jeremy Corbyn claimed at Prime Minister's Questions in Parliament on 16 March that 500 000 people in the UK would die due to a failure to meet air pollution rules, and that an estimate by the Royal College of Physicians put the cost to the economy at GBP20bn (EUR25bn) a year.

Air pollution has been estimated to cause far more deaths in the UK than either obesity or alcohol – and the problem is not new. A quick look back at the country's National Health Service in 1999-2000 (when figures in this format were last readily available) shows that there were over 10 500 respiratory disease-related operations, resulting in 2.8m bed days per year for treatment alone.

Time for action

Given such powerful evidence, and the wider legal implications for continued failure to abide by EU regulations, governments must take immediate action to tackle high pollution levels, particularly targeting nitrogen dioxide (NO_2) and fine particulate emissions.

But the story goes further. Following a landmark court ruling in April 2015, a panel of Supreme Court justices ordered that the UK Government must meet its obligations under European law on pollution limits and consult on new air quality plans. The case's findings showed that areas such as London, Birmingham, Glasgow, Edinburgh, Dundee, Aberdeen, Liverpool, Bristol and Leeds would not meet pollution limits until 2030 – 20 years after the original deadline of 2010.

▲ **Traffic gridlock is a common sight in towns and cities worldwide, crippling areas not designed to cope with the growth in private car usage; trams and light rail can reduce traffic and associated pollution.** bibiphoto / shutterstock

Various governments around the world have tried to sell us the 'low cost' options of more efficient roads, cars, vans, buses and trucks, but the evidence fundamentally shows that these do not work on the scale now required before towns and cities choke. Given the slow take-up of electric vehicles due to high initial purchase and leasing costs, and fundamental flaws in the current technologies and infrastructure around them, a step-change is needed urgently now that the facts are in the public domain. There is also the strong moral imperative to reduce illness and the risk of early mortality of our hard-working families, the very young and older citizens.

But there is a solution to clean, sustainable, efficient urban movement – and one that has been proven worldwide for over 150 years. UK light rail and tram system usage has been on the rise – in the 2014/15 financial year England recorded passenger numbers of 239.8m according to the Department for Transport – a record since the start of the compilation of comparable statistics in 1983. Light rail journeys have risen 51% since 2005 – this is in a climate of major expansion in Nottingham, Manchester and the West Midlands that is driving the mode's popularity in the UK. It is worth noting that this has been achieved without direct operational subsidies – unlike a number of lesser-performing mainline Train Operating Companies enjoy. Globally, there are more than 13.5bn light rail journeys per year, according to a statistics brief released by the UITP in October 2015. These figures are growing year-on-year, too, further proving the popularity of rail-based urban transport with cities and passengers alike.

There is a simple method of increasing the attractiveness of light rail and tram systems to local authorities currently put off by subconscious considerations of over-engineering, cost overruns and general urban blight. In the UK there needs to be a change to the current Department for Transport Cost Benefit Ratio measurement tool from the short 12-20-year period to something that better reflects the 50-year-plus generational benefits of light rail.

We also need to be more imaginative in our delivery to capture the soft benefits of urban regeneration and renewal, creating the vibrant places to live and work seen in many continental countries. Only then can we enjoy both a greater freedom of movement and continued longevity – and not one at the expense of the other.

A recent report launched by UKTram at a meeting of the All-Party Parliamentary Light Rail Group shows that significantly higher regeneration and jobs are created in the eight UK city regions with light rail or tram systems, something that will help drive the rebalancing and growth of the economy.

The case for tram-train

There is also a role for an intermediate type of rail vehicle – the tram-train. Tram-trains can run on mainline railways but have many of the characteristics of the modern LRV.

In the UK they would typically have a floor height of 950mm to give level access on standard platforms, plus the flexibility for street-level platform operation; magnetic track brakes and balancing making them capable of running on 'line of sight', as well as inter-working with conventional trains and freeing up capacity at main stations.

This would enable them to run on non-segregated tramway alignments and thus provide better transport access in places where a railway route does not run close to the intended destination of passengers – but where it would be either difficult or prohibitively expensive to construct a conventional railway.

Tram-trains have the potential to attract new passengers to rail, by facilitating a better transport offering (whilst reducing overall costs), and by the development of new services and creation of journey opportunities for rail users – in effect taking the railway to the people by going where they want to.

▲ **The Sheffield – Rotherham tram-train pilot could attract a whole new audience to urban rail.** R. Buckley

Substantial evidence from continental Europe shows that tram-train schemes can develop significant revenue streams and enhance the modal switch from road to rail in urban areas. However there is also evidence that tram-train schemes will only be delivered if the wider industry works in partnership to make that happen.

We have the money and the expertise, so this nasty nettle has to be grasped and a statesman's view of funding over multiple generations is needed. If this is done, we will go a very long way to cleaning up and regenerating our cities.

› *James Harkins is Chairman of the Light Rail Transit Association's External Relations Group, Secretariat of the UK All-Party Parliamentary Light Rail Group and Managing Director of the not-for-profit Light Rail (UK).*

DEFINING LIGHT RAIL

There is often some confusion in the terminology used to describe light rail because the technical and operational scope the term encompasses is very wide.

Light rail – or more properly Light Rail Transit – is a mode of transport that uses rail vehicles that are more versatile than conventional 'heavy rail' trains and have street-running capabilities. A light rail vehicle (LRV) can negotiate sharper curves in both the vertical and horizontal planes, and negotiate steeper gradients and stop much faster than a conventional train. It can therefore operate in 'line of sight' mode without having major signalling requirements.

LRT also moves large passenger flows in a more cost-effective way than buses, but at a fraction of the cost of a full urban railway or metro, so can be more appropriate in urban or inter-urban systems in medium-sized cities. It also offers valuable feeder and urban connector roles for wider transportation networks.

It is also clean, relatively quiet, and can be quicker to build than heavy rail systems.

In terms of attractiveness, LRVs can provide the ambience of a train, but run in places where trains cannot; they are thus able to attract motorists out of cars where a bus would not.