



# Light Rail (UK)

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## Light Rail and Trams,

The almost complete answer to poor Urban Air Quality

Urban air in much of Europe is not fit to breathe, and vehicles, especially diesel cars and buses, are the principal cause. High levels of particles, nitrogen oxides and unburned fuel create a cocktail of harmful pollution that is breathed by almost every urban European citizen. The effects are half a million premature deaths each year; a quarter of a million hospital admissions; and 100 million lost working days cumulatively costing over €900 billion. The crisis is taking place despite extensive EU laws that limit ambient air-pollution levels, total national emissions, and emissions from major sources including vehicles. The Commission has acted against 18 EU member states for breaching pollution levels but progress to tackle the problem is glacial. EU limits for air pollution are projected to be breached for at least another 15 years and levels will remain above World Health Organisation no-effect guidelines.

Road vehicles are the principal source of exposure because of their ubiquity and the proximity of the exhaust emissions to people. For example, vehicles produce 80% of the particulates and 46% of nitrogen oxides in London. There has been some progress: lead has been removed from fuel; carbon monoxide levels have been reduced; and the introduction of Euro 6 limits on diesel cars is reducing primary particulate emissions. But nitrogen oxides (NOx) remain a key problem especially from diesel engines. These are converted in the air to toxic nitrogen dioxide and ultimately to secondary nitrate aerosol particles and to ozone (when combined with unburned fuel in the air). Particle emissions from older diesels and vehicles with damaged or illegally removed diesel particulate filters remain an issue. There are also problems with gasoline vehicles, notably particles from gasoline direct injection vehicles

The failure of Glasgow to curb air pollution from traffic blamed for killing hundreds of people every year has been challenged in the supreme court. The environment group, Client Earth, has successfully taken the UK government to court for allowing lethal and illegal levels of toxic gasses belched out by vehicle exhausts to persist in the city centre.

Glasgow is one of 16 UK cities breaching European air pollution law. Levels of nitrogen dioxide, which can cause breathing problems, are expected to remain in breach of safety limits on the city's streets until 2025, 15 years behind the original deadline. Westminster's official air pollution warning service predicts that nitrogen dioxide gas levels in Glasgow this year could be almost twice the legal limit. In recent years Hope Street and Dumbarton Road have consistently ranked as some of the worst polluted streets in Scotland. An expert report last year backed by the UK Department of Health estimated that pollution from tiny, sooty particles emitted by traffic caused more than 300 premature deaths a year in Glasgow.

A rating last month by international environmental groups awarded the city an 'F' for its poor efforts in tackling the problem.



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The Supreme Court hearing in London is the culmination of a four-year legal battle on air pollution across the UK. It follows a major ruling last year from the European Court of Justice, which said that the UK must meet air quality standards in the “shortest possible time”. Client Earth’s lawyer, Alan Andrews, said that air pollution was causing a public health crisis. “Air pollution in the UK is an invisible killer, causing 29,000 early deaths every year, heart attacks, asthma attacks, strokes and cancer,” he said. “Politicians in Holyrood and Westminster need to work together to find a solution. Levels of pollution in Glasgow are not only harmful to health, they’re also illegal. We need to keep the most polluting diesel vehicles out of city centres to protect our children.” Client Earth had taken the case to the Supreme Court to try and get judges to force governments to act, Andrews said. He is calling on the court to order new plans to be drawn up showing how pollution levels will be reduced.

The case is backed by Friends of the Earth Scotland, which has led a campaign to cut air pollution. “Glasgow’s performance on tackling air pollution has been abysmal to date,” said the environmental group’s campaigner, Emilia Hannah. She pointed out that of the 17 measures being put forward by the city council to improve air quality, 11 are officially expected to have a “low” impact, five a “low to medium” impact and just one a “medium” impact. “It’s very poor,” she commented. According to Hannah, European safety limits were also being breached in Edinburgh, Central and North-East Scotland. Friends of the Earth Scotland is calling for the Scottish Government to introduce “low emission zones” to ban the most polluting vehicles from Glasgow, Edinburgh, Aberdeen and Dundee by 2018. Holyrood’s current plans “lack vision and clarity”,

Hannah said. “To tackle deadly air pollution the strategy must reduce traffic levels and improve vehicle emission standards,” she added “The Scottish Government needs to make a legal requirement that low emission zones be implemented in major cities. It also needs to provide the cash to city councils to enable them to happen.”

The Scottish government accepted that there were problems but stressed that improvements had been made. A consultation on a draft low-emission strategy was concluded last week. “Working in partnership with Scotland’s 32 authorities, we continue to make progress in improving our air quality,” said a government spokeswoman. “Data shows that significant reductions in air pollutants have been achieved since 1990 and the action we are taking will secure further reductions.” But she added: “Although there has been very good progress, we recognise that there is more to be done to deliver further health and environmental benefits where areas of poorer quality air remain.”

Glasgow City Council argued that there was a limit to what councils could do. “The issues around air quality are often directed towards local authorities, but the really big policy drivers are in the hands of central or devolved government,” said a council spokeswoman. “Councils need to be given the appropriate powers and resources to address these issues. We need to work together to reduce our air pollution levels, improve the health and well-being of our citizens and the council cannot do this alone.”



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We cannot choose where we breathe so we must stop cars polluting our city air. The technology to clean up vehicle and machinery exhausts is available and costs a few million euros. It is a small price compared to the nearly **€1 trillion spent annually in health care** and lost output and productivity.

Cars with combustion engines must be stopped from polluting our urban air or prevented from accessing our cities.

There is also a more serious effects caused by the wear & tear on the road surface, wearing out of rubber tyres and to a smaller extent the dust created by brake linings. This is commonly known as the “Oslo” effect and the pollution goes down to 2.5 microns and is highly carcinogenic with a high level of “Heavy metals”, a nasty toxic mixture which is being over shadowed by the “Tail Pipe emission issue. The “Oslo Effect” can effectively negate rubber wheeled electric vehicles in the built up area as all that we are doing is substituting a more toxic airborne pollutant for another without solving the congestion problem

Citizens deserve the right to clean air wherever we need to breathe.

The solution for most cities, towns and affected corridors is here already in the form of Light Rail, Trams and Ultra-Light Rail does not need to be invented yet, tried and tested but not supported by the Treasury as it is a generational solution and not a quick fix within the life of a Parliament.

Many advances have been made in reducing the high costs in installing Light Rail by UKTram and significant lessons learnt from Edinburgh, a classic example of how not to build a tramway.

There is a confusion in the term used to describe Light Rail in its many formats as the scope of this mode and operations are very wide so I will use the term Light Rail in specific and the term Tram in general as the term Light Rail generally has now become polluted by the sub conscious thoughts of over engineering, over costs and general urban blight etc., where as the term Tram is more acceptable in human and affordable cost terms

Light-rail transit, (LRT) or Trams, is a relative newcomer to the world of mass transit. Heavy rail, subways take a long time to build and they're expensive.

This is a mode of transport which uses rail vehicles which are more versatile than conventional “heavy rail” trains and have street running capabilities. A light rail vehicle can negotiate sharper curves than a conventional train (both vertical and horizontal), can negotiate steeper gradients and can stop much faster so can operate in line of sight mode without major signaling requirements.

The systems available provide the ability to follow the curves and gradients of the urban environment which a conventional train cannot do. Light Rail systems offer an attractive and effective system, reducing congestion and pollution by offering motorists an alternative to car use, Manchester Metrolink registered a modal switch approaching 32%, helping to create pollution-free zones in cities (clear zones).



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It moves large passenger flows in a more cost-effective way than buses, but at a fraction of the cost of a full urban railway. Light rail/tram is mainly appropriate in urban or inter-urban systems in medium-sized cities where full metro systems are inappropriate.

In the largest cities underground/metro systems tend to be the mainstay of public transport but such cities might use a light rail solution to supplement the metro system.

Light Rail vehicles can provide the ambience of a train, but can run in places where a train cannot. They are thus able to attract motorists out of cars where a bus would not be successful. Even when running on former rail alignments, light rail vehicles can offer a better service because they can offer a more frequent service. They can stop at more places because the stops are much easier and cheaper to construct than railway stations. On roads as trams, they can offer attractive journey times in comparisons with cars and buses by taking advantage of segregated alignments and the latest traffic engineering techniques to avoid road congestion.

A frequent light rail/tram service provides security in city streets throughout the day, both on and off the vehicle. Low-floors together with a spacious layout provide easy access to mainstream public transport for everyone including parents with buggies and disabled people using wheelchairs.

Trams are generally electric vehicles which produce no pollution at the point of service delivery, may use locally produced "green" electricity and the visible path makes sharing precincts with pedestrians a safe option. Thus pedestrian precincts with trams can provide access to city centre areas where buses and cars would be obtrusive.

A significant part of the success of any system is the demonstration that changing peoples life styles away from the car and its choking consequences and can be of considerable benefit to them and their surroundings

In some situations, where conventional tramway systems are not appropriate, intermediate rail can be considered.

Intermediate rail vehicles can be a TramTrain which can run on main line railways but have some of the characteristics of light rail vehicles. Typically they would have (in the UK) a floor height of 950 mm to give level access on standard Railtrack platforms and the flexibility for street level platform, magnetic track brakes and balancing, capable of running on line of sight, inter-working with conventional trains and frees up capacity at main stations

This would enable them to run on non-segregated alignments providing better access in places where the railway route is not near to the destination of passengers and where it would be difficult or prohibitively expensive to construct a conventional railway.



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In the meantime, LRT technology has made great advances. It's clean, relatively quiet, and can be quicker to build than heavy rail systems, for example Manchester Metrolink Airport Line which came in significantly under budget and a year early

Tram Train has the potential to provide a new passenger rail service, a better transport offering whilst reducing overall costs to UK plc, development of a new service to rail users, providing new journey opportunities, taking the railway to where people want it to go to both origin & destinations, providing easier access to trains, in effect taking the railways to the people again. May have higher upfront costs but deliver lower whole-life costs. Substantial evidence from Europe shows that this develops into a significant revenue stream and enhances the modal switch from road to rail in the urban area, but will only be delivered if the wider industry works in partnership to make it happen

Examples in the UK are:

Greater Manchester with plans for TramTrain in the Stockport/Marple area, Birmingham, Glasgow, Edinburgh, Liverpool, Leeds, London, Bristol, Cheshire, Cardiff Bay development but to name a few who are almost TramTrain ready

A recent development in light rail/tram is the growth of on board fuel supplied vehicles giving catenary free vehicles powered by hydrogen fuel cells.

Foshan, a city of some eight million in southern China, has rolled out the first of what will be many trams powered by hydrogen. When they enter service, each will carry up to 380 passengers, have a range of 100 km, and a top speed of 70 km/h, refueling it will take just three minutes. Hydrogen fuel cells generate electricity by creating a chemical reaction using hydrogen and oxygen. That means their exhaust is nothing but water.

The trams are manufactured by Sifang, a subsidiary of state-owned China South Rail Corp.

If the new trams turn out as planned, China plans to spend US\$32 billion in the next five years to build and equip 2,000 km of lines.

At the other end of the scale, several relatively low cost hydrogen trams have been developed in service.

One successful hydrogen tram is operating in Aruba linking the Port with the capital city Oranjestad



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*An example of a low cost hydrogen tram in the tourist role, there are standard type vehicles with this manufacture.*

*A scheme using this technology has been proposed for Dundee*

Air pollution has been linked to coronary artery disease, heart attacks and strokes, with studies showing that traffic-related air pollution affects lung function in children and older people. Diesel vehicles emit more of the dangerous pollutants than petrol vehicles. Sixteen cities and regions including London, Manchester, Leeds, Birmingham and Glasgow have illegal levels of air pollution long after they were obliged to comply with agreed limits

Particulates are one of the worst offenders in air pollution because they damage the lungs when inhaled.

Stand at a busy road junction on a bright day and chances are you will see it: a Wacky Races cloud of black smoke left hanging in the air after a car pulls away. These clouds are actually particles of soot – partially burnt fuel from diesel engines – and they are arguably the worst environmental menace facing city-living Britons – and children in particular.

Particulates are one of the worst offenders in air pollution because

"Exposure to air pollution affects the health of everyone, especially children, and those living with pre-existing lung conditions. Developing and implementing a coherent strategy for reducing air pollution is therefore essential if we are to clean up our dirty air and protect the health of us all."



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Photograph: Peter MacDiarmid

Air pollution causes 29,000 early deaths a year in the UK, more than obesity and alcohol combined

A look back at the costs in 1999/2000 to the NHS (when these figures in this format were last readily available) there were over 10,500 operations for respiratory disease.

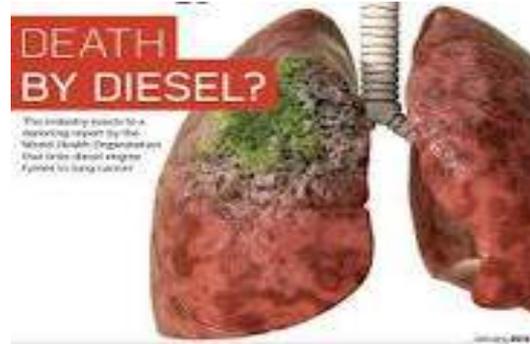
The total cost of respiratory disease to the NHS 1999/2000 £2,576 million made up of Primary Care for respiratory disease across the UK costs £647.5, hospital inpatient care costs £1,062.2 million, hospital day case care costs £18.2 million, outpatient care costs £40.7 million, 2,800,000 bed days per year used for treatment alone. In 1999 alone, respiratory disease caused 153,000 deaths (74,000 men and 79,000 women) production losses due to respiratory disease £3,194 million, mortality £1,643.6 million morbidity, working days lost 28,309,000 multiplied by the average daily earnings produces an estimated £2,239 million pound



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The Government must take immediate action to tackle high levels of nitrogen dioxide (NO<sub>2</sub>) pollution in the UK following a landmark court ruling.

Supreme Court justices announced the verdict today and said ministers must draw up new air quality plans to meet obligations under European law on pollution limits.

A panel of five judges, headed by the court's president Lord Neuberger, ordered "that the Government must prepare and consult on new air quality plans for submission to the European Commission, no later than December 31 2015

The Secretary of State "admits in this case the UK has failed to comply with the nitrogen dioxide limits first laid down by EU law in 1999, now contained in Article 13 of the directive". A DEFRA report from 2014 has lain unheeded until this court case

Some areas such as London, Birmingham Glasgow, Edinburgh, Dundee, Aberdeen, Liverpool, Bristol and Leeds will not meet pollution limits until 2030, 20 years after the original deadline of 2010.





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*The "Green bus solution", an oxymoron in itself may be electric and therefore "Green" the wearing out of the road surface, the dust from brake lining and the microscopic dust created by tyre wear produces a greater combination of heavy metals in the PM2.5 pollution, a extremely lethal combination over and above any tail pipe emissions in the urban area*

By forcing the Government to urgently clean up pollution from/and including diesel vehicles, by implementing as France has done light rail and tramway systems which are emission free and can use energy from non polluting means of power generation.

All governments have tried to sell us the low cost options of more efficient roads, cars, buses and trucks etc., but the evidence shows that these do not work on the scale now needed and this is a fatal path for many that they are taking and whilst it appears that lip service is paid to saving the planet etc., a step change with this new Government now that the facts are in the public domain has morally to do this to reduce the illness and death of hard working families, our very young and to enable our older citizens to enjoy considerable healthy, happy longevity

Light rail usage increased in 2014/15. Passenger journeys and vehicle miles reached the highest figures recorded in the modern era, continuing two decades of growth without any direct operational subsidies unlike that a significant number of bottom end Train Operating Companies enjoy at the moment

Across the 8 light rail systems in England there were 239.8 million passenger journeys in 2014/15, a 2% increase on the previous year.

The rising passenger journeys and vehicle miles can at least in part be attributed to network expansion, for example route miles on the Manchester Metrolink increased by 15% from 2012/13 to 2013/14.

Light rail and tram revenue increased by 6% in real terms to £290 million in 2013/14 compared to 2012/13. Average revenue per journey has increased 4.6 pence (3.8%) in real terms to 128 pence between 2012/13 and 2013/14

A simple method of doing this is to change the DfT measurement tool Cost Benefit Ratio from the short number of years (12/20yrs) to something to reflect the generational benefits of Light Rail to 60 years + and be imaginative to capture many of the soft benefits as is done on many continental countries and then we can be a one nation enjoying our movements and health together and not one at the expense of the other



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A recent report launched by UKTram at the summer meeting of the All Party Parliamentary Light Rail Group shows the significantly higher regeneration and jobs created in the 8 city regions in UK with this mode which will power the rebalancing and growth of the economy  
We have the money, experts and this nasty nettle has to be grasped and a statesman's view over several generation funding is needed and we will go a very long way to cleaning up and regenerating our cities



James Harkins FCILT MTPS  
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*A not for profit Company*  
October 2015

Source Material: Tackling Air Pollution from Vehicles. September 2015 by Transport & Environment  
[www.transportenvironment.org/publications](http://www.transportenvironment.org/publications)

Source Material: SNP Publication

Source Material: The British Thoracic Society Respiratory Illness 1999

Source Material: Defra Report: Estimating local mortality re PMs

Source Material: Sundry articles