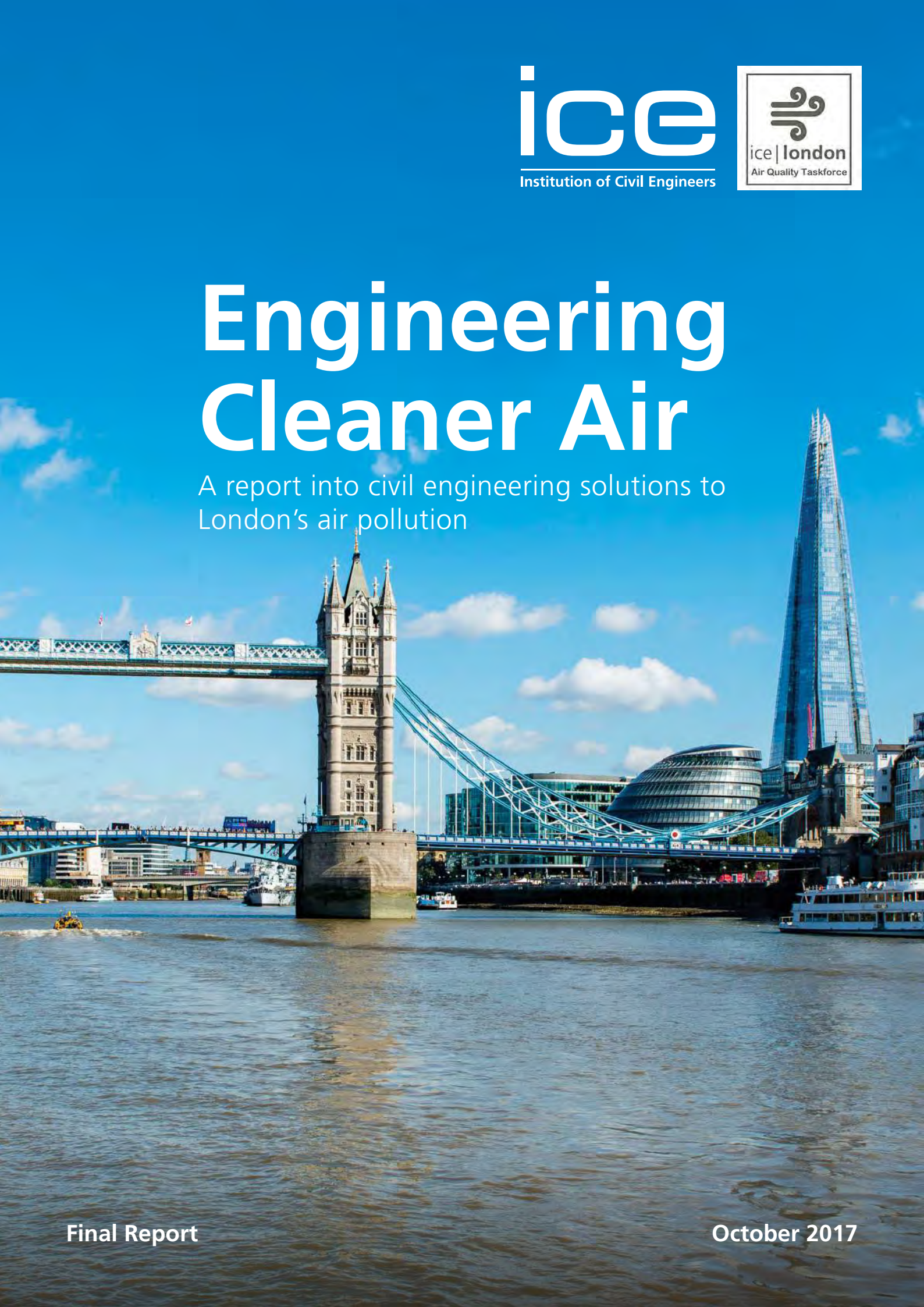
Institution of Civil Engineers

ice | london
Air Quality Taskforce

Engineering Cleaner Air

A report into civil engineering solutions to London's air pollution



Final Report

October 2017

About

Institution of Civil Engineers

The Institution of Civil Engineers (ICE) is one of the pre-eminent engineering institutions in the world. Established as a learned society in 1818, it has over 90,000 members and provides a voice for civil engineering, continuing professional development and promoting best practice throughout the industry. ICE produces reports, provides thought leadership and develops infrastructure policy to better inform decision makers across the world.

ICE London

ICE London supports and represents over 9,000 members living and working in the Capital to actively promote civil engineering with industry, schools, universities, local government and the media. ICE London and its members have been key in providing expert advice to City Hall and London policy makers on a wide range of infrastructure issues.

ICE London Air Quality Taskforce

The ICE London Air Quality Taskforce was established in early 2016 and brings together a group of experts in a variety of fields, along with key figures in the air quality debate, with the aim of thoroughly examining the issue of air pollution in London and developing a civil engineering response to the problem.
Led by Peter Hansford, former ICE President and Chief Construction Advisor to the Government, the Taskforce has engaged with a number of organisations and individuals to investigate what more can be done by policy makers and the civil engineering profession to play an important part in solving the issue of poor air quality in London.

Members of the Taskforce[1]:

- Professor Peter Hansford, Chair of Construction and Infrastructure Policy, UCL
- Simon Birkett, Founder and Director, Clean Air in London
- James Bulleid, Divisional Technology Director – Infrastructure Division, Costain
- Tony Caccavone, Expansion Airline Strategy Director, Heathrow
- Nigel Earnshaw, Asset Management Director, Black & Veatch
- Ralph Goldney, Managing Director, Railfreight Consulting
- Paul Gregory, Project Director, Sir Robert McAlpine
- Professor Prashant Kumar, Founding Director of GCARE, University of Surrey
- Professor Francesca Medda, Director of Transport & Infrastructure Studies, UCL
- Suzanne Moroney, Director, ICE London
- Heleni Pantelidou, Associate Director, Infrastructure London, Arup
- Ken Simmonds, Executive Director of Operations, Jacobs
- Max Sugarman, External Relations Executive, ICE London
- Jean Venables, Director, Venables Consultancy

[1] All views expressed in this paper are of the Taskforce members individually and not the companies listed above.

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Foreword

Air quality continues to be a pressing concern for Londoners. It is only right, that as civil engineers, we offer our expertise.

Air quality has continued to rise up the list of top concerns for Londoners. In March 2016, only a few months before the Mayoral election, 43% of Londoners listed air quality as their biggest health threat, more than drug use, stress or poor diet. When asking parents whether they were concerned for their children's health because of poor air quality, more than two thirds said they were.[2]

Sadly, the fears of the health risks caused by air pollution are well founded. Every year, it takes only a few days for a number of central areas in London to breach the Nitrogen Dioxide hourly EU legal limit value for the calendar year. 52,000 life-years were lost due to man-made particulate matter in London in 2010 – a cost that is being felt by people across the capital.[3]

Last year, the election of Sadiq Khan as Mayor provided a fresh opportunity for action. Mayor Khan has proposed an £10 emissions surcharge, bringing forward of the Ultra-Low Emission Zone to 2019 and expanding it. The Mayor's draft Transport Strategy, published in July 2017 provided a step change in how we think about transport, pollution and health in our city.

It is within this context, that we – the Institution of Civil Engineers – offer our expertise. If we are to tackle air pollution once and for all, we will need to consider the very layout of the city. How can the projects we build and the infrastructure we provide best ensure that air pollution is reduced? And what can civil engineers do to ensure our work is not adding to the emissions?

This work has been undertaken by a group of committed civil engineers, environmental experts and air quality campaigners. We have considered carefully what we believe the best solutions are for London and have engaged with the 9,000 ICE members in the London region to build a consensus in the industry on what needs to be done.

I hope this report spurs the action required by policy makers and the industry to make poor air quality an issue of the past.

Professor Peter Hansford FREng FICE
Chair, ICE London Air Quality Taskforce

[2] YouGov/ClientEarth Survey Results, YouGov, March 2016. [3] Mayor more than doubles funding to clean up London's air, Mayor of London's Press Office, December 2016.

Executive Summary

Air pollution is a major threat to the health and wellbeing of Londoners. Civil engineers, along with the whole built environment, must provide holistic solutions to air pollution. In this report, the transport, planning and water infrastructure systems are examined alongside new technologies and construction industry practices, all of which can be adapted to reduce air pollutant emissions.

This Report provides the findings of the ICE London Air Quality Taskforce. This report recommends:

1. City Hall and TfL should make a long term commitment to vehicle consolidation centres and provide strategic leadership in order to reduce the level of emissions from goods vehicles.
TfL and the GLA should actively promote the use of consolidation centres (whereby vehicles consolidate their loads at a centre near the delivery point). This should be done by investing in new consolidation centres in construction, freight, waste, recycling, delivery and 'last mile' deliveries.

2. Increase the level of pedestrianisation within London, taking a strategic approach which considers public transport links and the effect on local side streets.
Pedestrianisation should be implemented within a wider, more holistic view of the transport system.

3. Embed a zero emission approach to building planning within the London Plan
In the current review of the London Plan, the GLA should embed the concept of air quality positive, ensuring all new developments are zero emission.

4. Make air quality improvements a central objective of the new Energy for Londoners agency.
The Mayor's new agency, Energy for Londoners, should combine its mission to tackle carbon emissions with the challenge of reducing air pollution. Schemes that have dual benefits should be prioritised.

5. Promote good practice air quality planning policy in Neighbourhood Plans.
Replicate measures that reduce air pollutant emissions across the capital, so that local communities, residents and others can actively ensure their local environments are healthy for residents.

6. Incentivise use of commercial wharves along the river, for example through the use of a London Wharf Grant.
Promote the use of London's rivers by providing an additional grant to freight companies looking to switch from road to river transport.

7. Seek to become a world leading city in electric vehicle usage, taking action to prepare for the growing burden on the electricity grid.
TfL and the GLA take the lead and work with the local authorities in London, Electric Vehicle infrastructure providers and Distribution Network Operators to encourage the take-up of electric vehicles and the provision of the necessary charging infrastructure.

8. Roll out a programme of monitoring Underground station air quality and ensure new stations contain air pollution reduction solutions.
Understand the air quality issues facing London Underground employees and customers to ensure they do not suffer high exposure to air pollutants.

9. A Construction Logistics Plan (CLP) should be produced as part of every development planning submission embedding good air quality as a key part of Health and Safety assessments.
For the construction sector to take greater responsibility for site emissions and to tackle them through better planning and logistics through mechanisms like Air Quality Dust Risk Assessments (AQDRA), delivery strategies and delivery management systems.

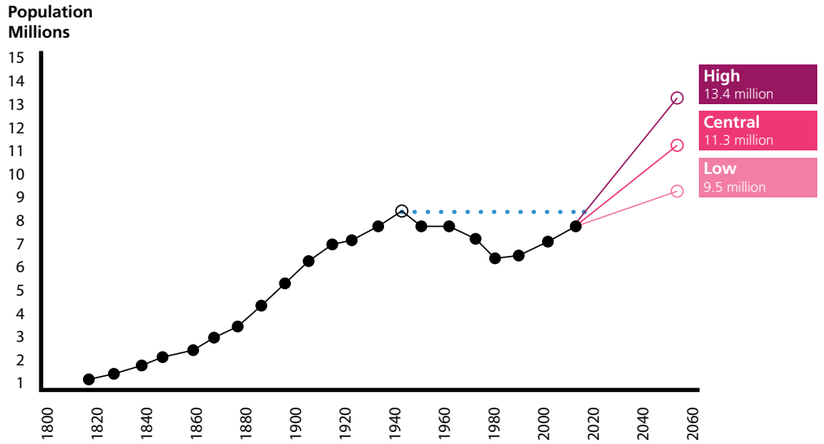
10. Industry Codes and Best Practice Initiatives to take greater consideration of air quality monitoring and pollution mitigation and adaptation when awarding construction projects.
For the construction sector to reward good air quality management and to make it a benchmark of excellence in the industry. In particular, Considerate Constructors Scheme should include compliance with NRMM (Non-Road Mobile Machinery) requirements as part of its regular monitoring and scoring system.

Context

With a rising population, London has seen a considerable increase in vehicle usage, large-scale construction and urbanisation, leading to little or no reduction in existing high levels of air pollution. For Londoners, this means health risks particularly for the young, old and those with pre-existing respiratory and cardiovascular problems.

London in 2017

London continues to grow. The population has recently exceeded 8.7 million, the same as the last peak in 1939. The London Infrastructure Plan 2050, developed by City Hall to identify the capital's infrastructure requirements, predict will reach 11 million by 2050.[4]



Population Predictions GLA 2014

With a growing population, there have been subsequent increases in demand for transport services, energy and heating, leading to a reliance on vehicles, and energy sources that emit air pollutants. The increased population density of inner London in particular has also led to higher ex exposure of Londoners to these pollutants.

High air pollution has been linked to a number of health problems, including bronchitis, asthma, stroke, cancer, diabetes, heart attacks and premature and low birth weight babies and cognitive effects in children. The social costs of air pollution in the UK have been estimated at £15 billion a year – similar to the cost of obesity or alcohol abuse.[5] The issue has led to serious health concern, with Kings College London estimating that in 2010, 52,630 life-years were lost (equivalent to 3,537 deaths at typical ages) due to poor air quality. The Greater London Authority (GLA) estimate that up to 9,400 Londoners die prematurely due to toxic air each year. The issue has been exacerbated by energy and transport policy that favoured diesel due to the lower carbon emissions by setting lower emission standards and promoting decentralised energy.

[4] London Infrastructure Plan 2050, GLA, 2014. [5] Something in the Air: The Forgotten Crisis of Britain's Poor Air Quality, Policy Exchange , 2012. [6] Summary Report, London Air Quality Network, Kings College London, 2014.

There have also been many breaches to the hourly EU legal limit for nitrogen dioxide, with Putney High Street and Brixton Road exceeding the limit within only a few days of the start of the year.[7]

The Pollutants[8]

Pollutants come in two forms: particulate matter, which comprises small airborne particulate matter (generally PM, specifically PM10 or the finer, PM2.5) and nitrogen dioxide (NO2). Currently, cars contribute around 14% of NOx and 56% of PM2.5.[9] However, construction and energy generation do also contribute to a varying extent in the capital, for example workplace gas use dominates in central London, whereas domestic gas use is higher in outer areas.

Nitrogen Oxides

Road transport is estimated to be responsible for about 50% of total emissions of nitrogen oxides, which means that nitrogen dioxide levels are highest close to busy roads and in large urban areas. Gas boilers in buildings are also a source of nitrogen oxides. There is good evidence that nitrogen dioxide is harmful to health.

Nitrogen dioxide inflames the lining of the lung and reduces immunity to lung infections such as bronchitis. Nitrogen oxides can also cause respiratory symptoms such as shortness of breath and cough, particularly affecting those with pre-existing conditions like asthma.

Particulate Matter

PM are tiny bits of solids or liquids suspended in the air. They vary in size, shape, composition and origin. These properties can also vary from place to place and time to time and the nature of their source.

Particles originating from road traffic include carbon emissions from engines, small bits of metal and rubber from engine wear and braking as well as dust from road surfaces. Others include material from building and industry as well as wind-blown dust, sea salt, pollens and soil particles.

Larger particles are generally filtered in the nose and throat and do not cause problems, but particles smaller than 10 micrometres, referred to as PM10, can settle in the airway and deep in the lungs and cause health problems.

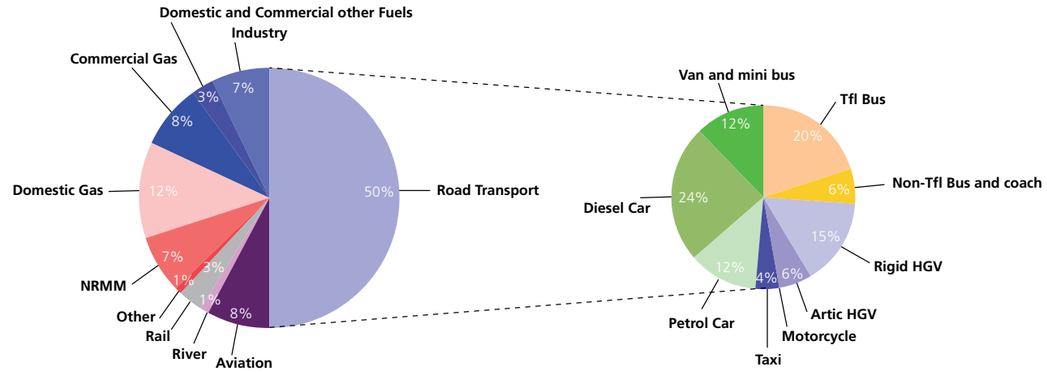
Road traffic is the biggest contributor to air pollution on London's streets accounting for around 50% of Nitrogen oxides. After that, domestic gas, commercial gas and aviation account for the largest emitters of air pollution.[10]

[7] Brixton Road breaches annual air pollution limit in five days, BBC News, 6 January 2017. [8] London Air Quality Network, Kings College London, website accessed 16th February 2016. [9] Mayor's Transport Strategy, TfL, July 2017. [10] New proposals to improve Air Quality, TfL, 2016 [Accessed 9 February 2017].

These main sources are examined below:

Road Transport: Car use has been falling. Between 2005 and 2014, trips taken by Londoners as a car driver, the distance travelled and time spent driving (the three main indicators of car use) fell by around 25 per cent.[11] Nevertheless, congestion has been on the rise with research by the London Assembly Transport Committee showing that delays for car journeys have been steadily increasing since 2012, with inner London affected worst.[12]

NOx source apportionment in Greater London in 2013 (LAEI 2013)



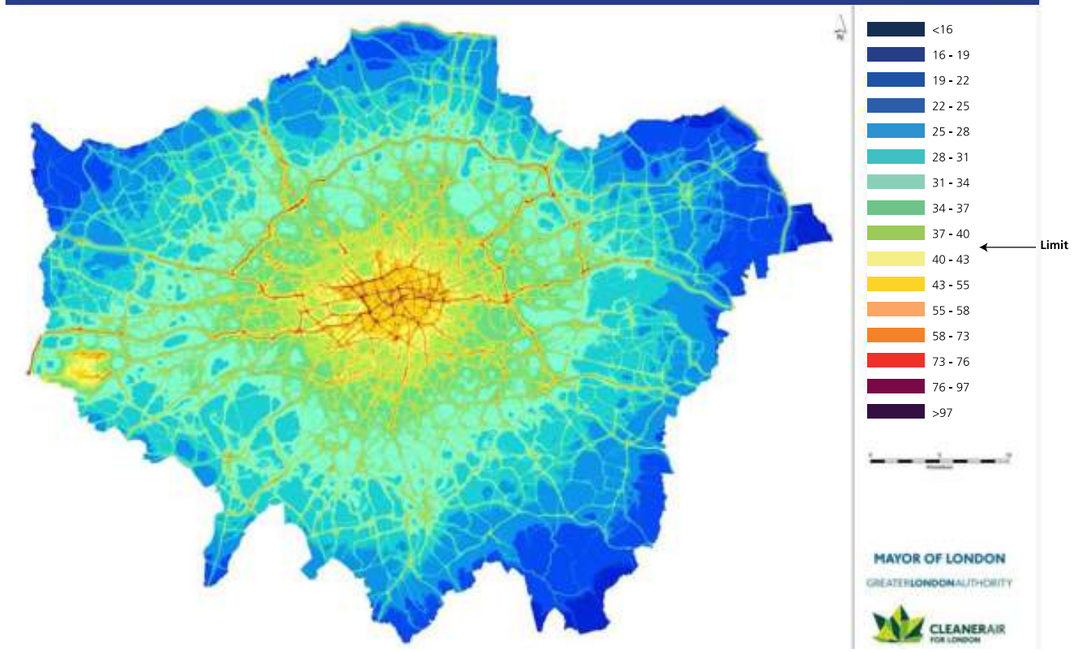
A number of reasons for increased congestion have been identified including changes to London's roads, more delivery vans and private hire vehicles and a reduction in road space for motorists. Diesel road traffic has also risen over the past decade due to Government policies to meet carbon emission goals and this has led to a degradation in air quality, with diesel now contributing around 40% of London's NOx emissions.[14]

[11] Travel in London Report, Transport for London, 2015. [12] London Stalling, London Assembly, January 2017. [13] NRMM: Non Road Mobile Machinery, often used in construction. NRMM can often use diesel generators. [14] Driving away from diesel: Reducing air pollution from diesel vehicles, London Assembly Environment Committee, July 2015.

Domestic and Commercial Gas Use: Gas boilers are some of the biggest outdoor air polluters. Heating and cooking are particularly significant in London, contributing around 13% of NOx emissions in 2013.[15]

Aviation: Air travel often leads to high number of pollutants within a small area, increasing the exposure of local residents and users. The need for airports to be serviced by delivery goods and construction vehicles also increases the number of mainly diesel Heavy Goods Vehicles (HGVs) and Light Goods Vehicles (LGVs) in the local proximity.

Greater London = Annual Mean NO_2 concentrations 2013



Spatially, the worst affected areas for NO2 concentrations are central London, main roads and airports. Central London in particular sees a high number of breaches of the EU air quality limit. However, recent research has shown travellers using Underground stations are most at risk from large sized particles and black carbon.[16]

Due to these breaches, the Government has had to revise their air quality plans due to legal action from environmental pressure group ClientEarth. The Government published revised plans in June 2017, but may face further legal action on the issue.

This report has focused particularly on particulate matter (PM10 and PM2.5), NOx and NO2 and ozone as being the air pollutants of concern in London.

[15] Guide to sources, Clean Air in London, April 2012. [16] New air quality study finds that car drivers cause the most pollution in London – but are least exposed to it themselves, University of Surrey, February 2017.

Current policy initiatives in London

As poor air quality has grown as a concern, government – at various levels – has sought to mitigate and reduce exposure to air pollutants. It has done so in a variety of ways, using both incentives and disincentives to businesses and members of the public. Some of the key policies effecting air quality are set out below:

- **Transport improvements:** These include improvements to the rail network, such as tube upgrades and Crossrail as well as to road infrastructure, such as the £160m cycle super highway network.
- **Encouraging modal shift:** Both the GLA and the Government have promoted the modal shift from vehicle use to public transport, walking, cycling, electric vehicles and river transport.
- **Investment in air quality improvements:** The Mayor of London has a £20 million Air Quality Fund, which is given over ten years to support new projects by London boroughs to improve air quality. Investing in blue infrastructure such as river transport can also reduce air pollution directly by trapping and removing fine particulate matter and indirectly by reducing air temperatures.
- **Planning changes:** These include the National Planning Policy statement that promoted sustainable transport and policies in the London Plan. For example, Policy 3 in the GLA's Air Quality Strategy says the GLA will work with local authorities to target high priority areas. In July 2017, Mayor Sadiq Khan set out his Transport Strategy which included plans to create Clean Bus Corridors and to pedestrianise areas with high pollution exposure, such as Oxford Street. The Localism Act 2011 and Neighbourhood Planning Act 2017 have also set out how local communities can input into planning decisions in their area.
- **Limits and bans.** These have worked with a number of pollutants such as sulphur dioxide, CFCs, ozone, lead, arsenic, benzene, carbon monoxide. Currently, there are Low Emission Zones (LEZs) fine polluting cars in Greater London. Mayor Sadiq Khan has announced plans to implement the Ultra Low Emissions Zone (ULEZ) in London by April 2019 and extend it in 2020 to cover the North and South Circulars. He has also announced a £10 emissions surcharge that will be charged to the most polluting diesel vehicles, to be implemented from October 2017.
- **Monitoring and warnings:** Monitoring and warning members of the general public can help limit the number of people on the streets during days of heavy air pollution. A number of organisations monitor London's air quality, particularly the London Air Quality Network run by Kings College London, and UK Air, run by DEFRA. TfL have also begun publishing warnings at transport nodes.
- **Scrappage schemes:** In London, the GLA established a car scrappage scheme in 2014 where car owners were offered up to £2000 to scrap their diesel vehicles. More recently, Mayor Khan has called for a national scrappage scheme and the reform and devolution of Vehicle Exercise Duty.

London in a global context

Air pollution is significantly higher in developing countries, particularly in cities with high levels of industrial activity. This means that globally, London ranks much lower for $PM_{2.5}$ exposure than Delhi, Jakarta, Shanghai or Rio de Janiero.[17]

However, a far fairer comparison is between other European cities. The European City Ranking, run by Clean Air Europe and Soot Free for Climate, ranks 23 European cities based on nine categories of air quality reduction. The top ten cities for 2015 are listed below:

2012	2015	City	EMISSION REDUCTION SUCCESS	LOW EMISSION ZONES & BANS OF HGH EMITTERS	PUBLIC PROCUREMENT	NON-ROAD MOBILE MACHINERY	ECONOMIC INCENTIVES	MOBILITY MANAGEMENT & MODAL SPLIT	PRODUCTION OF PUBLIC TRANSPORT	PRODUCTION OF WALKING & CYCLING	PARTICIPATION & TRANSPARENCY
B- 80%	B+ 89%	Zurich Switzerland	++	0	++	++	+	++	+	+	++
B- 82%	B 87%	Copenhagen Capital of Denmark	+	0	++	+	+	++	++	++	+
B- 80%	B 84%	Vienna Capital of Austria	++	0	+	+	+	++	++	+	+
B- 80%	B- 80%	Stockholm Capital of Sweden	0	0	0	+	++	+	++	++	+
B 84%	C 76%	Berlin Capital of Germay	0	++	++	+	0	+	0	0	+
	C- 71%	Helsinki Capital of Finland	++	0	+	--	0	++	++	+	0
F 58%	C- 71%	London Capital of United Kingdom	-	0	+	+	+	0	++	+	0
D 62%	C- 71%	Paris Capital of France	--	+	0	-	+	++	+	++	+
F 58%	C- 71%	Stuttgart Germany	0	++	+	--	+	+	+	0	+
C- 71%	D+ 69%	Amsterdam Capital of the Netherlands	+	-	0	-	+	0	+	++	+

As shown, London is sixth in the ranking, but does poorly in emission reduction success.[18]

[17] A review of emissions and concentrations of particulate matter in the three major metropolitan areas of Brazil, Transport Journal of Health, March 2017.
[18] European City Ranking 2015, Soot Free for the Climate, March 2017.

Focus and aims of this report

This report focuses on particulate matter (both PM_{10} and the smaller $PM_{2.5}$), nitrogen dioxide and ozone as those that pose the most serious health risk to Londoners.

The aim of this report is to bring London closer to achieving the World Health Organisations' (WHO) air quality guidelines.

World Health Organisation Air Quality Guidelines

$PM_{2.5}$:	10 µg/m3 annual mean 25 µg/m3 24-hour mean
PM_{10}:	20 µg/m3 annual mean 50 µg/m3 24-hour mean
NO_2:	40 µg/m3 annual mean 200 µg/m3 1-hour mean
Ozone (O_3):	100 µg/m3 8-hour mean

[19] Air Quality Guidelines for Europe, Second Edition, WHO.

Transport

Recommendations

1. City Hall and TfL should make a long term commitment to vehicle consolidation centres and provide strategic leadership in order to reduce the level of emissions from goods vehicles.

2. Increase the level of pedestrianisation within London, taking a strategic approach which considers public transport links and the effect on local side streets.

Transport is the single biggest source of air pollution. Civil engineers plan, design and build London's transport system and therefore they are well placed to examine how transport can be improved to reduce the pollution emitted by transport.

ICE London has examined two areas of the transport network – pedestrianisation and consolidation. By setting effective policies in these two areas, the Government, the Mayor and local authorities can ensure that travellers in London use the least polluting methods of transport and are least exposed to those transport methods that pollute most.

Construction Consolidation Centres

High volumes of construction materials are transported along London's roads every day. Usually, Heavy Goods Vehicles (HGVs) and Light Goods Vehicles (LGVs) use diesel engines, making them some of the most polluting sources of transport air pollution. Air quality degradation can also be exacerbated by these large vehicles remaining stationary on congested routes. Reducing HGV and LGV vehicle numbers must, therefore, be a key part of reducing air pollution.

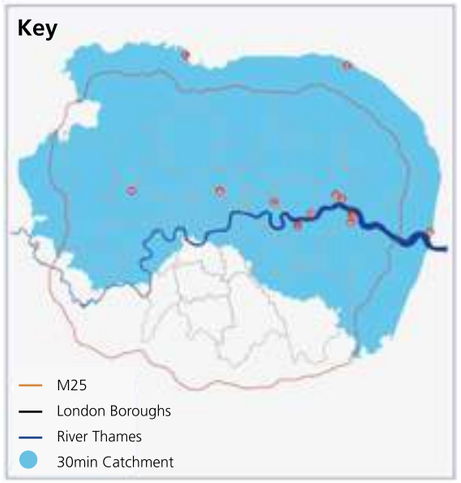
Consolidation, the means by which deliveries of materials and goods are combined to reduce the number of vehicles on the road, has shown to be an effective way of reducing road traffic, particularly vans and HGVs. Consolidation centres work by storing the materials or goods from where the centre operator consolidates loads and makes 'Just-In-time' deliveries. This reduces the number of vehicles with spare capacity on delivery runs, ensuring that the optimal amount of materials and goods are transported on any one journey.

Although data changes from area to area, the Waste and Resources Action Programme (WRAP) identified in 2011 that construction consolidation could lead to a reduction in freight traffic to site by up to 70%.[20] Similarly, reductions in vehicle traffic were found by Transport for London with the London Construction Consolidation Centre in South Bermondsey, which after two years of operating, saw an estimated 60-70 percent reduction in the number of vehicles delivering to the four sites being served.[21] In Monaco, one of the most densely populated countries, the procurement of a consolidation centre to the south west of the country was found to deliver a 25% reduction in NOx emissions and 30% reduction in PM emissions.[22]

[20] Using Construction Consolidation Centres to reduce construction waste and carbon emissions, WRAP, July 2011. [21] London Construction Consolidation Centre Final Report, Transport for London, 2008. [22] Rethinking Deliveries Report, TfL, 2016.

By reducing traffic, consolidation can have a considerable benefit on air quality, particularly on construction sites where HGV, LGV and construction equipment may already have increased particulate matter and nitrogen oxide emissions. Findings by Transport for London show that since the 1990s LGV traffic has increased heavily, although it fell slightly in 2007, whilst HGV traffic has remained constant.[23] In 2012, LGV and HGV journeys accounted for 13 percent and 4 percent respectively of all vehicle kilometres travelled on London's roads.[24]

However, the use of consolidation can be limited, with a number of companies choosing not to use a consolidation centre to manage deliveries. This is due to a number of reasons; often it is the contractor who chooses whether to use a consolidation centre, whilst it is the sub-contractors and suppliers who receive the largest benefit. Availability of consolidation centres can also be limited, with TfL only identifying twelve construction consolidation centres in their 2016 Directory.[25] There are also concerns from users that consolidation centres can delay deliveries.



Construction Consolidation in London © TfL Freight

TfL has sought to encourage consolidation uptake through the funding of centres and highlighting the benefits of their use to the private sector. Consolidation funding was included in Mayor Boris Johnson's Air Quality Fund, which provided £20 million over a ten year period to projects aimed at increasing air quality in the Capital. A number of these schemes have shown significant returns, such as the London Construction Consolidation Centre, which was jointly funded by TfL and the private sector.

The use of consolidation must be an integral part of the Mayor's new Environmental Strategy. ICE London will work with the Mayor on behalf of the civil engineering and construction industry to ensure air quality becomes a top priority for London's built environment.

Consolidated freight may travel a less direct route, leading to a vehicle traveling more miles than if it went directly to site. Nevertheless, this problem is still preferable to two vehicles delivering half full loads.

[23] London Freight Data Report: 2014 Update, TfL & University of Westminster, 2014. [24] Ibid. [25] The Directory of London Construction Consolidation Centres, TfL, March 2016

Case Study: Consolidation at Heathrow Airport[26]

Heathrow Airport's Sustainability Strategy focuses on a number of initiatives to reduce the level of emissions the airport produces with the aim of becoming a 0% carbon operation by 2050. With air quality, Heathrow has produced a 'Blueprint for reducing emissions', a ten point action plan to improve the air quality of the areas surrounding the airport.

A key part of this sustainability strategy, as well as a necessary component of the airport's security and logistics, is the Colnbrook Logistics Centre, a construction and logistics consolidation centre run by Wilson James. The Centre provides security checks for all non-passenger vehicles going into the airport, provides a space for construction materials and reduces the number of vehicles in the airport through just in time consolidation.

The centre manages the inflow of all construction materials and non-retail goods into the airport, such as toilet roll or newspapers. To stop construction works affecting the running of the airport, workers are allowed to bring a limited amount of materials into the airport at any one time, with the Centre transporting more materials as and when required. Materials can be ordered and delivered within a three hour period. The centre also has a direct rail link to the national rail network with its own sidings.

Storing materials in the centre also provides the opportunity for reuse. Should a particular construction material be needed, contractors can work with the Centre to see if there are any spares available.

Electric Vehicles

The Centre has recently upgraded its fleet of vehicles to six Nissan Leafs and will soon acquire an additional three. Due to the nature of airport management, the Leafs have to be available to use 24 hours a day, seven days a week. This means rapid charging is essential, allowing the vehicles to recharge in short periods of time.

[26] With thanks to Heathrow and Wilson James for hosting the ICE London Air Quality Taskforce.

Fulcrum

The Consolidation Centre uses a tailored booking system called Fulcrum which helps Wilson James and Heathrow monitor, analyse and manage vehicles coming in and out of the airport. Vehicles are booked online and provide a variety of data including the project they are working on, timings, vehicle type and origin. Wilson James can check through this system that all vehicles are FORS bronze compliant and can see the effect on emissions. This data gives Wilson James and Heathrow a full breakdown of data that can assist in defining their sustainability strategies or model new initiatives.

The Fulcrum system also provides potential benefits in the future. By allowing the Centre to see where vehicles originate from, there is the possibility of consolidating vehicles closer to the vehicle origin. For example, two HGVs travelling from the West Midlands could consolidate before travelling down to London.

Lessons from the Case Study

The case study shows that strategic direction is needed to push consolidation. Heathrow has pursued consolidation to improve efficiencies, for security and to reach sustainability targets and has therefore made it a high priority. The challenge for TfL is to replicate this in central London, by providing the same leadership.

Providing this leadership will be more difficult in central London, where TfL do not have the authority to manage all deliveries to construction sites. However, by bringing together a number of consolidation centres around London and promoting them effectively to the construction industry, TfL may improve the take up of consolidation and by doing so, reduce a number of HGVs and LGVs on the road.

The ICE London Air Quality Taskforce recommends that the TfL Freight team highlight a number of ways to encourage the uptake of consolidation, including:

- Identifying new sites for consolidation centres in London
- Working with the Greater London Authority to attract private sector investment into the construction and operation of new centres.
- Directing funding to those centres seeking to develop electric vehicle fleets
- Embedding consolidation to a greater degree within the London Plan.
- Providing incentives for the uptake of consolidation, whether financial, such as a congestion charge rebate, or non-financial, such as allowing longer parking periods.
- Examining the possible use of rail stations for consolidation centres.
- Making a strategic commitment to invest in individual sites to develop consolidation centres.

A consolidation strategy should also examine the ways that electric vehicles can be used for the delivery of materials and goods as well as the role that train stations can play in transporting freight, as is the case with Heathrow airport.

As will be set out further in Chapter Three, the use of river wharfs for freight could also provide valuable opportunities to reduce air pollution on roads.

Recommendation 1: City Hall and TfL should make a long term commitment to vehicle consolidation centres and provide strategic leadership in order to reduce the level of emissions from goods vehicles.

ICE London understands that without uptake from the industry of consolidation centres, there will be little reduction in vehicle numbers. Whilst providing more will increase uptake, ICE London will work to promote the benefits consolidation can have and will work with relevant parties, businesses and organisations to increase demand for consolidation services.

ICE London commits to:

- Working closely with TfL to identify the most appropriate sites to serve current and planned construction sites in London
- Promoting best practice examples of keeping construction traffic off London's roads, through consolidation centres and the delivery of goods and removal of waste through rail, rivers and canals.

ICE London also examines the role of good construction practice involving the role of consolidation in Chapter 8, Industry Practices. Good practices schemes like the Considerate Contractors Scheme could look to include consolidation as a criterion, encouraging the industry to take it up further.[27]

Outcome: Greater leadership over consolidation in London could lead to a significant reduction in nitrogen dioxide and particulate matter. The Hammarby Consolidation Centre in Stockholm helped to achieve a 90% in NOx and 90% in PMs from delivery vehicles. If this was able to be replicated across London, the 21% of road transport emissions coming from HGV travel would be significantly reduced.[28]

[27] See Considerate Constructors Scheme Website for more information. [28] Rethinking Deliveries Report, TfL, 2016

Pedestrianisation

The pedestrianisation of certain roads in London with high levels of air pollution has been proposed over a number of years by various organisations. It is a particularly attractive solution in areas of high pollution and high concentration of pedestrians, where the impact of improved air quality will be most felt.

Pedestrianisation can reduce exposure by lowering the numbers of pedestrians placed in direct contact with polluting cars. In main thoroughfares, polluting vehicles can pose particularly high health risks due the numbers of pedestrians – Oxford Street, for example, as a main retail district, is visited by 4 million people a year and yet in 2015, took just four days to break annual European air quality limits.[29]

During the 2016 Mayoral Elections, a number of candidates backed plans to pedestrianise Oxford Street, one of the worst roads for air pollution in the Capital. Following the election of Sadiq Khan, in July 2016 Deputy Mayor for Transport Valerie Shawcross stated City Hall's plans to pedestrianise Oxford Street by 2020, rolling the scheme out in two stages to minimise disruption.[30] Similar ideas for the pedestrianisation of Parliament Square and other highly polluting main roads have also been suggested by various commentators.

The implementation of pedestrianised roads can be effective. International examples of both full and partial pedestrianisation have shown that air pollution is reduced in the local vicinity. In Istanbul, since the Historic Peninsula was pedestrianised in 2010, 52% of residents surveyed said they saw a reduction in air pollution.[31]

However, there also risks associated with pedestrianisation. By removing traffic from major thoroughfare roads, congestion may be moved to the surrounding roads, leading to higher pollution levels in the areas surrounding the newly pedestrianised zone. This can particularly affect local residents, who may see increases in traffic levels and, as a result, air pollutants. If journey times for road traffic are increased, the pedestrianisation of one road may see an increase in the time vehicles spend on other roads. In large retail areas, access to stores can pose a challenge. Bus routes can also be affected, potentially extending journey times and reducing user experience.

Within the pedestrianised zone, there are also questions of accessibility of pedestrians so that residents and visitors are still able to easily access homes, places of work and shops. Those with low levels of mobility can be particularly affected by the creation of a pedestrianised zone.

It is also important to note that pedestrianisation should not only be for pedestrians but also other active road users such as cyclists. Separate cycle lanes that connect up to cycle superhighways and quiet ways will ensure pedestrianisation also benefits this group of road users.

Oxford Street in Numbers (June 2016)[32]

500,000 pedestrians walk on Oxford Street every day

C. 270 buses travel along Oxford Street every hour

15,000 taxi passengers are picked up, set down, or carried along Oxford Street every day

4 tube stations along Oxford Street, with an average 470,000 passenger entries and exits every day.

[29] 'Oxford Street pollution levels breached EU annual limit just four days into 2015', Evening Standard, 6 January 2015. [30] London's Oxford Street to be pedestrianised by 2020, The Guardian, 14 July 2016. [31] Istanbul Historic Peninsula Pedestrianisation Project, Current State Assessment, June 2014. [32] Oxford St – the busiest feet street in the world?, GLA, 28 June 2016.

With the opening of the Elizabeth Line in December 2018, Oxford Street is predicted to see a significant increase in footfall that may further exacerbate issues over air pollution exposure.

Strategically, pedestrianisation in London should be implemented with a wide consideration of the road and transport network. In particular, consideration should be taken for (a) the wider transport network and (b) transportation within the pedestrianised zone. Policy makers must consider a number of questions:

(A) The wider transport network

- How will bus journey times be increased by the pedestrianisation of a road?
- Will nearby thoroughfares be able to manage with planned increases in road vehicle use?
- Can new public transport infrastructure provide a suitable alternative for vehicle users who previously used the pedestrianised zone?
- Will nearby residents see air quality reduce by the pedestrianisation of a road?
- How can London halve the traffic volumes so as to allow more opportunities for pedestrianisation?

(B) Transport within the pedestrianised zone

- Are there adequate accessibility points on local roads and rail services?
- Can pedestrians with low mobility easily use the pedestrianised zone?
- Can new infrastructure, such as a tram, be constructed to boost accessibility?
- Can local shops and businesses easily retain the goods, services and customers they had before pedestrianisation?

Plans for pedestrianisation must, therefore, take a holistic view of the wider transport network, assessing how the pedestrianised zones could affect wider congestion levels and traffic flows as well as accessibility within the zone itself. By doing so, policymakers can ensure that pedestrianisation does not degrade air quality in other areas of the city.

Options for pedestrianisation, including associated public transport improvements, should then to be subject to holistic analysis of cost-effectiveness that accounts for health benefits and any impacts on surrounding areas. Oxford Street provides a possible case study in considering pedestrianisation as part of the holistic transport system.

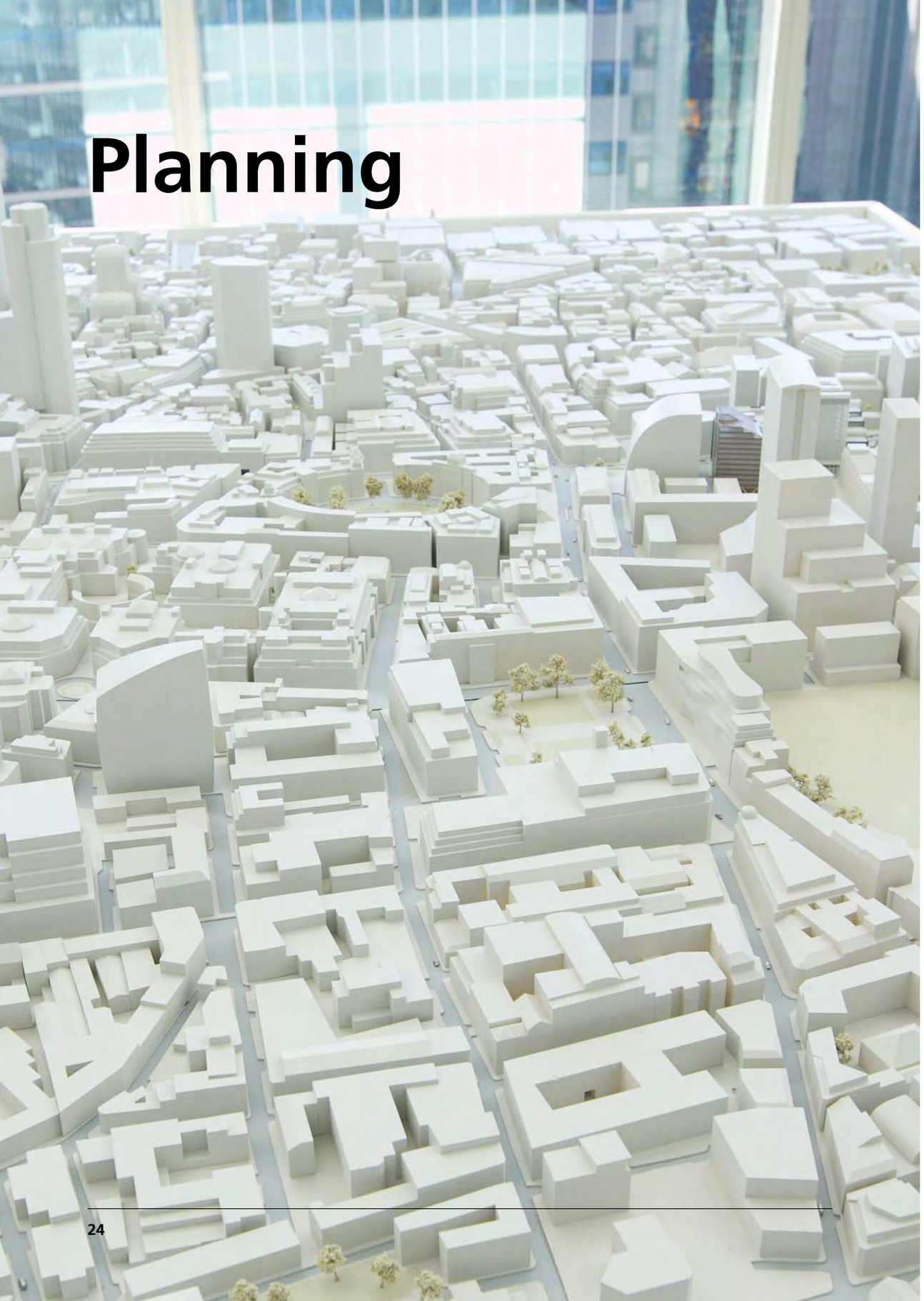
Recommendation 2: Increase the level of pedestrianisation within London, taking a strategic approach which considers public transport links and the effect on local side streets.

ICE London Commits to:

- Producing guidance on how to successfully pedestrianise a road. This guidance will show how pedestrianisation can be used to reduce air pollution not only on the pedestrianised road but also on local streets.

Outcome: Successful pedestrianisation can help to transform a city. Barcelona, which has sought to implement a radical plan to reduce car usage is looking to reduce the number of vehicles on the road by 21% through planned 'superblocks'.[33] A similar transformation in London could provide not only a reduction in vehicle use but also a cultural shift away from driving.

[33] Superblocks to the rescue: Barcelona's plan to give streets back to residents, The Guardian , May 2016.



Planning

Recommendations

3. Embed a zero emission approach to building planning within the London Plan
4. Make air quality improvements a central objective of the new Energy for Londoners agency.
5. Promote good practice of air quality planning policy in Neighbourhood Plans.

By 2025, it is predicted that domestic and commercial gas use will overtake transport emissions as the principal source of NOx.[34] With London's population estimated to be 9 million by 2020 and 10 million by 2035[35], commercial and domestic gas use is projected to overtake transport as the main pollution source, unless action is taken.

This requires action from planning policy to ensure new developments do not contribute to air pollution and that current polluting buildings can be retrofitted to lower the pollution they produce.

In the past, carbon emissions and air pollutants like nitrogen dioxide have often been seen as two separate issues, often siloed with different strategies and solutions. If London is to be carbon neutral and pollutant free, it needs to combine this carbon and pollutant policy together.

Zero emission buildings

If the Mayor of London is to achieve his aim of making London carbon neutral by 2050, a shift is required in how London plans and builds its structures.

As part of the development of the London Plan, the GLA is also looking to develop the concept of 'Air Quality Positive'. As set out in the Mayor's A City for All Londoners, buildings will have to contribute actively to a progressive reduction in the total amount of London's emissions and associated exposure.'[36] The concept is still under development, but initial plans by the GLA show that it may encompass:

- Setting a progressive emissions ceiling for London as a whole;
- Ensuring that exposure to pollution, inside and out, is minimised through design;
- Designing out, wherever possible, new emissions sources;
- Considering the development in context to ensure that it helps improve the surrounding area.

[34] Presentation by Stephen Inch, GLA to ICE London Air Quality Taskforce. [35] London Infrastructure Plan 2050, GLA, July 2014. [36] A City for All Londoners, GLA, October 2016.

Under this definition, air quality positive buildings will be zero emission, adding no new pollutants to the environment. This is a shift from air quality neutral, under the last City Hall administration that focused on ensuring new developments did not increase emissions.

The 'Air Quality Positive' concept must be tied into carbon reduction too, looking at both air pollutants and carbon emissions as a single issue. The GLA should also take a whole life approach to building emissions, meaning that from construction to decommissioning, the building is zero emission. To do so, the building must:

- Have maximum possible level of energy efficiency;
- Maximum possible level of onsite renewable energy;
- Must connect to a decarbonized grid for all further energy requirements.

However, GLA should consider in the future how buildings could actively remove pollutants from the surrounding area, not simply limit a number of pollutants being emitted. This could be done through air filtration systems that take external pollutions out of the surrounding area. This is developing technology currently being developed, but could provide future options for air quality reduction.

Below are defined four distinct elements that together, will ensure that planning policy is zero emission:

1. Remove sources of pollutants

Examples:

- Reduce gas heating through the use of non-polluting utilities
- Encourage non-polluting industries
- Encourage use of non-polluting construction plant

2. Provide better alternatives

Examples:

- Use non-road transport of passengers, goods and services such as electric rail; water and cycling.
- Strategically link infrastructure to make cleaner journeys easier to take.
- Provide energy and heat sourced from solar, geothermal, water, ground source heat pumps; air source heat pumps and heat uptake.

3. Create pollutant sinks/capture

Examples:

- Enhance green spaces.
- Mandate green elements on new developments, such as green roofs and walls[37]
- Enclose road corridors to contain and capture pollution: roads in tunnels.

[37] A number of examples are provided in Cities Alive – Rethinking Green Infrastructure, Arup, 2014.

4. Lifestyle Change

Examples:

Create a pedestrian and cycle-friendly city environment. Incentivise energy and heat efficiency.

The review of the London Plan, the spatial strategy for the Capital, is underway. In particular, Policy 7.14 examines how planning policy is used to improve air quality. The current Plan makes no reference to the concept of zero emissions nor does it embed the above thinking within it. A number of measures within Policy 7.14 could be revised to better reflect the concept of 'zero emission'.

Current London Plan Policy

"Development proposals should minimise increased exposure to existing poor air quality"

"Be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality"

"Ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site."

Whilst it may be difficult for London Plan policy to mandate the inclusion of air quality and carbon reduction measures, the Mayor should consider making the planning process faster for those developments that do commit to air quality positive measures. This has already been done with affordable housing, with the GLA issuing Supplementary Planning Guidance that will make the viability process more consistent and transparent for developers looking to include high levels of affordable housing.[38]

Zero emission thinking must also be implemented through a number of rewards and restrictions for new developments. The GLA can embed Air Quality Positive thinking by:

- Committing to having all zero emissions development in Opportunity Areas managed by a Mayoral Development Corporation;
- Working with local authorities to get commitments to have zero emission developments for Opportunity Areas identified in the London Plan;
- Working with boroughs to encourage the planning consents for developments that can demonstrate that they have embedded zero emission thinking;
- Ensuring that all significant infrastructure projects have strategic air quality and carbon reduction plans. For example, sites from which Crossrail 2 could be used to develop district heating.

ICE London commits to:

- Working with the GLA to define the concepts of air quality positive and zero emission buildings and to increase awareness of it amongst civil engineers and planners.

Outcome: Zero emission buildings will provide a radical reduction in pollutants, achieving both Mayor Khan's goal to ensure London is zero carbon by 2050 and reducing airborne pollutants. Currently, homes and workplaces account for around 78% of CO2 emissions in London so bringing these levels down will be an important step towards a carbon neutral city.[39]

[38] Affordable Housing and Viability Supplementary Planning Guidance (SPG), GLA, November 2016. [39] Energy in Buildings, GLA website [Accessed 28 February 2017].

Energy for Londoners

Energy for Londoners, "a not-for-profit clean and green energy company that will lead on promoting low-carbon technologies and community energy generation across the city" is one of Mayor Sadiq Khan's key policies for London's energy sector.[40]

Energy for Londoners will be a key component for the GLA to meet its aim of making London zero carbon by 2050. However, the GLA should look to combine the objectives of the new agency with air quality measures, in particular, to tackle emissions from commercial and residential gas use.

Currently, the GLA has five Low Emission Neighbourhoods (LENs) to trial measurable and local improvements to air pollution. £1 million has been provided by the GLA and matched by the local authority, implementing a variety of measures, including parking and charging infrastructure, engagement with schools, businesses and residents and smart travel initiatives amongst others. Notably, the current LENs proposals are mainly focusing on transport interventions – less so on domestic and commercial energy efficiency measures.[41]

What is Energy for Londoners?[42]

Energy for Londoners will be a non-for-profit agency with the aim of:

- A dedicated solar strategy, making use of London's roofs, public land and in particular TfL land and buildings (e.g. photovoltaic cells on station roofs) to generate clean energy
- Ensuring new developments have solar and low carbon designed in, and work with local authorities and housing associations to increase energy efficiency measures and renewable energy generation in social housing stock
- Collective purchasing of community generated energy, using this to power public buildings and the tube
- Establishing further district heating schemes (such as the Islington Bunhill Energy Centre which will take heat from the Northern Line)
- Issuing Green Bonds and exploring the use of debt-based instruments such as ISAs to invest in green projects across the city
- Provide advice and support to those wanting to set up community energy projects, and act as a community connection for those wanting to be part of a community energy project with commercial premises with space for solar panels.

By adding air quality as a key objective of Energy for Londoners, the Mayor will ensure that he is not silo-ing measures for carbon air pollution, often which overlap. Some measures that Energy for Londoners will implement like community generated energy and district heating, will also benefit air quality and it is therefore vital that the GLA records and shows these dual benefits so as to encourage and promote clean energy and improved air quality schemes.

Recommendation 4: Make air quality improvements a central objective of the new Energy for Londoners agency.

[40] Sadiq Khan unveils plan for London clean energy revolution, Sadiq Khan, February 2016. [41] Low Emission Neighbourhood Guidance, TfL. [42] Sadiq Khan unveils plan for London clean energy revolution, Sadiq Khan, February 2016.

ICE London Commits to:

- Working with Energy for Londoners to ensure energy and air quality issues are combined and dealt with as one, providing the expert advice of our membership in how the GLA can do this.

Outcome: Widening the scope for Energy for Londoners will ensure that retrofitting, community energy schemes and solar generation are also directed at reducing air pollution, not only carbon reduction.

Neighbourhood Planning

The Localism Act of 2011 and Neighbourhood Planning Act 2017 allows local communities to develop Neighbourhood Plans, Neighbourhood Development Orders and Community Right to Build Orders. These documents help to determine planning applications within the local area, becoming part of the areas Local Plan. This allows local communities to shape the development of their area over the next 20 years.

Neighbourhood Plans are a major opportunity for local areas with high levels of air pollution to bring in specific measures. The policies within a Neighbourhood Plan can determine the type of energy new buildings use, the need for green infrastructure to be built and how construction vehicles and workers must use the site.

In London, a number of areas have set up Neighbourhood Forums with the intention of developing Plans. Many are currently being consulted on or are being planned in conjunction with the local authority.

Best practice in terms of air quality planning has been in a number of proposed Neighbourhood Plans and can ensure that local communities are able to lower the health risks of air pollution, particularly in areas near main roads and other sources of high pollution.

Best Practice in Neighbourhood Plans – Knightsbridge Construction Activity[43]

The Knightsbridge Neighbourhood Plan is currently being finalized, includes guidance on Construction Activity that sets out a number of policies to reduce air pollution during the construction process. Some of the key measures are:

- A draft or final Construction Logistics Plan (CLP) must be submitted with the planning application.
- All vehicle access to the site must take place along arterial roads with the minimum distance along Local Roads.
- All vehicles must be the latest Euro 6 emission standard by 2019 unless no alternative exists. In future, vehicles must use the latest emission standard within 12 months of 'type approval'.
- 'Just in time' arrival of vehicles on Local Roads meaning they arrive no more than 10 minutes before the hours permitted for noisy works
- Controls must be in place for generator running times to ensure they are shut down when not in use. There shall be no idling of any plant and equipment

[43] Knightsbridge Neighbourhood Plan 2017-2036, Knightsbridge Neighbourhood Forum, December 2016.

It is for public bodies and organisations as well as the GLA to promote good practice in Neighbourhood Plans. ICE London will work with these organisations to show how these policies can reduce and mitigate air pollution sources.

Recommendation 5: Promote good practice of air quality planning policy in Neighbourhood Plans.

ICE London commits to:

- Back best practice from Neighbourhood Plans to promote greater planning policies across London.

Outcome: Local Plans will ensure communities can take control over the emissions their local buildings produce and require that future developments take greater consideration of air quality issues. This will impact benefit London boroughs.

Water

Recommendation

6. Incentivise use of commercial wharves along the river, for example through the use of a London Wharf Grant.

London's rivers, canals and natural assets can assist in reducing pollution from roads. Water transport is often less polluting than road transport and is being increasingly used by freight delivery companies to transport goods to and from the site.

'Blue infrastructure' as it is termed has a variety of benefits to London. Better use of canals can add extra capacity to the transport network by moving freight from roads. Ensuring that blue infrastructure is considered as a key part of London's transport system, and not as an addition, is therefore crucial.

It is important to note that whilst river transport does emit pollution, peoples exposure to it is often less than road transport due to the close proximity of road transport to pedestrians, cyclists and other road users.

London Wharf Grant

The River Thames is London's central river and is used in a number of ways to transport goods. In particular, the River Thames is used to export waste from the City, Wandsworth and Battersea, export construction spoil from tunnelling projects like Crossrail and soon, the Thames Tideway Tunnel and a few wharves importing aggregates for construction purposes,

Safeguarded Wharves in London, © TfL

West Sub-region **South East Sub-region** **North East Sub-region**

All of these uses are characterised by being high volume, high weight, low-value materials without a great time criticality around delivery. This means there are certain barriers to river use around the ability for companies to fit their supply chains around the water system. Delivery times are also affected by tidal factors, which could delay the time of arrival for some freight goods. Moreover, the cost of using wharves is high due to lift charges (the cost of placing containers on and off of barges). This makes barge freight more expensive than road freight.

Companies need to be actively incentivised to use the river. The Mayor should seek to make it in companies' interests to use the river by providing financial incentives. This should be done in conjunction with improving road connections to and from wharves so that they can provide a competitive service in comparison with road use.

A grant scheme could be based up the Modal Shift Revenue Support Grant (MSRS) currently provided by the Department for Transport (DfT). MSRS helps companies to manage the operating costs of running freight via rail or inland water instead of the road where they are more expensive and is aimed to promote a modal shift from the road.

A London specific scheme would help promote water freight further, particularly in the capital where freight travel can be particularly expensive. This would encourage more businesses, especially those requiring less time sensitive deliveries, to use the river rather than the road.

The GLA should model how a grant would be implemented and work with the freight community to develop such a scheme. Connections to and from the wharves must also be improved, with TfL taking a more active approach to wharf maintenance. Wharves like those at Gateway Port, in particular, require road infrastructure improvements to make them more attractive to use.

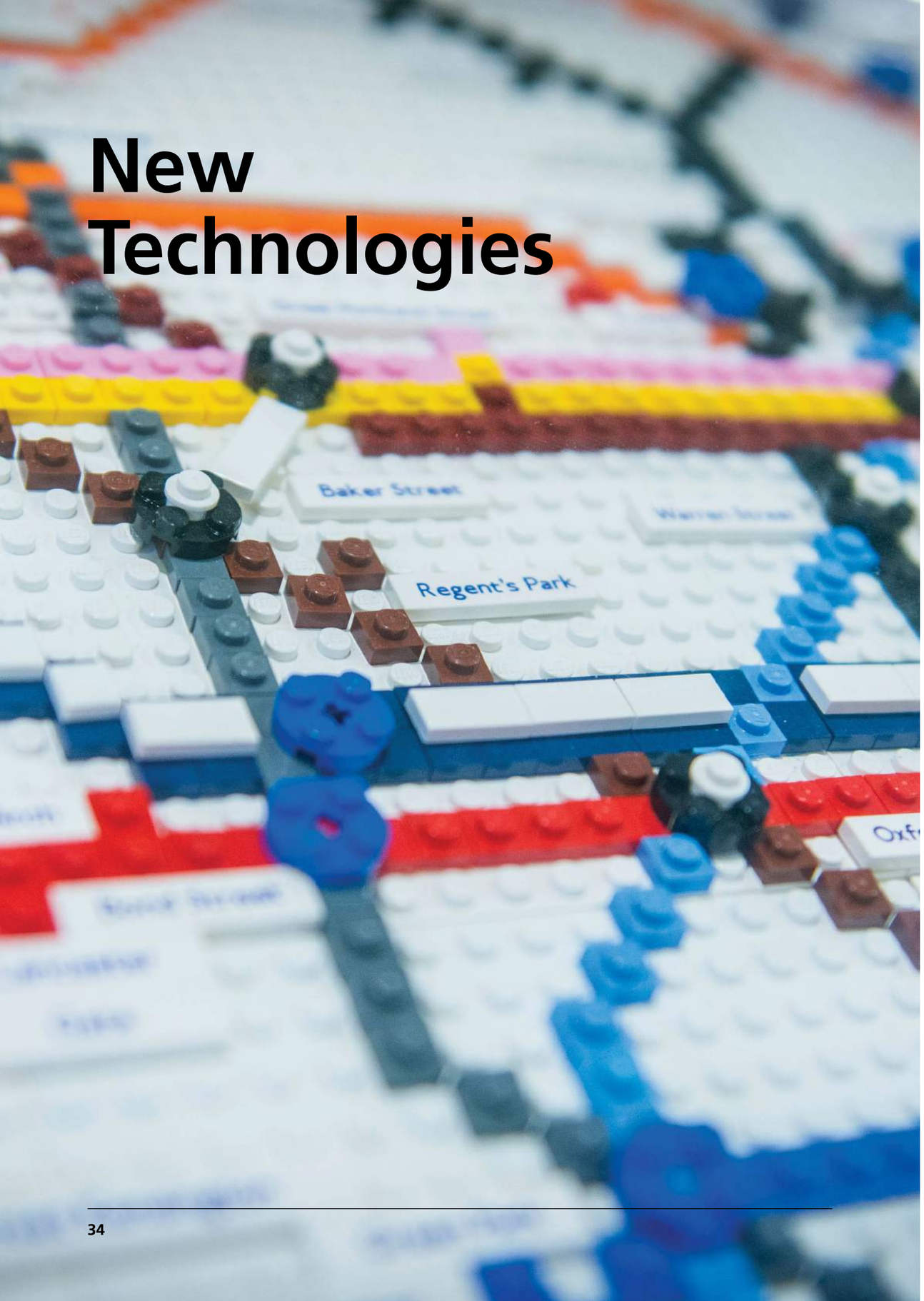
In conjunction with a renewal of London's wharves, the Mayor should lobby government for greater regulation of water transport to achieve substantial reductions in emissions. By doing so, the Mayor could assist in helping to radically transform London and the UK's waterways into a new transport route for freight.

Recommendation 6: Incentivise use of commercial wharves along the river, for example through the use of a London Wharf Grant.

ICE London commits to:

- Utilising the experience of our water engineers to examine how infrastructure can be improved around commercial wharves.

Outcome: Moving transport of freight off the road and onto the water will not remove pollutants, but will reduce exposure to pollution. With the correct standards in place, London could revive one of its past industries whilst providing transport solutions that do not expose the public to health risks.



New Technologies

Recommendations

7. Seek to become a world leading city in electric vehicle usage, taking action to prepare for the growing burden on the electricity grid.

8. Roll out a programme of monitoring Underground station air quality and ensure new stations contain air pollution reduction solutions.

Whether it's electric vehicles, better monitoring systems or ways of promoting a lifestyle change, new technologies will radically shape the way that London reduces and mitigates air pollution. However, this requires decision makers to be forward thinking, embracing possibly disruptive solutions.

Many aspects of smarter transportation and the electric grid are currently seeing transformational change. City governments, utilities and fleet managers must work together to understand total generation capacity and account for the influx of distributed energy resources (DER), how these will change energy use and draws from the grid.

With electric vehicles, the location of charging points, the use of energy storage invehicle technology, and the integration with the grid are all key issues that will need to be planned in order to establish an efficient clean transport system. This will involve many stakeholders, including utilities, software companies, service providers, fleet operators and local transport authorities. The use of infrastructure sensors, communications and analytics to monitor and improve this smart system will be necessary.

Data is an invaluable resource in this mix. Collected from vehicles, mobile phones and smart infrastructures, such as charging stations and smart meters, this information will ensure that civil engineers provide upgrades and improve capacity where most needed.

When it comes to air quality, these smart technologies can have a big impact. Improving monitoring and measurements of exposure, promoting lifestyle change and cleaner transport choices and reducing pollution sources are all areas to which 'smart city' thinking applies.

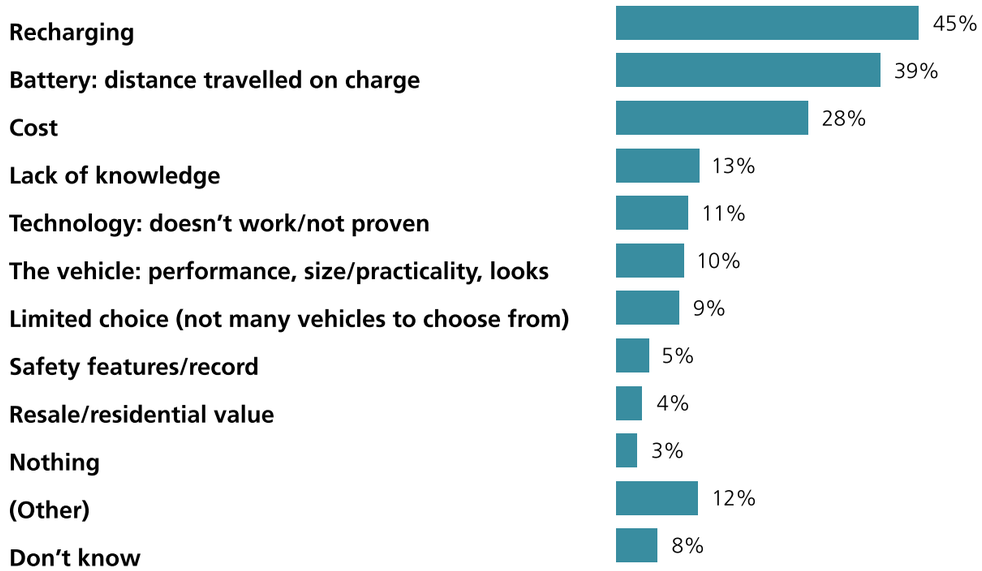
Electric Vehicles

London should seek to become a world leader in electric vehicle usage. Moving towards greater electric vehicle (EV) use will reduce the level of road transport emissions, particularly NOx and PMs. Whilst EVs are not completely pollution free - they still produce pollution from brake, tire and engine wear – there are significantly less pollutants produced in comparison with diesel vehicles. They provide a more environmentally friendly method of travel, cutting carbon emissions (depending on the energy source used) as well as air pollutants.

Uptake of EVs will be encouraged by several factors.

Firstly, increase the number of charging points and make sure that there is an industry standard common to all cars.[44]

Factors deterring people from buying an electric car or van, driving licence holders: 2016 results



Sources ONS Omnibus Survey February 2016. Unweighted base: 649 (full license holders only). Up to 3 responses coded from each respondent hence total will add up to more than 100%

Secondly, make information about the charging infrastructure widely and easily available so that people can gain confidence that they wont run out of charge.

Thirdly, it is vital that there is the investment plan to increase EV charging infrastructure that takes into consideration the capacity of the grid. Increasing EV take up may lead to problems with capacity on the grid. A report by the Green Alliance showed that as more EV charging stations are installed, the chances of brown-outs (a drop in voltage of supply) will become more common. Modelling has shown that "if as few as six closely congregated vehicles charge near a sensitive node at peak times, this may place more local demand than the system can handle."[45]

[44] Public attitudes towards electric vehicles: 2016 (revised), Department for Transport, July 2016. [45] People power: How consumer choice is changing the UK energy system, Green Alliance, 2017.

The role of City Hall

In 2009, the GLA developed an Electric Vehicles Plan with the target adding 100,000 EVs on to London's roads, reducing emissions of particulates by 70-90 tonnes per year and emissions of oxides of nitrogen by 350-400 tonnes per year.[46]

The Mayor's Electric Vehicles Plan sought to encourage the uptake of EVs, provide more charging points across London and educate motorists of the benefits of EVs. The Strategy contained three strands:

- Infrastructure: Developing a comprehensive network of charge points across London by work with the boroughs and other partners and businesses. The Plan aimed to provide 25,000 charge points across London by 2015 with the majority being provided in partnership with businesses
- Vehicles: Electrifying the public sector vehicle fleet, including 1,000 EVs in the GLA fleet by 2015 as well as support other public sector partners to extend the EVs in their fleets.
- Incentives, marketing & communications: Increase and communicate customer benefits, including working with boroughs to deliver parking incentives for EVs and Congestion Charge discounts.[47]

A delivery organisation, Source London was established to lead on the programme. In 2014, Source London was handed to a private company the Bolloré Group to provide information on London's EV network.[48]

However, whilst moves are being made to increase EV uptake (and there have been recent hikes in demand for EV[49]), they still remain a small minority of London's road transport mix. As of 2012, EVs accounted for only 0.8% of London's vehicles.[50]

This issue means that there needs to be greater strategic thinking as to where EV infrastructure should be provided and where the grid will need capacity upgrades to cater for EV charging points.

Simultaneously, a greater consideration needs to be given to the type of charging infrastructure being installed, with a move to smart charging that provides feedback to Distribution Network Operator (DNO). By doing so, the DNO is able to see where there are areas of high EV demand, increasing their visibility of use on the electricity grid.

This strategic role needs to be taken by TfL and the GLA working with the local authorities in London, EV infrastructure providers and DNOs. Currently, TfL is working with the boroughs and investing £18million to unlock potential sites, including upgrading the power supply.

This is a positive step, but greater availability of data must also be shared with local authorities so that they can make the right planning decisions on EV infrastructure installation.[51] For example, City Hall could provide a map of London showing the most cost effective points to install new EV charging points. This would show where extra capacity in the system is and where boroughs can utilise this capacity. By doing so, TfL will allow the boroughs to take greater control of their infrastructure planning, making more informed choices that consider the capacity of the grid.

[46] An Electric Vehicle Delivery Plan for London, GLA, May 2009. [47] Electric Vehicles Plan Presentation, GLA, 2009. [48] About Source London Website [Accessed 28 February 2017]. [49] Sales of electric cars soar 85% amid fear over pollution, Evening Standard, January 2016. [50] Charging ahead?, An overview of progress in implementing the Mayor's Electric Vehicle Delivery Plan, London Assembly, February 2012. [51] TfL drives forward £18 million electric vehicle scheme, TfL, April 2017.

In the last Parliament, the Vehicle Technology and Aviation Bill was introduced to implement standardisation for charging infrastructure. These will lead to a number of changes including requiring data from charging points to be openly available and setting minimum technical specifications for charge point connectors.[52] However, because of the 2017 General Election, this Bill did not pass into law and has be replaced in the Queen's Speech with the Automated and Electric Vehicles Bill.

For City Hall, providing a more strategic role on EV infrastructure provision will allow London to make a head start on the specifications of the Bill, should it be reintroduced. These measures should be included in the new London Plan.

The future of EV charging

Providing charging infrastructure has been one of the major hurdles to EV uptake. For Londoners, there are concerns about the availability of charging points when they go on longer journeys and the amount of time it will take for their vehicle to recharge.

High powered inductive charging pads which allow electric vehicles to be charged without the need for a cable could be the future of charging infrastructure. These pads, which are currently being developed, could be used for all forms of vehicles and could be installed in parking locations across London.

Charging pads could also be installed in new consolidation centres and – in connection with **Recommendation 1** – would allow for deliveries from electric HGVs and LGVs, providing a dual benefit from the new consolidation centres.

Recommendation 7: Seek to become a world leading city in electric vehicle usage, taking action to prepare for the growing burden on the electricity grid.

[52] Vehicle Technology and Aviation Bill, Department for Transport, February 2017.

ICE London commits to:

- Bring together stakeholders to ensure a more strategic approach to EV infrastructure planning. Creating a forum for stakeholders, providing more information to decision makers in London's local authorities and by improving standardisation ahead of legislation from the Government are all key measures that London can take to be a leader in electric vehicle usage.

Outcome: A more strategic approach to EV infrastructure planning would speed up the transformation of the EV sector in London, bringing the capital towards becoming a world leader in EV use. It would allow for more charging points across London without the risk of brownouts from low supply.

Air Quality on the Underground

Monitoring of air pollutants is a vital part of understanding where concentrations are highest, levels of exposure and the health risks associated with breathing in the pollutants. Currently, air quality is monitored by different groups in London, such as Kings College London.

On the Underground, these are no air pollution monitors to regularly provide feedback to the public on concentrations. However, a recent study by the University of Surrey and Taskforce Member Prof Prashant Kumar has shown that Underground users were exposed to the highest levels of particulate matter out of all transport users in the Greater London area. For the study, monitors worn by commuters found that they were exposed to 68 microgrammes of harmful pollutant PM10, in comparison with car drivers, exposed to 8.2 microgrammes.[53]

It is clear from this new data that Underground tube dust and particulate matter must be re-examined by TfL in order to assess the health risks to passengers. Information from TfL shows that the last study of air quality on the Underground was taken in 2004 and showed that it does "not pose a risk to the health of our customers or employees".[54] A re-evaluation of this evidence is recommended.

Monitoring air quality more widely on the Underground should be carried out because encouraging modal shift onto the rail network is one aspect of reducing vehicle use and thereby improving air quality. If those traveling in and around London are being exposed to PM10 on the Underground, then they may choose not to shift from private vehicle use.

TfL should look to see whether air quality monitors can be installed into stations where upgrade works are taking place. For new investment programmes, such as the Northern Line Extension, the Bakerloo Line Extension and Crossrail 2, TfL should examine how it could build into the scheme measures that will ensure air quality remains high, such as better ventilation systems. This is particularly important as new ventilation improvements will be highly costly once these stations are built.

New rolling stock on the Underground should also be examined to assess how new trains can limit the exposure to pollutants. The New Tube for London Programme, which will add 250 new tube trains for the Piccadilly, Bakerloo, Central and Waterloo & City lines, should consider these necessary improvements.[55]

[53] Exposure to air pollutants during commuting in London: Are there inequalities among different socio-economic groups?, University of Surrey, February 2017.
[54] Air Quality on the Underground, TfL, 2016. [55] Improving the Trains, TfL Website, Accessed February 2017.

Recommendation 8: Roll out a programme of monitoring Underground station air quality and ensure new stations contain air pollution reduction solutions.

ICE London commits to:

- Raising awareness of air quality issues on the Underground.

Outcome: Underground users should not face high pollutant levels as this may drive them to private vehicle use, adding to the above ground pollution levels. By tying in monitoring infrastructure and reduction measures into the current programme of upgrades, TfL can ensure that it is not only increasing capacity on the rail network, but also protecting its customers from health risks.

Radical Innovations

What radical innovations are there for air quality improvements in the Capital? We asked this question to a group of engineers on 13 February 2017 as part of an Air Quality Hackathon organised by the Taskforce.

Groups were tasked with finding new and innovative ways that London could reduce air pollution. Some of the solutions are offered below to inspire further thought:

Street Lamps showing the levels of pollution

Even with warnings on the transport network, it can often be hard to visualise the risk from air pollution and when concentrations are particularly high. Changing street lamps to change different colours based on levels of pollution would show members of the public when pollutants are high, encouraging them to take clean routes or modes of transport.

Buildings and structures that absorb pollutants

Could buildings and structures help absorb pollutants? With cities being dense, buildings can often direct pollution into one area. However, if the structures had materials to catch pollutants, then they could actively mitigate the issue. This requires the installation of biofilms to digest pollutants, green infrastructure, catalytic filters in building ventilation systems and possibly titanium dioxide pavements.

Clean travel miles

A clean travel mile scheme was proposed as the 'carrot' to the Congestion Charge 'stick'. Members of the public who travel in London using the cycle scheme, Underground and rail network, and buses could claim discounts on their next journey, encouraging them to take public transport again.

- Satellite navigation on TfL's Cycle Scheme

An upgrade to the cycling stock of TfL's cycle sharing scheme could encourage those less familiar with London to use the scheme. The navigation system could also direct users to Cycle Superhighways and onto quiet ways to provide the safest, quietest and easiest route.

ICE London would like to thank all participants of the Air Quality Hackathon for their participation in the event.

Industry Practices

Recommendations

9. A Construction Logistics Plan (CLP) should be produced as part of every development planning submission embedding good air quality as a key part of Health and Safety assessments.

10. Industry Codes and Best Practice Initiatives to take greater consideration of air quality monitoring and pollution mitigation and adaptation when awarding construction projects.

Construction and demolition can produce harmful emissions such as nuisance dust, fine particulates and nitrogen oxides. By changing the habits, techniques and technologies of those working in the construction sector, impacts on local air quality can be reduced. By taking these steps, the industry can ensure that London's growth is not at the expense of its environment.

In London, there are currently a number of major infrastructure projects, significant areas of regeneration and ongoing re-build or refurbishments of buildings within the heart of the city centre. This trend seems set to continue for the foreseeable future and the associated construction activity and practices will come under increasing scrutiny as a significant contributor to London's air quality problems.

A significant proportion of traffic in London is generated by the construction and civil engineering industry, including some of the most polluting diesel vehicles. Apart from the road traffic movements, there are also sources of air pollution that are attributed to the actual onsite construction machinery and industry practices.

According to the Supplementary Planning Guidance on the Control of Dust and Emissions during Construction and Demolition, 15% of air pollutant emissions are from construction and demolition activity and the machinery used in these processes.[56]

According to the latest London Atmospheric Emissions Inventory (LAEI 2013) the construction industry in London contributes 7% of the nitrogen oxides, 8% of the particulate matter (PM10) and 12.5% of the ultrafine particulate matter (PM2.5) of the total directly emitted directly into the air.

Emissions from construction can be divided into three main categories:

- Dust: Particulate matter mechanically generated from construction activity contributing to PM10 concentrations.
- Construction Plant: Exhaust emissions from diesel non-road mobile machinery (NRMM) contributing to elevated NOx and PM10/PM2.5 concentrations.
- Construction transport: Road transport delivering and collecting construction materials and waste. Often these are HGVs or LGVs using diesel engines. Additionally, fine particles 'tracked out' onto the public highway on the wheels of these vehicles are also resuspended and can remain in the air for many hours, day or even weeks.

[56] The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance, GLA, July 2014. The latest LAEI figures show a slight decline in Construction and Demolition emissions since 2014.

There is very little collated data to accurately apportion the pollution associated with each of the listed construction sources but currently published data (LAEI 2013) shows industry and NRMM emissions together account for 7% of total NOx emissions in Greater London.

By comparison, road transport contributes 50% of total NOx emissions and of that total construction vehicles fall into the categories Rigid HGV (15%) Artic HGV (6%) Vans and Minibus (12%). Whilst there are no published figures for the actual percentages attributed to construction activities, of the 33% category totals, it is reasonable to expect that construction vehicle activity would produce as much NOx emissions as NRMM if not greater.[57][58]

Key Definitions

Dust: All airborne particulate matter including ultra-fine particles suspended in the air. PM can include both organic and inorganic particles such as dust, soot, smoke and pollen. Many of these particles are detrimental to health when inhaled. Two sizes of the particle are commonly monitored: PM10: Course particles with a diameter of 10 µm or less. PM2.5: Fine particles with a diameter of 2.5 µm or less.

Most particulate emission from construction is not visible to the naked eye i.e. solid particles that are suspended in air or have settled out onto a surface after being suspended in the air. It generally results in visible dust plumes and dust deposition adjacent to the construction activity.

This is no published data for overall dust from construction activity as it is generally more a local problem and does not contribute to the NOx levels in London. However, fugitive or nuisance dust is estimated as contributing 1% of the total emitted into the air in London.[59]

Non-road mobile machinery (NRMM): NRMM is defined as any mobile machine, an item of transportable industrial equipment, or vehicle - with or without bodywork - that is: -

- not intended for carrying passengers or goods on the road
- installed with a combustion engine - either an internal spark ignition (SI) petrol engine, or a compression ignition diesel engine

Generators, pumps, compressors and similar construction tools are also classed as NRMM.

[57] Emission control in road engine technology is far more advanced than construction machinery. A fully loaded Euro6 HGV with SCR DPF fitted will produce lower emissions than a family car! [58] London Atmospheric Emissions Inventory, GLA, 2013. [59] London Atmospheric Emissions Inventory, GLA, 2013.

There are a number of regulations, controls, guidelines and industry good practice schemes that support measures for the improvement of air quality generated by construction activity:

- Town and Country Planning – including Supplementary Planning Guidance (SPG)
- Neighbourhood Plans
- Considerate Constructors Scheme
- Industry Forums, for example, TfL's Construction Logistics Group
- BREEAM and Well Accreditation
- Guidance on the assessment of dust from demolition and construction[60]

Whilst many of these measures are long established, they are not currently co-ordinated and could be further joined-up to achieve the significant improvements required in London's air quality.

It is incumbent on us as civil engineers involved at all stages of the construction process, (planning, design and implementation) to consider the effects of construction on air quality. It is not sufficient to wait for other sectors or policy makers to make these changes.

The observations in this report were supported by the findings of a recent audit carried out on construction sites within the City of London Low Emissions Neighbourhood (LEN) – 10 sites were inspected during this audit.[61]

The report also draws on responses to ICE London Air Quality Taskforce Industry Practices Survey carried out in early 2017.[62]

[60] Guidance on the assessment of dust from demolition and construction, IAQM, 2014. [61] These audits were carried out by Sir Robert McAlpine. For more information please contact: pr.gregory@srm.com. [62] The survey is open for responses and can be found here.
Full results will be shared in the final report published in September 2017.

Construction Emissions

Dust generated by civil engineering and construction projects has traditionally been the most visible form of pollution from the industry. Whilst the effects of dust emissions in rural areas are generally less of a health hazard, dust generated within city centres and urban areas can be a major concern for nearby communities and local stakeholders. [63]

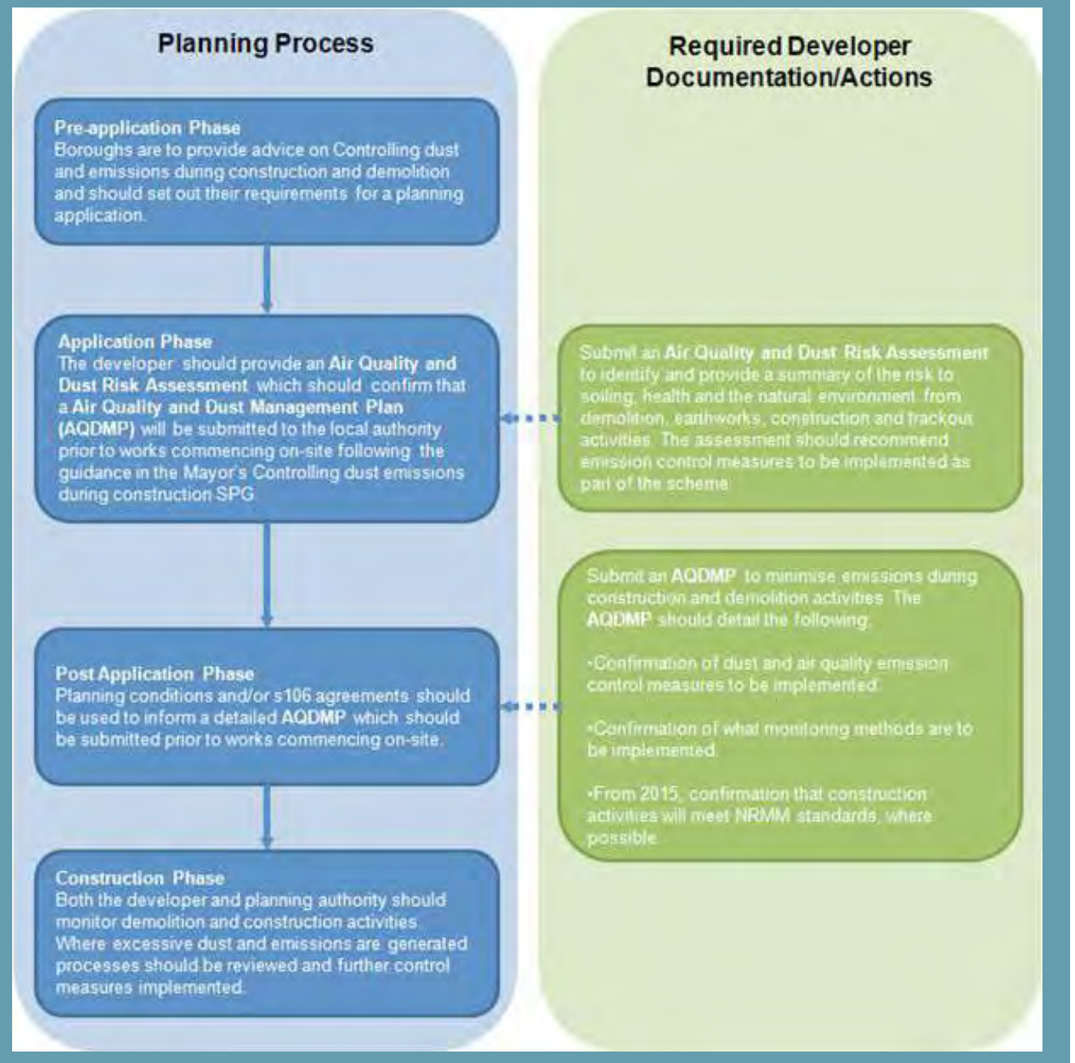
Dust generation during construction is primarily dealt with as part of the Town and Country Planning Application Process [64] and in London is covered by the Supplementary Planning Guidance (SPG): 'The control of Dust Emissions during Construction and Demolition (2014)'.[65]

The SPG sets out for developers where in the planning process submissions are required to comply with the SPG, but as a guidance document, it can only offer best practice advice. A good practice is therefore reliant on the relevant planning authority who must implement full compliance through the Section 106 legal agreement.

Compliance is often deferred until the contractor is appointed (unless for very large schemes). This often means that breaches in compliance are only identified during construction when they result in a nuisance to neighbours or third parties. The planning process, therefore, needs to become more effective at pre-emptively identifying breaches in compliance, particularly for small projects.

[63] Assessment of the long-term impacts of PM10 and PM2.5 particles from construction works on surrounding areas: http://pubs.rsc.org/en/content/articlelanding/2015/em/c5em00549c#!divAbstract. [64] For more information see DCLG website: https://www.gov.uk/guidance/making-an-application#types-of-application. [65] The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance, GLA, July 2014.

Guidance in the Control of Dust and Emissions during Construction and Demolition SPG



TfL's Construction Logistics Improvement Group (CLIG) is currently working towards producing a Construction Logistics Plan (CLP) Guidance document that would set the minimum standard for CLPs. This would act as a template that could be applied across all projects depending whether they are considered low, medium or high impact.

This CLP should include a commitment for projects to produce an Air Quality Dust Risk Assessment (AQDRA) in accordance with the Supplementary Planning Guidance. This should be submitted in all cases, other than very small developments, with the planning submission.

The planning consent should, as a minimum, reference the requirements of the CLP and AQDRA in the planning conditions. For high-risk projects, these assessments should be included in Section 106 Legal Agreement accompanying the consent.

This will ensure that for the larger projects developers will need to consult with construction experts and contractors during the initial design phase by including the planning consent in the tender documents. Air quality requirements related to dust will be properly considered as part of tender returns so that only contractors that use best practice will be awarded the contract.

Through CLPs, commitments can be made for developers and contractors to work with neighbouring sites to reduce pollution in a local area. This can be achieved in a number of ways but is of even greater importance if all vehicles servicing multiple sites are using a single 'corridor' and so not adding to the local traffic.

Recommendation 9: A Construction Logistics Plan (CLP) should be produced as part of every development planning submission embedding good air quality as a key part of Health and Safety assessments.

ICE London commits to:

- Ensuring engineering professionals fully support this requirement by considering and promoting dust abatement measures during planning, design and implementation of construction and civil engineering projects.
- Ensuring air quality becomes an important part of Health and Safety requirements.

Outcome: By embedding air quality into the planning process, the construction sector can avoid breaches in compliance. Contractors will actively seek to implement best practice in air quality to win contracts, thereby improving conditions during construction. A number of sites across London would see reductions in air pollution as a result.

Examples of Best Practice Dust Control Measures:

Stakeholder Engagement

Site Layout – well planned and constructed site access roads.

Covering of vehicles

Green Infrastructure: Green hoardings and green walls

Continuous Site Monitoring stations

Site maintenance[66]

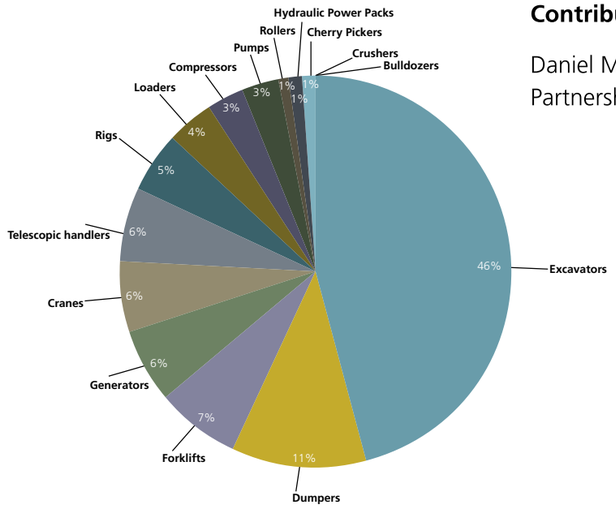
[66] Including: Wheel cleaning and regular cleaning of site access roads both on and off site. Consideration given to using dust suppressants (Calcium Magnesium Acetate CMA) on haul roads and surrounding access roads where large scale and prolonged excavations are expected.

Non-Road Mobile Machinery

Since 1st September 2015 Non-Road Mobile Machinery (NRMM) of net power between 37KW and 560 KW used in London is required to meet the set standards.[67] These are based upon engine emissions standards set in EU Directive 97/68/EC and its subsequent amendments: [68]

- NRMM used on any development site within the Central Activity Zone (CAZ) or Canary Wharf will be required to meet Stage 3B of the directive as a minimum.
- NRMM used on any major development site within Greater London will be required to meet Stage 3a of the directive as a minimum

These standards will be further enhanced in September 2020 to incorporate stage IV for CAZ and Canary Wharf and Stage IIIB for Greater London. [69]



Contribution to NO_x by NRMM type

Daniel Marsh, London Low Emission Construction Partnership, Presentation 3 February 2017

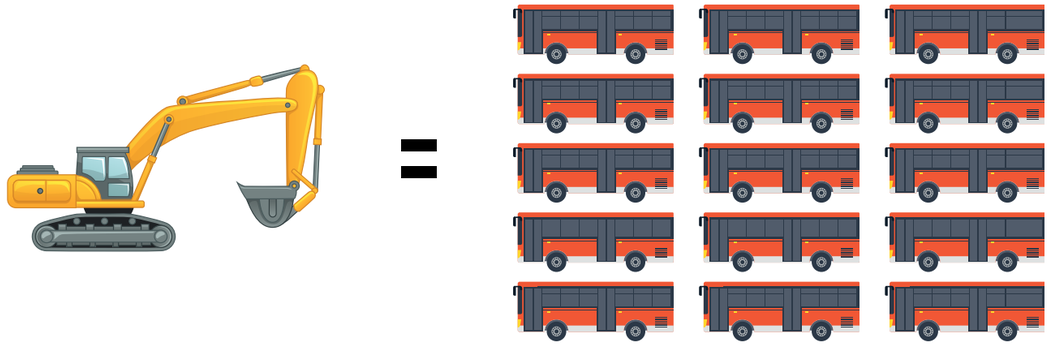
A snapshot of the data on the register showed the greatest contribution to NOx pollution was from excavators, which emitted 46% of all NRMM emissions, followed by dumpers at 11%. However, the compliance for these machines is far below those of motor vehicles. The current compliance limit for excavators in the Greater London Area (stage 3A) is likely to produce the same level of emissions as 15 Euro IV trucks or buses.

Putting this into further context, Euro IV trucks will be subject to a further surcharge in London from late 2017 as they are now largely superseded by Euro V and the new Euro VI diesel vehicles, yet it is not currently intended to raise the limits for NRMM until 2020.

This means that whilst measures are being taken to clean up the most polluting vehicles using the roads, NRMM used on sites will continue to have lower emission standards and will continue to add high levels of pollution into London's air.

[67] These apply to both variable and constant speed engines for both NOx and PM. [68] Introduction of the European Emission Standards for engines used in new non-road mobile machinery (NRMM) have significantly reduced emissions. The standards are split into categories for spark ignition (SI) and compression ignition (CI) engines and then further classified according to the engine power rating. These categories are then given limit values for specified gaseous outputs, more commonly known as the engines stage. [69] See nrmm.london for further information and policy updates.

Emission limit for particulate Matter (PM)
Euro IV truck/bus (LEZ compliant) = 0.02g/kWH
Stage IIIA Excavator (NRMM LEZ Greater London) = 0.30g/kWH



It is important to note that NRMM is often left idling on site, increasing exposure to emissions to the local community. The operators of these machines are often the most exposed to high levels of pollution. Better operator training can be a cost-effective way of reducing emissions whilst saving fuel costs.

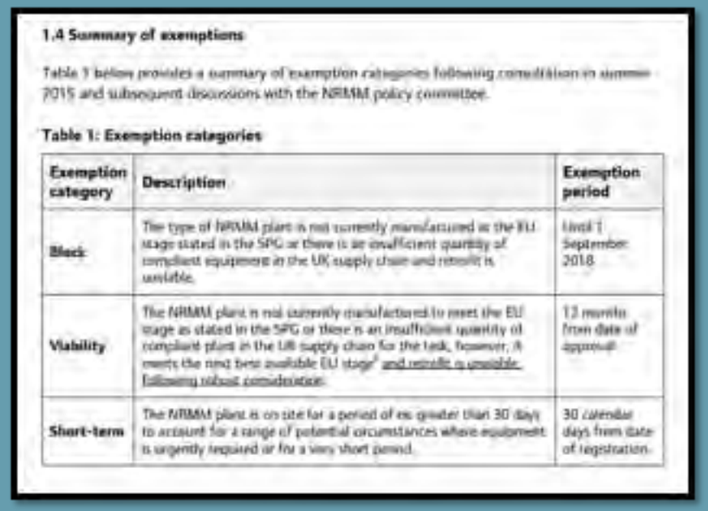
The GLA's Supplementary Planning Guidance (SPG) requires registration of all developments within the Central Activity Zone (CAZ)/Canary Wharf and all major developments within Greater London.

This register means that local planning authorities can check what NRMM is being used in their boroughs for compliance purposes and for the industry to self-regulate the use of NRMM. This register has been available online since September 2015 and is administered by the London Low Emission Construction Partnership (LLECP).[70] The purpose of the website is to: -

- Register the development
- Upload the details of all NRMM
- Apply for exemptions where applicable.[71]

Exemptions fall into three categories: Block, Viability and Short Term. These are summarised in the table overleaf.

[70] See nrmm.london. [71] The GLA will only accept exemption requests if they are made through the register.



1.4 Summary of exemptions

Table 1 below provides a summary of exemption categories following consultation in summer 2015 and subsequent discussions with the NRMM policy committee.

Table 1: Exemption categories

Exemption category	Description	Exemption period
Block	The type of NRMM plant is not currently manufactured at the EU stage stated in the SPG or there is an insufficient quantity of compliant equipment in the UK supply chain and retrofit is unviable.	Until 1 September 2018
Viability	The NRMM plant is not currently manufactured to meet the EU stage as stated in the SPG or there is an insufficient quantity of compliant plant in the UK supply chain for the task, however, it meets the next best available EU stage[1] and retrofit is unviable following robust consideration.	12 months from date of approval
Short-term	The NRMM plant is on site for a period of ex greater than 30 days to account for a range of potential circumstances where equipment is urgently required or for a very short period.	30 calendar days from date of registration

NB: Currently the block exemptions are limited to truck mounted cranes and constant speed engines (e.g. generators) Exempt plant is still required to be registered when used on construction sites.

Source: NRMM LEZ exemption and retrofit policy - March 2016 update[72]

However, as of May 2017 only:

- **711 sites had registered**
- **1716 NRMM units had registered**

These figures are not aligned with the level of construction in London since September 2015 and suggest a low level of compliance or a lack of understanding of the requirements.

A recent survey for City of London of 10 selected construction sites within the Low Emissions Neighbourhood (LEN) found 7 out of the 10 sites had registered on the NRMM website. Of the 7 sites that had registered 2 sites did not register all the NRMM. All sites involved demolition, which traditionally relies on excavators.[73]

This survey recorded a number of user interface issues with the website that is being addressed by the LLECP, but suggested that major projects were complying with air quality requirements with some examples of good practice being employed.

A draft template has been produced for use by City of London auditors to monitor not only compliance with NRMM requirements but wider air quality improvement measures. This is appended to this report.

Fundamentally, however, there will not be improvements in NRMM emissions until sites are registered as common practice and NRMM is recorded on the website, only then can authorities get a more complete picture of construction pollution sources in London and take actions to reduce emissions.

[72] NRMM LEZ exemption and retrofit policy, GLA, March 2016 – see nrmm.london. [73] For more information on this survey contact pr.gregory@srm.com.

Whilst there will be a drive by local authorities to enforce compliance going forward it is suggested that to support this that the Considerate Constructors Scheme[74] is encouraged to include compliance with NRMM requirements as part of its regular monitoring and scoring scheme.

In addition, the innovation marks for this topic should be focussed on good practice measures associated with NRMM.

Retrofitting NRMM

It is possible to retrofit most plant with Diesel Particulate Filters (DPF's) to deal with PM emissions but the technology to achieve

NOx reduction, Selective Catalytic Reduction (SCR), is still under development for the NRMM sector but will be included on EU stage V machines.

The overriding drive for all construction projects should be to set standards that ensure only compliant plant is used on sites and that it is well maintained and serviced regularly.

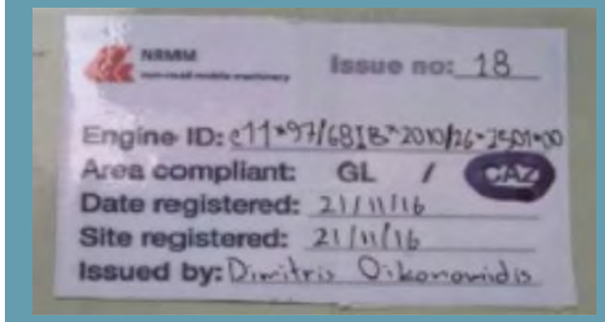
If retrofit options are to be considered as a short term solution then these should only consider suppliers and products endorsed by the Energy Savings Trust (EST). The GLA only recognise retrofit from an EST endorsed Supply Company.

Examples of Best Practice NRMM Measures

- NRMM Inventory kept on site in addition to registering website to ensure full compliance including photographic reference of plant.
- Individual plant stickers to record information and registration details to facilitate compliance audits.
- Site no idling policies.
- NRMM and associated air quality requirements included in site induction.
- Tool box talks given to plant operators about air quality requirements and benefits of efficient driver operation and to reinforce no idling policy.

[74] The Considerate Constructors Scheme involves construction sites, companies and suppliers voluntarily registering with the Scheme and agreeing to abide by the Code of Considerate Practice, designed to encourage best practice beyond statutory requirements in the industry. The Scheme is concerned about any area of construction activity that may have a direct or indirect impact on the image of the industry as a whole. The main areas of concern fall into three categories: the general public, the workforce and the environment. See here for more information.

- All machinery to be regularly serviced and service logs kept on site for inspection.
- Use of generators limited by early engagement with UKPN to ensure temporary power available for the construction phase. If generators are the only option then generators should be appropriately sized and/or hybrid technology should be considered.
- All block exempt plant should be registered for monitoring purposes.
- Use of hybrid fuel source plant.
- Use of offsite manufacturing where appropriate.



Construction Delivery Vehicles

Other than NRMM, construction emits pollution through the use of vehicles for deliveries to and from the site.

In Recommendation 1, we have the use of consolidation centres to reduce the construction-related traffic and when used these can have a significant impact in reducing traffic movements.

However, it is not always possible to use consolidation centres primarily because the initial cost of the project is high and in a competitive market, it is unlikely to be an initiative that is funded by either the developer or the contractor. An alternative is to consider the use of a delivery management system similar to that employed by the consolidation centres to monitor and control the deliveries direct to site.

In addition, a local facility adjacent to the site may be used as an alternative to deliver, off-load, store and transport the materials to site in a similar way to a purpose built consolidation centre. Alternatively, the site could agree with the local planning authority to allow out of hour arrival of vehicles which are then unloaded during the site operational hours. This eases congestion in the morning rush hours, reduces emissions as well as increasing pedestrian and cyclist safety and can improve site performance.

The final leg of that journey may be able to use alternative transport sources that produce fewer emissions and deliver the materials in more convenient sized deliveries to suit the construction programme. This site could be an adjacent vacant site or, in the case of larger schemes, land that forms part of a later construction phase. When considering the Construction Logistics Plan for a project, if the use of a consolidation centre is not an option, then a delivery management system should be considered as a minimum alternative option.

What is a Delivery Management System?

These are online systems that require the pre-booking of any delivery to the site, especially where access to the site is limited. The system may offer the opportunity to hold lorries remotely for 'Just in time' deliveries. This can avoid wasted journeys and the potential for idling lorries parking adjacent to the site (and thereby polluting the local area).

These systems have the added advantage that the details of any delivery vehicles can be pre-loaded and, in conjunction with pre-established project performance criteria, non-compliant vehicles can be prohibited or diverted away from the site.

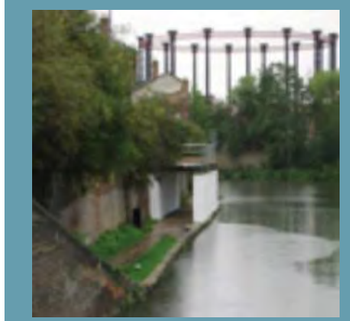
Such performance criteria can include setting the type of diesel vehicles that are permitted to deliver to site. For instance, they can be aligned with the Mayor of London's strategy to target Euro IV diesel with the toxicity charge (to be implemented in October 2017).

If the construction industry collaborates on this issue then project specifications and sub-contractors terms and conditions can be set to determine the type of vehicles used for delivery to construction sites. This will accelerate the transition to less polluting Euro VI trucks and delivery vans.[75]

This delivery management system can also set standards for cycle safety by enforcing levels of FORS registration and CLOCS compliance.

In addition, alternative delivery strategies can be considered by utilising vacant land either adjacent to or a future part of the current development to support delivery logistics. These measures can only be truly realised by developers, planners, designers and contractors working collaboratively to achieve the goals. This supports the works being currently carried out by the TfL Construction Logistics Improvement Group (CLIG).

Case Study: King's Place



By considering the Construction Logistics Plan from a very early stage in the project and by involving a contractor in early discussions, projects can often use alternative means of transport that are less polluting.

[75] Whilst Euro VI diesel trucks have been manufactured since 2013 it is only in the last year that similar standards have been mandatory for the manufacture of smaller vehicles e.g. 'white vans'.

One such case is the Construction of King's Place, one of the first projects constructed as part of the re-generation of Kings Cross.

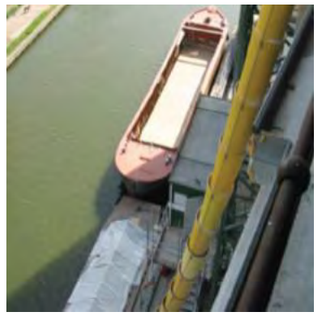
At the time of original construction the project, on the banks of the Regents Canal was faced with severe unloading restrictions by TfL to serve its tower cranes. The project team dealt with this by using the canal for the final delivery leg of materials to the site.

In negotiation with British Waterways, the site utilised a nearby area of waste ground adjacent to the canal but remote from the site to provide an unloading and storage area for heavy construction materials. A high-level loading facility was constructed over the canal footpath to enable structural steel, pre-cast cladding and glazed units to be delivered to site by barge and erected directly from the barge by tower crane

This allowed full loads to be delivered to the holding area without restriction and delivered on a 'just-in-time basis' to the site. Eventually, the site utilised the canal to also take plasterboard waste several miles along the canal to a waste transfer facility.

Covering of vehicles

Green Infrastructure: Green hoardings and green walls



Screens and wraps

Construction Industry Codes and Best Practice Initiatives

The recent City of London survey and feedback from the London Low Emissions Construction Partnership (LLECP) shows that awareness of pollution resulting from construction industry practices is varied and that awareness of the effects of NRMM is limited.[76]

With public attention clearly focused on air quality across London there is an immediate need for all the various mandatory, advisory documents and industry best practice procedures to be aligned to support improvements in London's air quality.

The work currently being carried by the TfL Construction Logistics Improvement Group (CLIG) and the Neighbourhood Forums being formed under the Localism Act 2011 and Neighbourhood Plan Act 2017 are raising the awareness and necessity for well-considered Construction Logistics Plans to be submitted early in the planning process. This will as a necessity encourage developers to consult with industry specialists and contractors to support planning applications and raise air quality matters to the forefront of considerations.

The drive to increase the specification and operating conditions of buildings, especially commercial office space, has led to higher targets being set for BREEAM assessments.

More recently the introduction of WELL Accreditation is driving up the standards. They not only increase the sustainability standards of buildings during design and occupation but also consider the sustainability credentials during construction. Many of these construction related targets are aligned to improving air quality.

BREAMM and WELL

BREEAM/Considerate Constructors: BREEAM uses the Considerate Constructors Scheme. Additional BREEAM points can be achieved by gaining a higher score in the Considerate Contractors Scheme. This high score attainment is driven by innovation during construction and provides a basis for improving air quality measures. The Considerate Constructors Scheme is currently the only scoring and award scheme that measures performance during construction, although a similar award scheme is operated by the City of London.

The SPG also encouraged developers to sign up to the scheme.[77]

WELL Accreditation: The introduction of Well Accreditation has raised the awareness of the air occupants to breathe within a building and require the air intake air quality to be measured to ensure pollutants are not present at increased levels. These include monitoring PM10 and PM2.5 levels amongst others.

[76] The London Low Emission Construction Partnership is a project funded by the Greater London Authority and Transport for London through the Mayors air quality fund and includes several of the central London boroughs as members. Further details can be found at www.llecp.org.uk.
[77] The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance, GLA, July 2014.

These best practice schemes should involve the requirement that sites set up continuous multi-functional monitoring stations in conjunction with their local authority. This would allow air quality professionals to establish the local ambient air quality and the impact on air quality due to construction activity. This information would contribute to the ever growing database of air quality across London and supports research into air quality impacts and measures.

Recommendation 10: The Considerate Constructors Scheme should give more weight to compliance with NRMM requirements as part of its regular monitoring and scoring system. Industry Codes and Best Practice Initiatives should take greater consideration of air quality monitoring when awarding construction projects.

These changes could be applied to the Considerate Constructors Scheme for an updated scoring matrix due for reissue in early 2018.

ICE London commits to:

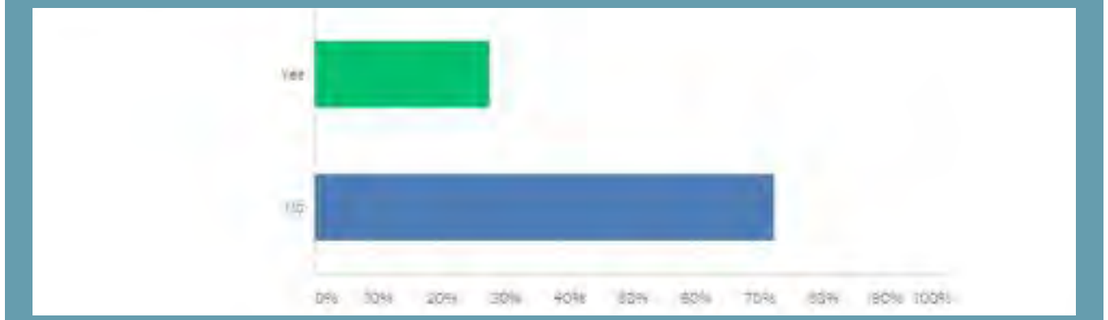
- Work with the Considerate Constructors Scheme to make air quality management good industry practice.

Outcome: By including air quality measures in these best practice schemes, the industry can help monitor local air quality and reduce the emissions from sites. This will make construction sites healthier places to work and help to record the impact of construction on air quality. Delivery management systems and delivery strategies should be included as part of the Construction Logistics Plan.

ICE London Members Survey

In early 2017, ICE London surveyed 48 London members about their view on air quality in the industry. Below is an analysis of the 48 responses.[78]

Are you aware that Non Road Mobile Machinery (NRMM) had to be registered online in the City of London (and other boroughs) since September 2015?



More than 70% of respondents did not know that NRMM had to be registered online in the City of London and other boroughs.

[78] All results can be received upon request by emailing: ice.london@ice.org.uk.

53% selected "totally agree" when asked if they considered air quality issues during a project, yet only 32% said the same when asked if air quality issues on site are a key concern of the senior management in their company.

On air quality measures, respondents showed the following results:

	YES	NO	TOTAL
Toolbox Talks on air quality	51.72% 15	48.28% 14	29
Guidance to turn off engines when stationery	70.00% 21	30.00% 9	30
Monitoring emissions	60.00% 18	40.00% 12	30
Use of consolidation centres	44.83% 13	55.17% 16	29
Use of non-diesel CHPs	58.62% 17	41.38% 12	29
Using alternatives to diesel fuels such as CNG	43.33% 13	56.67% 17	30
Appointing an air quality champion within your organisation or on your site	43.33% 13	56.67% 17	30
Covering air quality matters in your Construction Management Plans (CMP) for your projects	75.00% 21	25.00% 7	28

Comments on the air quality challenge included:

"There are barriers on all sides – for customers, fleet operators, infrastructure providers and vehicle manufacturers. However, the headline obstacles are: 1. Lack of clarity around priorities and definitions for "low emission" commercial vehicles 2. No clear, long term policy framework for alternatively fuelled commercial vehicles"

[When asked if air quality issues are considered in construction] "Yes, this is part of our role. However, occupational exposure is not typically considered. Dust impacts are most frequently the main issue along with vehicle traffic."

Summary of recommendations

1. City Hall and TfL should make a long term commitment to vehicle consolidation centres and provide strategic leadership in order to reduce the level of emissions from goods vehicles.

2. Increase the level of pedestrianisation within London, taking a strategic approach which considers public transport links and the effect on local side streets. Pedestrianisation should be implement within a wider, more holistic view of the transport system.

3. Embed a zero emission approach to building planning within the London Plan.

4. Make air quality improvements a central objective of the new energy for Londoners agency.

5. Promote good practice air quality planning policy in Neighbourhood Plans

6. Incentivise use of commercial wharves along the river, for example through the use of London Wharf grant.

7. Seek to become a world leading city in electric vehicle usage, taking action to prepare for the growing burden on the electricity grid.

8. Roll out a programme of monitoring Underground station air quality and ensure new stations contain air pollution reduction solutions.

9. A Construction Logistics Plan (CLP) should be produced as part of every development planning submission embedding good air quality as a key part of Health and Safety assessments.

10. The Considerate Constructors Scheme should give more weight to compliance with NRMM requirements as part of its monitoring and scoring system. Industry Codes and Best Practice Initiatives should take greater consideration of air quality monitoring when awarding construction projects.

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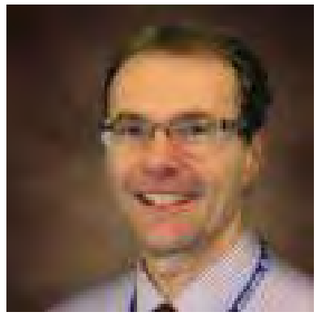

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