REAL WORLD VEHICLE EMISSIONS DATA CAN BE A GAME-CHANGER IN URBAN AIR QUALITY MANAGEMENT

The impact of poor air quality on human health is well documented. Every year, it is estimated that more than four million people worldwide die as a result of exposure to outdoor air pollution.

This needlessly high number of deaths is the reason that so much effort is being made to mitigate the risks associated with air pollution. However, in order to ensure a successful outcome, further scientifically credible research and innovation is still required.

Over the past six decades, significant progress has been made in understanding and improving air quality in many parts of the world. Economic growth in some countries is helping to lift people out of poverty, but the associated urbanisation is bringing fresh challenges in managing local air quality. The main areas and pollutants of concern and principal sources may be changing, but the issue of tackling air pollution remains.

Our knowledge and understanding of air pollution are developing constantly and by adopting innovative approaches and utilising new sources of information, we have the opportunity to address the challenge much more effectively than we have been able to do previously.

At Ricardo, we have numerous strands of innovation in relation to understanding and improving air quality progressing in parallel. As road transport remains a principal source responsible for the majority of air quality management areas in the UK, we will focus on our work on this issue here, including how we can use new data and approaches to provide unparalleled insight into the mobile sources of air pollution in our towns and cities.

Policy development needs to be underpinned by accurate and detailed data and information. When it comes to emissions from road traffic sources, as evidenced by dieselgate, sometimes the information issued by vehicle manufacturers doesn't tell the full story. Data collected in lab testing doesn't always reflect what is happening in real world situations – and when it comes to the impact on local air quality, this can be a significant consideration.

Ricardo's focus for innovation has always been informed by improving the air quality evidence base, maximising the value of existing data sets and, importantly, developing quicker, more responsive systems that empower authorities and individuals to make informed decisions quicker and more effectively. In putting our expert teams and extensive knowledge to the test we believe we have come up with some game-changing solutions.
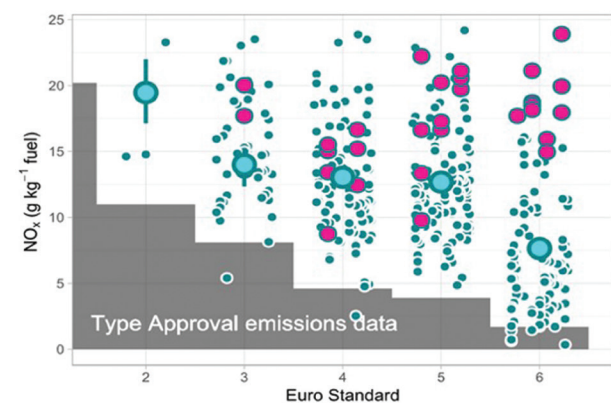
Real world vehicle emissions are a high profile area of research and over the past four years Ricardo has operated a vehicle emissions remote sensing service, supporting both clients and our own internal research programme.

Research has indicated that real-world emissions from vehicles on the road are typically significantly higher than those recorded under laboratory conditions, and yet currently, most air quality management strategies are still based on lab-based emissions factors. Over the past few years, Ricardo's vehicle emissions remote sensing team, led by Professor David Carslaw, has undertaken considerable research in this area, bringing enhanced insight into emissions, performance and impact for a wide range of considerations, particularly in urban environments where the vast majority of the air quality management areas and clean air zones are located.

We have developed a growing database of more than 600,000 measurements from campaigns across the UK, providing insight into the real-world emissions performance of most makes and models of vehicles on the roads in the UK under a range of conditions. By supplementing this data with the expertise of our Ricardo Group automotive and industrial specialists, we have developed great insight into real-world emissions in urban environments, including details on the principal contributors to local emissions. Notably, Ricardo's remote sensing service has supported the evaluation of the real-world emission performance of buses retrofitted with Selective Catalytic Reduction (SCR) technology as part of Transport Scotland's bus emission abatement retrofit programme.

We have also developed real-world emission factors to inform emissions inventories and to support the enhancement of dispersion modelling, linking our database with Ricardo's RapidAir® city-scale air dispersion modelling system. We have already used this approach in a number of studies and have shown that by combining insight from a real-world emissions database with the unique capabilities of RapidAir, we are able to offer significant added value to air quality policy and decision makers.

RapidAir was initially developed in 2012 to address a number of limitations of dispersion modelling software. The system has undergone significant development over the past eight years and is now available as a cloud-based software solution. RapidAir has been tried and tested in a large number of air quality studies in the UK and internationally, including in relation to clean air zones, city-scale and national scale modelling. It has been subject to independent peer review and offers numerous unique advantages.

One of the most significant benefits is that it is really fast, offering the capacity to model large domains in a high spatial resolution in a matter of minutes. Combined with real-world emissions factors, the speed and versatility of RapidAir opens up new opportunities to model air quality in the urban environment and provide a near real-time proactive air quality management system.

Many authorities now have access to a diverse range of data sources that could be used effectively to drive improvements in air quality. These include traffic datasets, such as Automatic Number
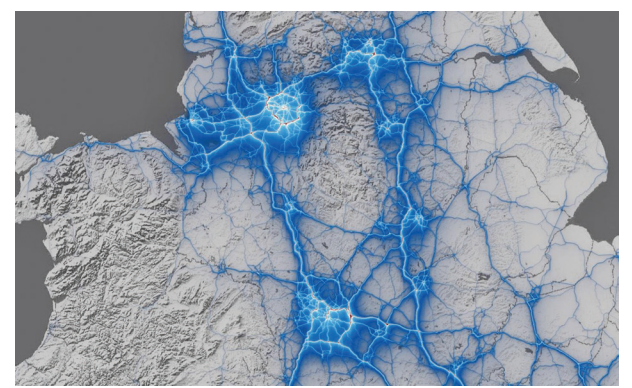

Plate Recognition and lower-cost air quality sensor data, which many authorities have invested in. It is important that we continue to look at such data sources and how they may be used to help improve the air quality evidence base, and where possible to help secure targeted and cost-effective improvements in air quality.

During 2021, Ricardo has been developing and testing the use of such data sets using our innovative and responsive urban air quality management system – Air Quality Now. The system combines the capabilities of our real-world vehicle emissions database and city scale modelling system RapidAir, consuming traffic data and generating near real-time mapped concentrations of key pollutants, and detailed information on sources of road traffic emissions; enabling users to proactively and accurately track levels of air pollution and evaluate the effectiveness of measures such as Clean Air Zones.

The principal ambition of the work is to provide users with trusted information on emissions and air quality across a given area without needing to wait weeks or months to evaluate the impact of traffic schemes. By accessing near real-time traffic data feeds, we're able to provide detailed estimates of emissions and specific road links, undertake source apportionment, and provide information on the vehicle fleet and how these vary across the day, week, month or year. As the system is able to run in near real time, it offers the potential to share detailed information on air quality in a simple to understand and visually appealing way, raising awareness of local air quality as widely as possible.

Furthermore, by combining the capabilities of real-world emissions and RapidAir with traffic datasets already being collected by authorities, we've been able to develop a responsive urban air quality management system that offers users the opportunity to maximise value from existing camera and traffic data infrastructure whilst gaining further detailed insight into local air quality.

The system represents a potential game changer in helping to quickly evaluate, monitor and secure sustainable improvements in urban air quality, facilitating a better understanding of air quality in towns and cities; and, perhaps most importantly, offering the potential to facilitate actions that will help to improve air quality as effectively as possible.

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