Virtual Emissions Monitor

Calculating localised emissions in real-time

Deteriorating air quality is a growing concern for a large number of local authorities in the UK; with European fines just around the corner, leaving it until tomorrow is simply too late.

European directives on ambient air quality stipulate limits for the concentration levels of nitrogen dioxide (NO_2) within road networks in the UK to protect public health. The limits are 40 µg $^{m-3}$ (hourly average) and 200 µg $^{m-3}$ (not to be exceeded more than 18 times in a calendar year).

The UK's Department for Environment, Food and Rural Affairs (DEFRA) forecasts that by 2020 (the target date for compliance), the majority of air quality reporting zones in the UK will still be non-compliant for NO_2.

In the UK, the principal NO_2 concentration in urban environments is due to primary NO_2 emissions from road transport. For this reason, the appropriate management of transport has a big role to play in meeting the government's objectives on the environment and public health.

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The virtues of virtual monitoring

Dynniq's Virtual Emissions Monitor (VEM) platform is a new data driven approach to calculating localised emissions from road transport in real-time without the need for expensive on-street air quality monitors. Instantaneously it combines published data on vehicle emissions factors, real-time reported traffic speed and flow measurements, to calculate total NO_2 emitted – accurate to the lane in which the vehicle was travelling.

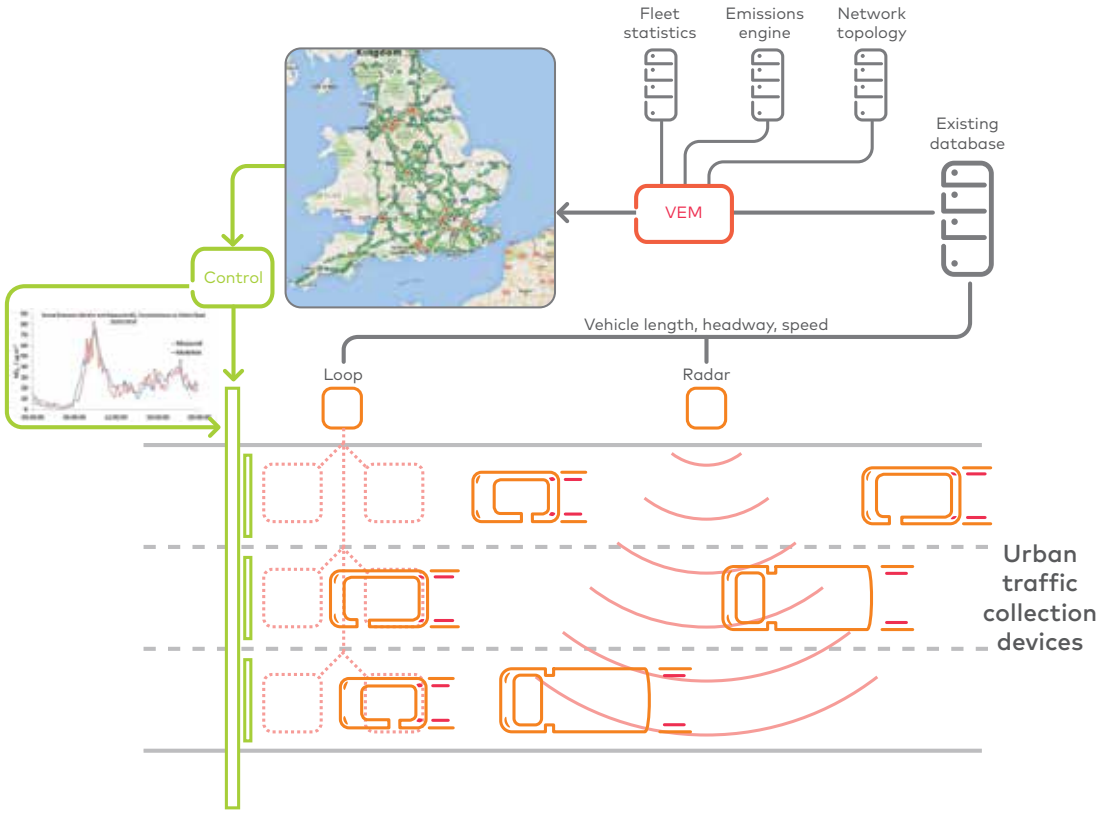
For many years air quality monitors have been the 'go-to' tool for determining air quality in and around our highway networks. Whether they are diffusion tubes or automatic analysers, their accuracy is dependent on regular calibration and can be compromised by wind direction. They are ideal for understanding long term trends across an area such as a town or city. However, they are limited to being able to report the concentration of a substance at the point of analysis.

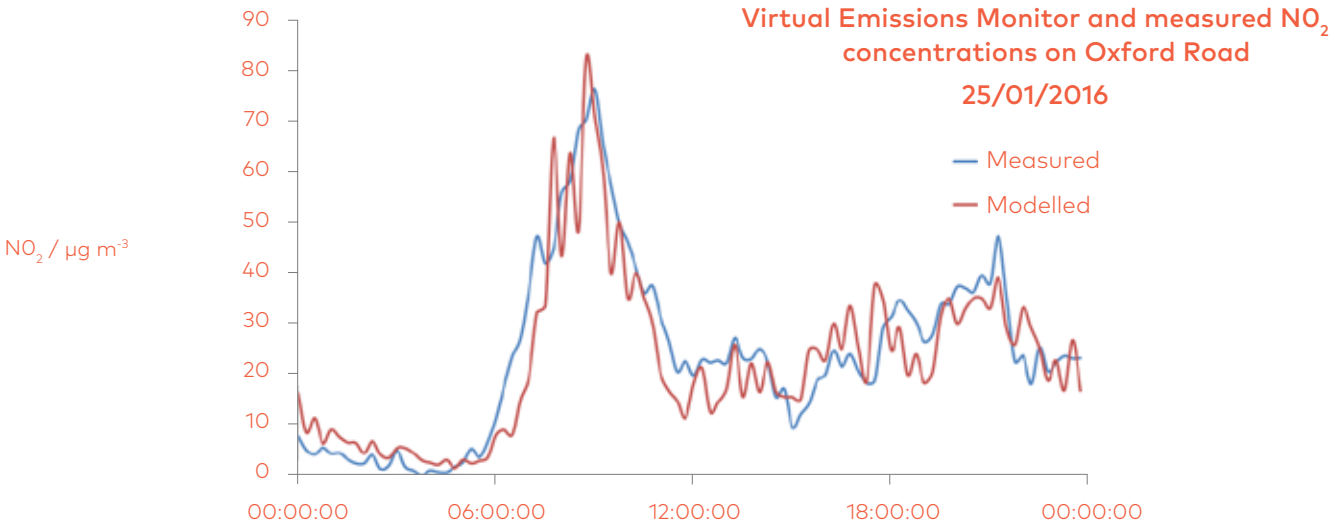
However, Dynniq's Virtual Emissions Monitor assigns emissions to many points: i.e. much more widely implemented infrastructure such as traffic detection loops.

By relating emissions to the 8,000 Highways England MIDAS detection points on the motorways, air quality (e.g. NO_2 and CO_2 concentrations) along corridors and at junctions can be analysed to see when (minute by minute), where (lane by lane detection sites), and with what traffic mix issues arise.

Many factors can impact air quality in a given area, the vast majority of which we have no control over, resulting in a very complex relationship. The intricacy of the relationship between variables makes associating cause to effect difficult and unreliable. By segregating the variables we have control over, from those we don't, the VEM allows authorities to quickly identify increased emissions, make informed operational decisions and measure the impact. This provides the confidence that a measured reduction in emissions will result in an improvement in air quality.

The VEM provides a platform to accurately determine the contribution of traffic on air quality allowing operators to intervene and policymakers' justification for change.





AQUARIA

AQUARIA is an additional module designed to perform localised air quality calculations. Building on the VEM platform, AQUARIA converts grams of NO_2 to atmospheric concentration. The dispersion algorithms account for wind direction and speed to properly model the life of NO_2 in the atmosphere.

The AQUARIA module and its accompanying dashboard have been designed to inform operators and assist in the creation of scenarios to improve air quality. Triggers and associated traffic plans can be saved, allowing operators to review the measured impact.

During a short study, the AQUARIA module was deployed along an arterial route in to Manchester, with pre-determined traffic control plans over a specified period. On average the AQUARIA module measured a 13% reduction in the concentration of NO_2 in the atmosphere compared to usual traffic conditions.

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