

Exposure to Particle Number, Particle Mass and VOCs across Transport Modes



The health impacts of air pollution on an individual depends on their personal exposure, of which their choice of transport mode(s) is one component. *Emissions Analytics* have carried out a scoping survey to assess individual exposure on comparable journeys by different transport modes (car, bus, train, cycle, foot). They used state-of-the-science instruments to measure exposure to fine particles and volatile organic compounds (VOCs), and a combination of GPS and journey logs to identify pollution sources.

What did we do?

Personal exposure was measured during a series of test journeys between London Paddington and Oxford city centre via diesel and electric trains, diesel coach, hybrid bus, diesel and battery-electric cars and, for some segments of the journey, bicycle and on foot. Measurements included real-time CO₂, fine particulate matter (PM) concentrations, and post analysis of VOCs (via 2D GC-MS) sampled onto cartridges.

Please note, only a small number of journeys (one per transport mode) could be considered in this scoping study. Further research is needed to assess the statistical significance of its findings.

Full Report

<https://transition-air.org.uk/di-molden-report>

Data

<https://transition-air.org.uk/di-molden-data>

Key Messages

- Personal exposure to air pollution varies significantly between transport modes; for example, in-vehicle exposure appears to be greater than when cycling or walking.
- Peaks in exposure are associated with localised sources, for example at transport interchanges, that stand out from an often much lower background level of exposure on the remainder of a door-to-door journey.

Next Steps

- For most vehicular modes, simple steps by transport operators to optimise vehicle ventilation could much reduce exposure.
- Standardised testing, measurement and reporting standards must be developed to drive, evidence, and communicate reductions in transport-related exposure.

What did we learn?

- Active travel (by bicycle and on foot), bus and car travel all showed lower PM_{2.5} levels on average, but these were affected by episodic urban spikes.
- For on-road vehicles, the vehicle's ventilation system was a more important determinant of in-cabin air quality than the vehicle's fuel type.
- Rail travel was associated with the highest short-duration spikes in PM exposure, for example in train stations and interchanges.
- Careful communication of approaches to reduce transport-related personal exposure is needed, including the multiple benefits of active travel and potential of public transport.