

Roadside Black Carbon Vehicle Emissions: Influence of High Emitters and Contribution to Roadside Ambient Air

Markus Knoll^{1*}, Åke Sjödin², Erika von Schneidemesser³, Alexander Bergmann¹

Graz University of Technology, Institute of Electrical Measurement and Sensor Systems, Inffeldgasse 33/I, 8010 Graz, Austria

Research Institute for Sustainability at GFZ, Berliner Str. 130, 14467 Potsdam, Germany

IVL Swedish Environmental Research Institute, Aschebergsgatan 44, 41133 Gothenburg, Sweden

*markus.knoll@tugraz.at

Key words: Black carbon, roadside measurements, vehicle emission screening, high emitter, roadside ambient air quality

Black carbon (BC) is a key metric for identifying combustion-based emissions, and the influence of BC on the climate is a widely discussed topic. Recognizing its importance, the EU has included BC as ambient air metric that must be measured by member states for the first time in Directive (EU) 2024/2881. The transport sector is one of the main contributors to BC, with vehicles accounting for a significant proportion of emissions in urban areas. Continuous measurements next to the road allow vehicle emissions and their influence on ambient air to be quantified.

Roadside point sampling (PS) is a technique that can measure vehicle emissions and their contribution to ambient air quality [1]. This is achieved through fast-response, continuous, second-by-second measurements, which enable both emission determination and the provision of high-resolution data on the influence of emissions on ambient air quality. This study analyses data from various roadside PS campaigns conducted in European cities as part of projects such as CARES and Net4Cities. An Aethalometer and a custom-developed black carbon tracker are used as measuring devices.

At the roadside locations PS measurements show that only 10 % of vehicles are responsible for nearly 80 % of emissions from the total monitored fleet in three European cities (see Fig. 1). The evaluations provide information trends of BC emissions for different vehicle parameters such as Euro standard and age. During winter measurements, ambient air concentrations of more than 25 $\mu\text{g}/\text{m}^3$ were observed at the roadside. The contribution of vehicle emissions to roadside ambient air pollution is investigated at the measuring locations.

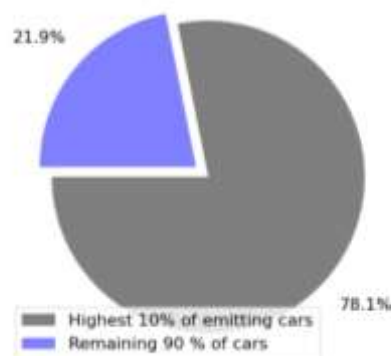


Figure 1. Contribution of the highest 10 % and the remaining 90 % of vehicles to the total BC emissions of the monitored fleet.

References

- [1] N.J. Farren, M. Knoll *et al.* 2025. Highly disaggregated particulate and gaseous vehicle emission factors and ambient concentration apportionment using a plume regression technique. Environ.Sci.Technol.