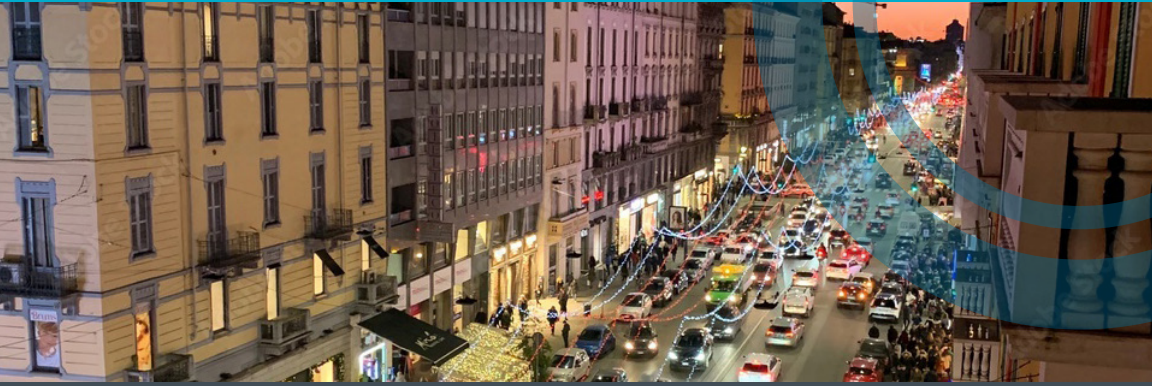


City Air Remote Emission Sensing



Making remote sensing an effective
tool for monitoring pollutant emissions
and improving city air quality



The use of remote sensing technology to measure vehicle pollutant emissions is becoming more widespread across Europe. But more can be done to reduce the hurdles for practical applications and to make remote emission sensing data collected available and relevant to researchers, regulators, policymakers, and citizens. That is the purpose of the CARES - City Air Remote Emission Sensing - project.

The CARES project, which includes partners from European and Chinese research institutions, has contributed to efforts to determine the actual emissions rate of road vehicles quickly and comprehensively. The outcomes from the project will help to ensure that vehicles comply with emission regulations over their whole lifetime and under all driving and ambient conditions. The data collected by CARES can further be used to manage air quality and to help to inform citizens and policymakers.



CARES ACHIEVEMENTS

- Improved accuracy of measurements of particulate matter (e.g., black carbon and particle number)
- Improved detection of high-emitting vehicles, including those that show evidence of emission control system tampering
- Evaluated three types of remote emission sensing measurement techniques to show how the methods can work in concert to maximize the data captured
- Lowered costs of remote emission sensing measurements and data summary results analysis
- Established a novel and proper remote emission sensing data infrastructure
- Supported local air quality plans, including the design and implementation of Low Emission Zones



CARES MEASUREMENT CAMPAIGNS

Milan

CARES partners completed a remote sensing campaign at three locations in Milan, Italy, to monitor the performance of the city's Low Emission Zone (LEZ). The campaign used remote sensing technology to collect real-world vehicular emissions data and evaluate the direct impact on local air quality. The campaign was run in partnership with the Municipality of Milan and its Mobility, Environment and Territory Agency. The data analysis will be used by researchers and policymakers to evaluate the effectiveness of the LEZ in reducing harmful pollution from vehicles.

During the measurement campaign, researchers also tested newly developed remote sensing technology. CARES partners evaluated the precision and the accuracy of these sensors by collocating them with a commercial remote sensing system, vehicle onboard emission measurements (PEMS) and an air quality monitoring station. The technology was used to measure vehicles of multiple fuel types, including gasoline, diesel, compressed natural gas, and liquified petroleum gas.



Krakow

CARES researchers undertook a remote emission sensing campaign in Krakow, Poland, to measure the impact that specific vehicle groups have on the air quality in the city. The campaign collected pollutant emissions data from more than 100,000 vehicles, along with data points such as vehicle age and Euro standard. The campaign was conducted with support from the Krakow Public Transport Authority.

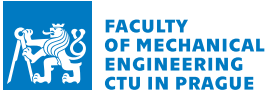
The results of the remote emission sensing campaign carried out by the CARES project, combined with previously collected emissions data, provided important information that was used in the design of a new Low Emission Zone (LEZ) in the city. This included information regarding the shares of cars that would be impacted by the LEZ and the pollutant reductions that could be achieved through the restrictions. As of July 2026, all cars driving in Krakow will have to be certified to at least Euro 3 for petrol and Euro 5 for diesel. This will result in significant air quality improvements.

Prague

The CARES project, with support from the Traffic Police Service Department of the Central Bohemian Region Police Directorate, completed a demonstration campaign in Prague, Czech Republic, to provide the city a valuable overview of the vehicle fleet and related emissions. The researchers used three types of contactless technologies—cross-road remote sensing, point sampling, and plume chasing—with the main objective of identifying high-emitting vehicles. Early results suggest that over 12% of the measured trucks had high NO_x emissions of several times their emission limits, most likely related to tampering or malfunctions, proven by roadside inspections of the vehicles.

Although high-emitting vehicles represent a small fraction of the fleet, they disproportionately contribute to total emissions. The CARES project helped to develop the tools needed for their identification on the road, which is paramount in the fight for better air quality.





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