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A tunnel study to validate motor vehicle emission prediction software in Australia

R. Smit [a, b, *], P. Kingston [a], D.H. Wainwright [a], R. Tooker [a]

[a] Department of Science, Information Technology and Innovation (DSITI), GPO Box 5078, Brisbane, Q4001, Australia
[b] University of Queensland, School of Civil Engineering, Brisbane, Australia

HIGHLIGHTS

- Tunnel studies are useful to partially validate vehicle emissions software.
- Air flow in tunnels can compensate the impacts of road gradients on vehicle emissions.
- Local fleet mix is an essential factor in validation studies.

GRAPHICAL ABSTRACT

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ABSTRACT

A tunnel emissions study was conducted to (partially) validate the Australian vehicle emissions software COPERT Australia and PIARC emission factors. The in-tunnel fleet mix differs substantially from the average on-road fleet, leading to lower emissions by a factor of about 2. Simulation with the PΔP software found that in-tunnel air-flow compensates to a large extent for road gradient impacts on NO_x emissions. PIARC emission factors are conservative and exhibit the largest prediction errors, except for one very good agreement for LDV NO_x. COPERT Australia is generally accurate at fleet level for CO, NO_x, $PM_{2.5}$ and PM_{10}, when compared with other international studies, and consistently underestimates emissions by 7% −37%, depending on the pollutant. Possible contributing factors are under-representation of high/excessive emitting vehicles, inaccurate mileage correction factors, and lack of empirical emissions data for Australian diesel cars. The study results demonstrate a large uncertainty in speciated VOC and PAH emission factors.

1. Introduction

Motor vehicles are a major source of air pollution and greenhouse gas (GHG) emissions in urban areas around the world. The close proximity of motor vehicles to the general population makes this a particularly relevant source from an exposure and health perspective. This is illustrated by Caiazzo et al. (2013) who estimated that total combustion emissions (particulates, ozone) in the U.S. account for about 210,000 premature deaths per year, with motor vehicles being the largest contributor, contributing to around 58,000 premature deaths per year, despite the fact that road transport only contributes about 7% to total $PM_{2.5}$ emissions.

Comprehensive measurement of vehicle emissions in urban networks is cost prohibitive due to the large number of vehicles

* Corresponding author. Department of Science, Information Technology and Innovation (DSITI), GPO Box 5078, Brisbane, Q4001, Australia.
E-mail addresses: robin.smit@qld.gov.au, mr.robin.smit@gmail.com (R. Smit).

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