Integrating Type Approval and Mileage Data to Estimate NOx Emissions : A Case Study of Newly Registered Motor Cars in Sri Lanka

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Abstract

Nitrogen oxides (NO_x) are major hazardous air pollutants originating from internal combustion engine vehicles, which significantly induces the decline of urban air quality as well as respiratory diseases and environmental pollution. In a country like Sri Lanka, with recent growth in motorization, the accurate prediction of NO_x emissions due to road transport is necessary to guide air quality management and climate action programs. However, the lack of a localized and integrated emission baseline and especially for separated vehicle classes, has constrained the development of rational policies. This gap addresses in this study by presenting a data-driven approach to estimate NO_x emissions only for registered new motor cars in Sri Lanka, which combines Type Approval emission factors for vehicles and on-road vehicle mileage data. The core of this approach lies in combining two key data sources: (1) Vehicle Emission Test (VET) data obtained from the Department of Motor Traffic (DMT), which includes odometer readings for individual vehicles, and (2) NO_x type approval emission factors sourced from international repositories such as the Vehicle Certification Agency (VCA) and the Car Emissions Testing Database. VET data from 2016 to 2023 were processed to estimate the average annual mileage of newly registered motor cars, while the type approval data provided standardized NO_x emission factors based on vehicle manufacturer, model, fuel type, and production year. A matching algorithm was developed to associate vehicles in the VET database with the corresponding emission factors. The estimated NO_x emissions for individual vehicles were then extrapolated to represent the entire population of newly registered motor cars using a weighted average method based on manufacturer distribution and registration trends. The results offer a credible baseline for annual NO_x emissions from newly registered motor cars, highlighting the variation in emissions across fuel types, model years, and manufacturers. This methodology is particularly valuable for contexts like Sri Lanka, where advanced emission testing infrastructure such as chassis dynamometers is unavailable. By utilizing existing administrative data and internationally recognized emission factors, this framework provides a cost-effective, scalable alternative to direct measurement methods. Beyond its specific focus, the study demonstrates a transferable approach that can be extended to other vehicle categories or developing countries facing similar data limitations. It contributes to the advancement of national emission inventories and supports evidence-based policy development aligned with the findings are expected to guide regulators, environmental agencies, and transport planners.

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