

Real-world motor vehicle exhaust emissions in Delhi and Gurugram using remote sensing

BACKGROUND

The Indian cities of Delhi and Gurugram have faced severe air quality issues for decades, with the road transport sector being a major contributor to this pollution. Despite numerous measures aimed at reducing on-road transport emissions, the ever-increasing number of vehicles continues to offset the gains achieved from improved efficiency and fuel standards and traffic mitigation measures.

For policymakers in the capital region, remote sensing technology, a non-intrusive method of collecting real-world emissions data on a mass scale, can provide new insight into the makeup of the city's fleet and identify high-emitting vehicles.

The TRUE Initiative, with analysis led by the International Council on Clean Transportation (ICCT) and in collaboration with the Delhi and Gurugram authorities, conducted a testing campaign that aimed to:

- Develop a new understanding of the real-world tailpipe emissions of the Delhi and Gurugram vehicle fleets.
- Demonstrate remote sensing technology and provide recommendations to support its broader application in India.
- Provide an independent evaluation of the tailpipe emissions from Indian vehicles to support evidence-based policymaking and provide guidance to decision-makers, connecting findings to policies and actions to mitigate vehicle pollution.

CAMPAIGN STATS:

Testing schedule: December 2022 - April 2023

Sampling locations: 20 total sites around Delhi and Gurugram

Samples: 111,712 tailpipe emission measurements

Measured vehicle types: Two-wheelers, three-wheelers, private cars, taxis, light goods vehicles, and buses

Measured fuel types: Petrol (45%), CNG (32%), diesel (23%)

Pollutants analyzed:

- Carbon monoxide (CO)
- Hydrocarbons (HC)
- Nitrogen oxides (NO_x)
- UV smoke (a proxy for particulate matter)

Collaborating agencies:

Transport Department of Delhi, Office of the Gurugram Deputy Commissioner, Delhi Police Department, Gurugram Police Department, National Highways Authority of India

The study provided a unique opportunity to evaluate real-world emissions within the broader policy landscape that includes India's recent leapfrogging from Bharat Stage (BS) IV to BS VI tailpipe emission standards and the long-standing promotion of compressed natural gas (CNG) fueled vehicles as a clean transportation alternative in the capital region.

STRATEGIES TO REDUCE EMISSIONS

Insights into Delhi's real-world vehicle emissions uncovered important patterns that can guide the development of targeted and effective policies to combat traffic-related pollution. Possible strategies are highlighted below.

#1. Setting and transitioning to more stringent emission standards and introducing on-board emissions monitoring could further help lower tailpipe emissions from road transport.

- India's strategy of leapfrogging from BS IV to BS VI emission standards led to significant reductions in tailpipe emissions across all pollutants measured and vehicle types captured. For example, real-world NO_x emissions from private cars showed a reduction of 81% and emissions from buses showed a reduction of nearly 95% (Figure 1).
- Despite this improvement, real-world emissions from BS VI vehicles in many cases remain higher than type-approval limits, particularly for NO_x. Across the range of BS VI vehicles measured fueled by CNG, emissions were 1.5 - 14 times greater than the limits (Figure 2).¹

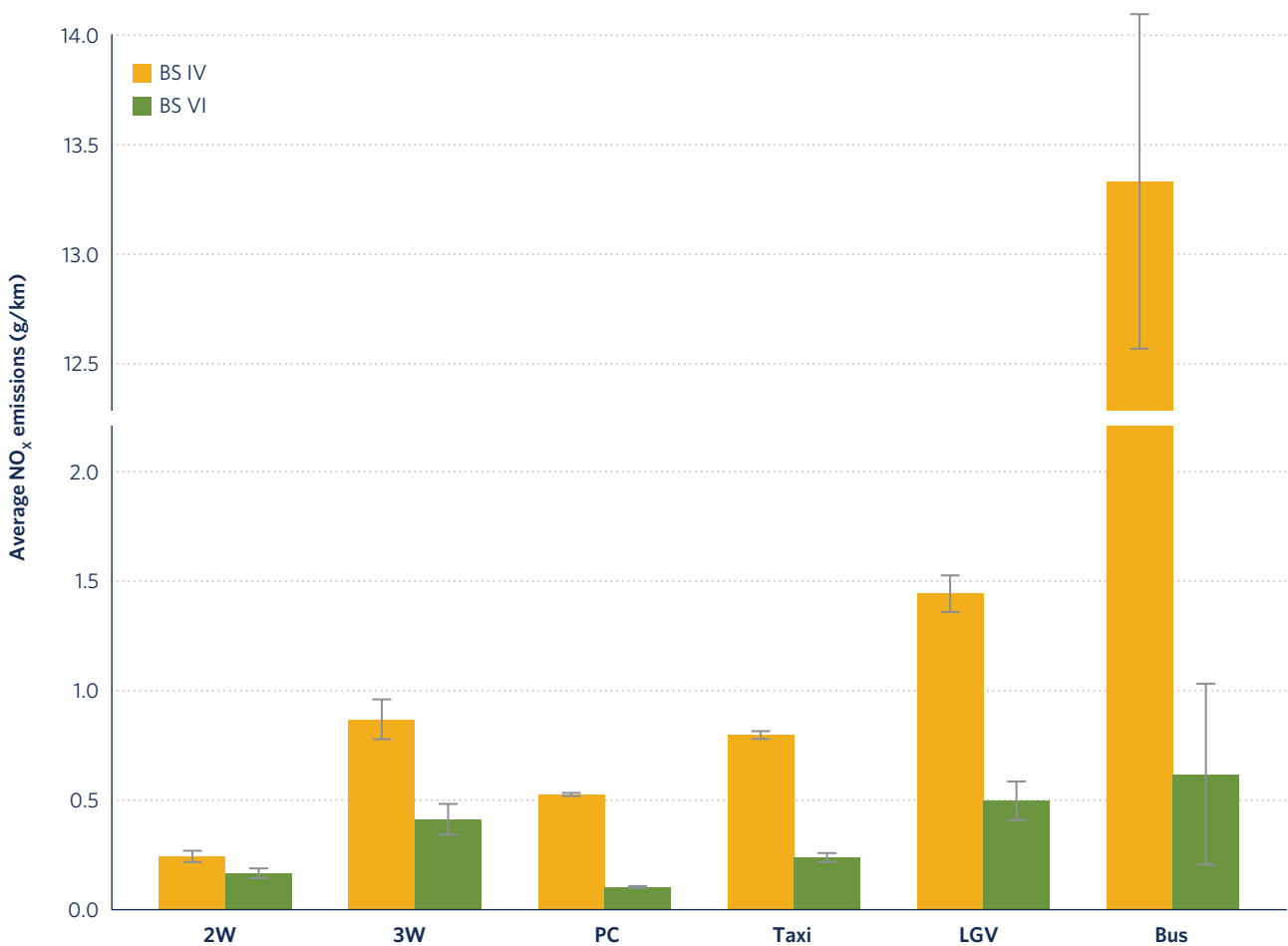


Figure 1. Average distance-specific NO_x emissions measured across BS IV and BS VI vehicle fleets

¹ The comparison with type-approval limits is for representative purposes. There is no on-road emissions compliance requirement to these limits for the measured fleet.

Policy Implications:

- A swift adoption of new BS VI phases with regulatory provisions aligned with the latest Euro 6/VI-e/E standard would reduce real-world emissions by lowering the on-road conformity factor and including extended testing conditions. The design of future phases would benefit from continued monitoring of vehicles introduced in April 2023 and later, which are subject to BS VI Phase 2 on-road type-approval test requirements.
- Designing and implementing stringent BS VII standards could deliver even lower real-world emissions by tightening type-approval limits and introducing on-board emissions monitoring.

#2 Accelerating the transition to zero-emission vehicles could significantly reduce real-world emissions from high-use and high-emitting commercial fleets in the Delhi National Capital Region.

- Average emissions from commercial vehicles are much higher than from private vehicles, with NO_x emissions from BS VI taxi and light goods vehicle fleets being 2.4 and 5.0 times more, respectively, than their private car counterparts (Figure 1).
- Certain BS VI vehicle fleets fueled by CNG also showed high NO_x emissions (Figure 2), and this aligns with previous TRUE and ICCT analyses that challenge the conventional view that CNG is a “clean” alternative fuel.

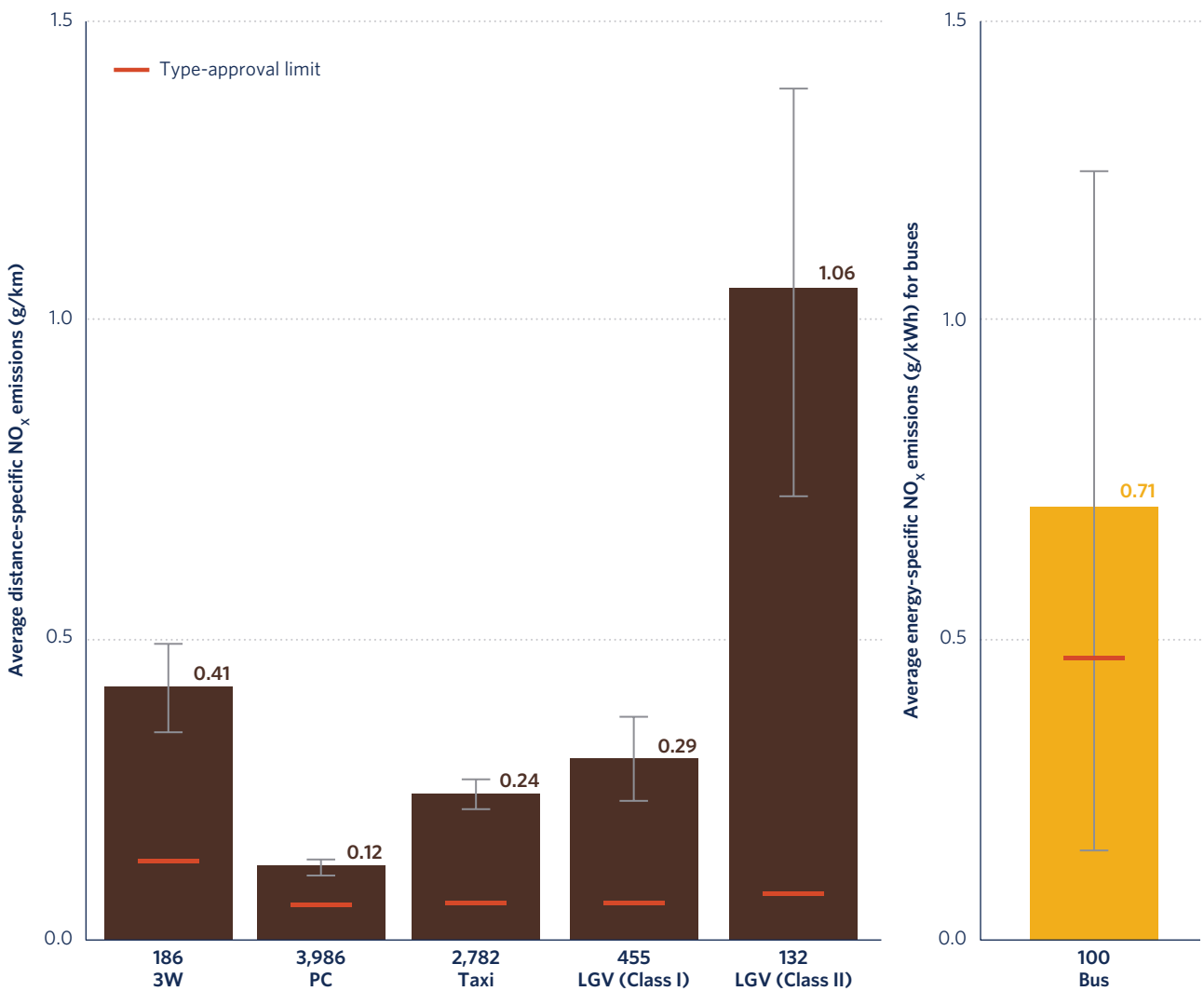


Figure 2. Average real-world NO_x emissions from BS VI CNG vehicles compared with type-approval (laboratory) limits

Policy Implications:

- Agencies like the Commission for Air Quality Management in NCR could implement policies such as a zero-emission vehicle (ZEV) sales mandate and a phaseout program for these highly polluting segments to accelerate the transition to cleaner vehicles.
- Considering CNG vehicles as a viable alternative or transitional step toward ZEVs may not be the right approach, and restricting the retrofitting of vehicles to CNG could instead encourage the retrofitting to electric vehicles within the region, further reducing emissions.

#3 Finalizing and publishing the proposed AIS 170 will be crucial to multiple agencies in deploying remote sensing technology within their jurisdictions.

- The Automotive Industry Standard (AIS) 170 proposes a monitoring phase to capture vehicle emissions data using remote sensing, which could be used to define accurate polluter thresholds.
- AIS 170 will set the required technical parameters for remote sensing devices. However, current gaps in the proposal, such as making measurement of CO₂ absorption and pollutants like NO_x optional, should be addressed.

In July 2024, the Supreme Court of India directed the Ministry of Road Transport and Highways to implement remote sensing technology for monitoring vehicular emissions. The directive mentioned the technology could be piloted in the National Capital Region first.

Policy Implications:

- A task force could be created that includes providers of remote sensing devices to help define the minimum technical specifications and ensure successful deployment.
- Publishing this standard will provide a legal standing for agencies to take action against high-emitting vehicles and potentially remove them from the roads.

Related Report:

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Accessible here: <https://www.trueinitiative.org/publications/reports/real-world-motor-vehicle-exhaust-emissions-in-Delhi-and-Gurugram-using-remote-sensing>



TO FIND OUT MORE

For details on the TRUE remote sensing database,
contact **Yoann Bernard, y.bernard@theicct.org**.
For more information on TRUE, visit www.trueinitiative.org.