

Public health benefits of battery electric buses in Oxford City



Health effects of air and noise pollution

Air pollution is the largest environmental risk to health in the UK contributing to an estimated 30,000 early deaths each year.¹ Exposure increases the risk of asthma, stroke, heart disease and lung cancer and is linked to adverse birth outcomes, diabetes, high blood pressure and dementia.² In Oxford city, air pollution has fallen in recent years but while legal limits are widely met across the city, levels still exceed World Health Organisation global air quality guidelines.^{3,4}

Noise pollution has a direct impact on sleep and increased risk of heart disease, stroke, diabetes, depression and anxiety.⁵ Previous research in Oxford shows traffic interventions such as Low Traffic Neighbourhoods can alter the local soundscape.⁶

What is the ZEBRA Scheme?

Oxfordshire County Council secured £32.8m from the Department for Transport Zero Emission Bus Regional Area (ZEBRA) scheme in 2022, enabling 159 battery-electric to be introduced across 34 Oxford SmartZone routes by the end of 2024.⁷

The purpose of the ZEBRA scheme is to:

Key points

- Air and noise pollution are a public health concern in Oxford City.
- Introduction of battery electric buses has reduced nitrogen dioxide levels and traffic noise in Oxford City centre.
- Electrifying bus fleets can improve people's city experience, creating a cleaner, more pleasant streetscape.
- Bus passengers and drivers noted better ride quality, improved accessibility, and a sense of civic pride.

- Decarbonise bus transport
- Improve air quality
- Improve transport user experience
- Support sustainable economic growth

What research was carried out?

We investigated air and noise pollution changes before and after the introduction of battery electric buses in Oxford. We also explored people's experiences of introducing and using the new fleet, including key stakeholders, bus passengers, residents and commuters.

What did we learn?

Air Pollution

Electric bus rollout was linked to **reduced Nitrogen Dioxide (NO₂) levels** to 2024, with reductions of up to 24% in St Aldates and High Street - areas of high bus traffic (**Figure 1**).⁸

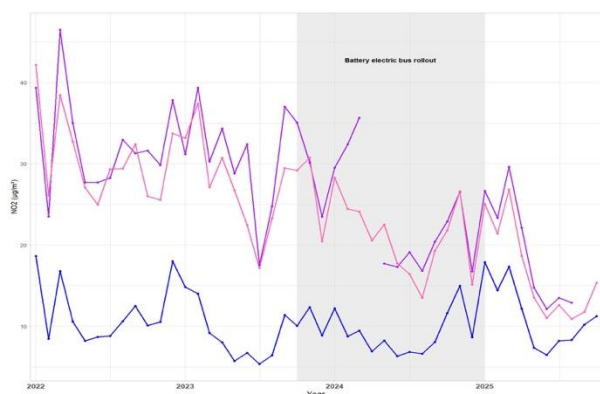


Figure 1 | Monthly average Nitrogen Dioxide (NO₂) concentration by reference monitoring station // Purple: Oxford Centre (St Aldates) – Roadside. Pink: Oxford High Street* – Roadside. Blue: Oxford St Ebbes – Urban Background. *Site managed by Oxford City Council. All data available at <https://www.oxonair.uk/data/data-selector>

Residents in Oxford told us that air quality improvements were noticeable by less exhaust smoke and diesel fumes:

” They tend to just glide along the road rather than belching out lots of diesel smoke. (Resident/Commuter)

Noise Pollution

The electric buses reduced roadside traffic noise in central urban areas by 5.1 decibels. This is comparable to the reduction in noise you would experience by **moving three times further away from a road**.

On-board noise levels were lower on electric compared to diesel buses when in use.

People told us that **reduced vehicle noise had a positive impact in the city centre**. Residents on bus routes reported fewer disturbances, including disruptions to sleep.

The quieter buses led to some safety concerns for pedestrians and cyclists due, particularly those who have hearing or sight impairment

” They stop nearly opposite my house, then you’d know straight away they’re going past. But now we don’t notice them half as much. (Resident/Commuter)

Health and Economic Benefits

Sustained reductions in harmful roadside NO₂ concentrations will **deliver public health and economic benefits**.

Health and economic gains will be **greatest among those living close to major bus routes**.

City Experience

Electrifying bus fleets can **improve people’s city experience**, creating a **cleaner, more pleasant streetscape**.

Bus passengers noted **better ride quality, improved accessibility**, and a sense of **civic pride** – feeling that their city cares for them

People also told us that despite electric buses making bus travel more pleasant, **they had not changed the way people travel**.

Wider factors such as ticket cost, how reliable the service is and whether routes run to places they need to go to play an important role when deciding which transport mode to use.

Policy Implications

Introduction of electric **buses delivers environmental benefits and improved passenger experience**. To maximise scheme benefits local transport authorities should:

- Prioritise routes serving communities most affected by air and noise pollution.
- Consider complementary measures which make bus travel more affordable, reliable and convenient.

Authors and acknowledgements

The evaluation was undertaken by Dr Suzanne Bartington, Dr Kate Garrott, Dr James Hodgson, Dr Rasiah Thayakaran, Dr Jessica Tanner, Dr Haliyya Bakare, Dr Lucy Oakey, Dr João Martins, Luke Tappin, Dr James Hall, Professor Laura Jones, Professor Peymane Adab and Professor Miranda Pallan from University of Birmingham, Dr Felix Leach from University of Oxford and Kay Stevenson from Keele University on behalf of PHIRST PHRESH.

We are grateful for the support of the study management team, which included Ruth Anderson, Melissa Goodacre, Louisa Chenciner, Hannah Battye, Katie Parnell, Foyeke Tolani from Oxfordshire County Council, Pedro Abreu from Oxford City Council, Rosie Rowe from Ealing Council and Peter Richardson and Karen Keates as public collaborators. We are also grateful to Dr Paul Mullins and Jason Taylor from Oxfordshire County Council for supporting qualitative data collection.

The Public Health Intervention Responsive Studies Team (PHIRST) PHRESH conceived the evaluation in collaboration with the local authority partner, all authors contributed to this process.

Funding and governance

This study is funded by the National Institute for Health Research (NIHR) Public Health Intervention Responsive Studies Team (PHIRST/NIHR166658). The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care. Ethical approval was provided by University of Birmingham Ethics Committee [ERN-3088].

Contact

Email: phirstphresh@contacts.bham.ac.uk Department of Applied Health Sciences
University of Birmingham, B15 2TT

Citation

Garrott, K., Hodgson, J., Leach, F., Bartington, S., on behalf of the project team. 2025. Public health benefits of battery electric buses in Oxford City. ZEBRA Evaluation Briefing Note No.2.

Metadata

<http://epapers.bham.ac.uk//id/eprint/4447/10.25500/epapers.bham.00004447>

Deed - Attribution 4.0 International - Creative Commons

References

1. Royal College of Physicians. (2025). A breath of fresh air: responding to the health challenges of modern air pollution. Available at: <https://www.rcp.ac.uk/policy-and-campaigns/policy-documents/a-breath-of-fresh-air-responding-to-the-health-challenges-of-modern-air-pollution/> (Accessed: 10 November 2025)
2. Health matters: air pollution. <https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution> (Accessed: 10 November 2025)
3. Oxford City Council Annual Air Quality Status Report. (2024). <https://www.oxford.gov.uk/downloads/download/665/download-the-air-quality-annual-status-report-2024> (Accessed 10 November 2025)
4. Singh et al. (2022). Impacts of emergency health protection measures upon air quality, traffic and public health: evidence from Oxford, UK. *Env Pollution*, 293, 118584, <https://doi.org/10.1016/j.envpol.2021.118584>
5. Jephcote et al. (2023) Spatial assessment of the attributable burden of disease due to transportation noise in England. *Env International*, 178, 107966, <https://doi.org/10.1016/j.envint.2023.107966>
6. Leach et al. (2024) The impact of a low traffic neighbourhood intervention on urban noise measured with low-cost sensors in Oxford UK. *Transportation Research Part D: Transport and Environment*, 134, 104357, <https://doi.org/10.1016/j.trd.2024.104357>
7. Oxfordshire CC (2022) Oxfordshire County Council Zero Emission Regional Area (ZEBRA) - Business Case Executive Summary, https://www.oxfordshire.gov.uk/sites/default/files/file/roads-and-transport-policies-andplans/OCC_ZEBRA_Business%20Case_Executive_Summary_REDACTED.pdf (Accessed 14 November 2025)
8. Interim findings based on Oxford City Council 2024 Air Quality Annual Status Report. Pending research analysis to 31 October 2025.

Find the evaluation of the
ZEBRA scheme online:

