Study on non-exhaust emissions in road transport

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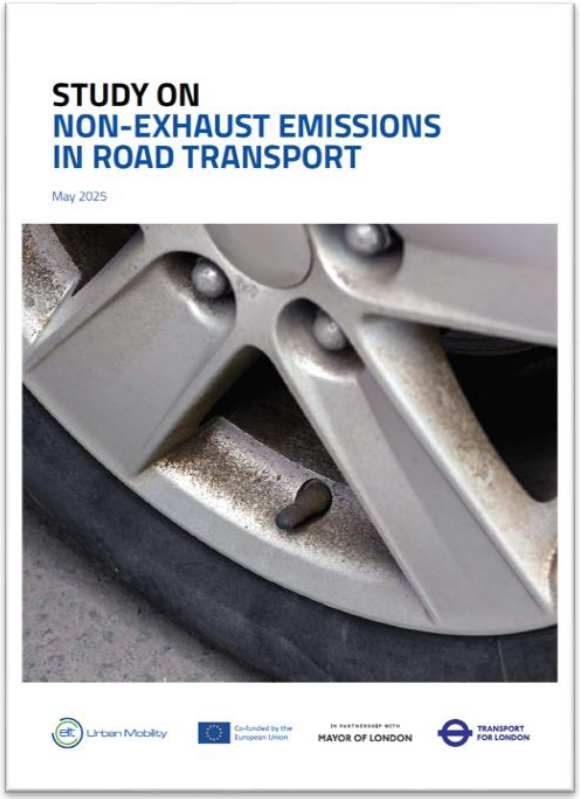
EVERY JOURNEY MATTERS

Background to the study

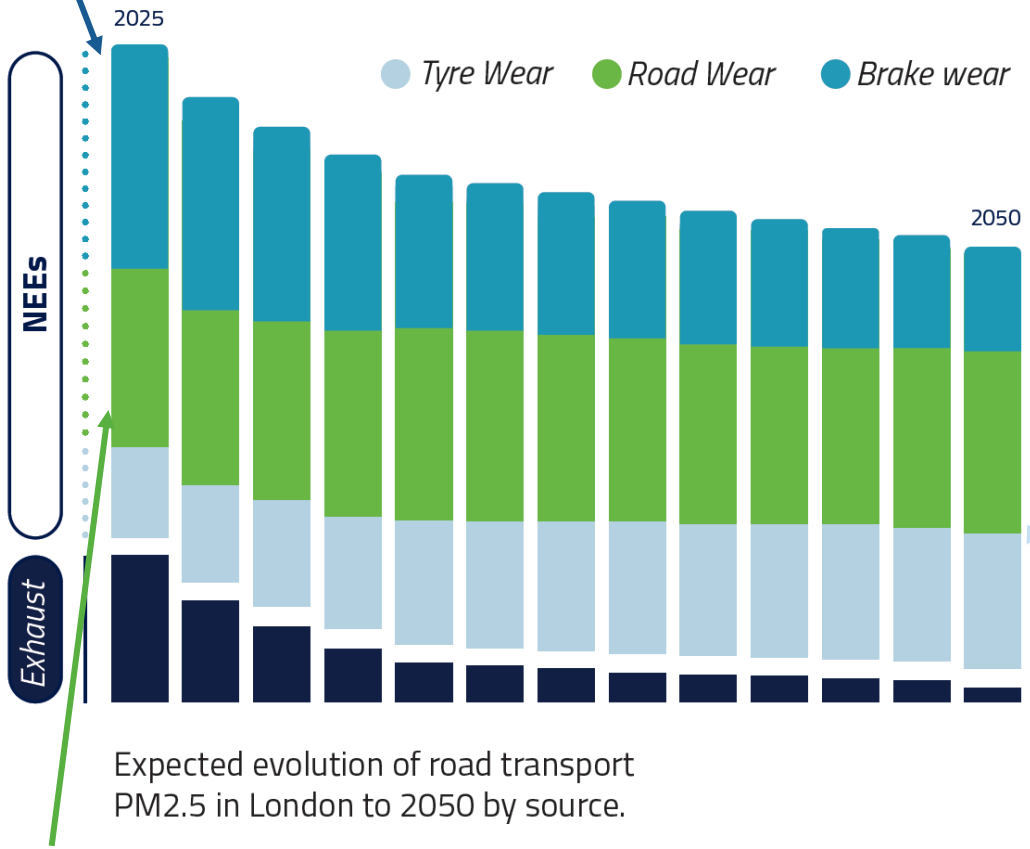
- Air pollution is a **major global challenge** - particulate matter (PM) poses serious health and environmental risks.
- Many urban areas **exceed** World Health Organization's air quality guideline limits.
- In the large European cities we considered, non-exhaust emissions (NEEs) is the **predominant source of PM from road transport**.
- Transport for London, the Greater London Authority and EIT Urban Mobility commissioned e:misia to carry out a study looking at:
  - **Sources** of NEEs
  - **Key factors** affecting NEEs
  - Chemical **composition** of NEEs
  - Policy and technical **interventions** to tackle NEEs
  - **Recommendations** for policy makers
- London used as a case study city. Modelling results available in an **interactive Power BI tool**



Sources of non-exhaust emissions (NEEs) from road transport

By 2030, over 90% of PM emissions from London's road transport will come from NEEs

Brake wear: largest source of NEEs in urban areas, exacerbated by frequent acceleration and deceleration. >40% of particles become airborne. Impact will reduce over time with fleet electrification.



Expected evolution of road transport PM2.5 in London to 2050 by source.

Tyre wear – 2nd largest source, only 2–5% becomes airborne, remainder in road dust, water systems, and soil. Heavier vehicles, including EVs generate more tyre wear.

Road wear - harder to quantify as they mix with tyre wear particles and resuspended road dust. Most concerning in cities with poor road maintenance. Well-maintained road infrastructure can play a key role in mitigating these emissions.

Key factors affecting NEEs

Brake wear emissions:

- Driving conditions and style
- Type of braking system
- Brake pad and disc materials
- Vehicle weight
- Regenerative braking

Tyre wear emissions:

- Driving conditions and style
- Tyre type
- Tyre material
- Vehicle weight
- Ambient temperature

Road wear emissions:

- Hard to separate from tyre wear and road dust resuspension
- Road surface condition
- Road surface type

Environmental and public health impacts

Health Impacts:

- Known negative health impacts of long-term exposure to $PM_{2.5}$
- Tyre wear particles linked to respiratory issues, including bronchitis, pneumonia, chronic obstructive pulmonary disease (COPD)
- $PM_{2.5}$ exposure from brakes and tyres negatively impacts reproductive health are associated with premature death

Environmental Impacts:

- Changes in soil chemistry and acidification
- Harms plants, crops and water
- Disrupts ecosystems, impacting overall environmental health
- Black carbon poses a significant global environmental challenge

Toxicity trade-offs:

- Reducing total PM emissions is important
- Toxicity of the particles also an important consideration and emerging picture

Policy and technical interventions to tackle NEEs

Reducing NEEs at source by changing travel behaviour

- Expansion of Low Emission Zone schemes
- Mode shift
- Traffic flow & volume control
- Vehicle speed
- Fleet electrification
- Driving style and behaviour

Reducing NEEs at source through technical intervention

- Wear resistant braking components & materials
- Wear resistant tyres
- Wear resistant road materials
- Speed/acceleration limiters

Mitigating NEEs once emitted

- Particle collection/filtration devices for brake/tyre wear
- Street cleaning
- Road run-off treatment

Regulatory interventions to tackle NEEs – Euro 7

Introduces brake and tyre wear limits for PM for the first time.

The UK Government have currently not adopted the new standards

Brake Wear

- PM10 brake wear limits and testing method have been defined but, so far, for light duty vehicles only.
- Limits based on particle mass not number to start with and expected to become more stringent over time.
- Different limits based on vehicle power train – most stringent for electric vehicles.
- Will take effect on new cars & vans from Nov 2026 and for all new cars and vans from Nov 2027 on. Heavy duty vehicles follow 2 years later

Tyre Wear

- PM limits and testing method for tyres yet to be defined.
- Will apply to tyres of passenger cars gradually from July 2028, then light commercial vehicles from 2030 and heavy-duty vehicles from 2032.
- Expected to reduce PM (10-30% modelled) but will do so gradually, until all after-market tyres meet abrasion standards from 2036

Fleet electrification

Impact on emissions:

- Regenerative braking in electric vehicles (EVs) can significantly reduce brake wear, lowering emissions by over 80%.
- Heavier vehicles, including EVs (on average 20% heavier than internal combustion equivalent), generate higher tyre and road wear
- In urban areas, overall positive impact on non-exhaust emissions due to benefits of regenerative braking.
- Fleet electrification also has wider air quality and carbon benefits in the removal of exhaust emissions

Recommendations for policy makers

City

- Recognise NEEs as major source of pollution and prioritise in all urban air quality policies.
- Traffic management and speed reduction.
- Public awareness raising.
- Disincentivise heavier combustion engine vehicles.
- Faster fleet electrification.
- Good road maintenance.

National

- Promote and support wear resistant brake and tyre materials.
- National research on effectiveness and impact of brake/tyre materials (including negative effects).
- National databases for tracking NEEs and interventions.
- Procurement policies that favour low wear vehicles and road maintenance.

International

- Work together to develop standard monitoring and measurement protocols.
- Develop new regulations to mitigate trade-off between reduced wear and toxicity.
- Robust evaluation of effectiveness of NEE interventions.
- Global funding to reduce knowledge gaps and support innovation.

Contacts detail and QR code for the full report

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