Congestion Pricing System And Social Segregation

Emergence of a New System and Urban Dynamics in London

Yixuan Liu, Yining Xu, Qiwei Qu, Jiayu Zhang

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Introduction & Recap

From Transportation to Demographic:

A. Emergence of a new system - Transit-driven Social Segregation

B. Congestion Pricing System’s particular impact

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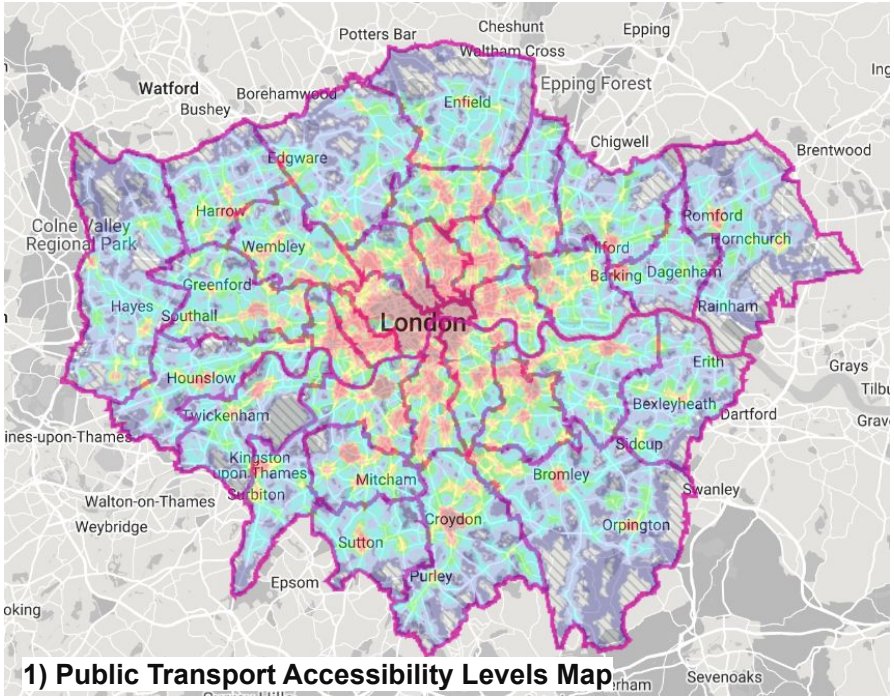
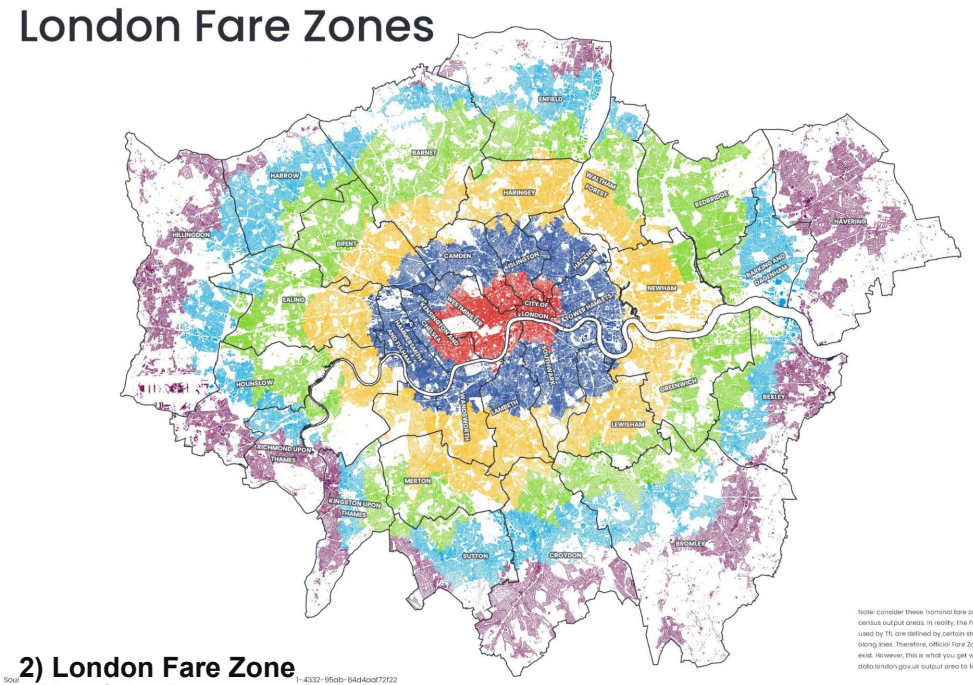
Recap of Project 1: Transportation System



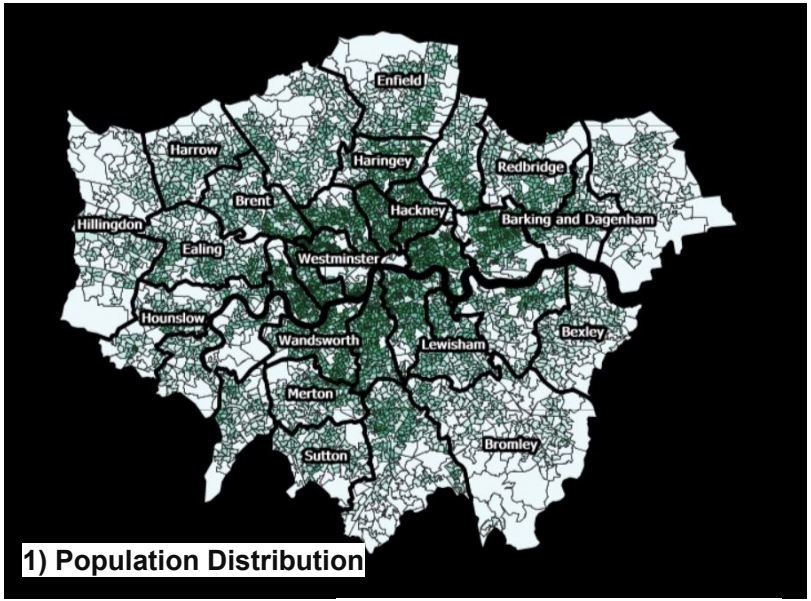
1) Public Transport Accessibility Levels Map



2) London Fare Zone

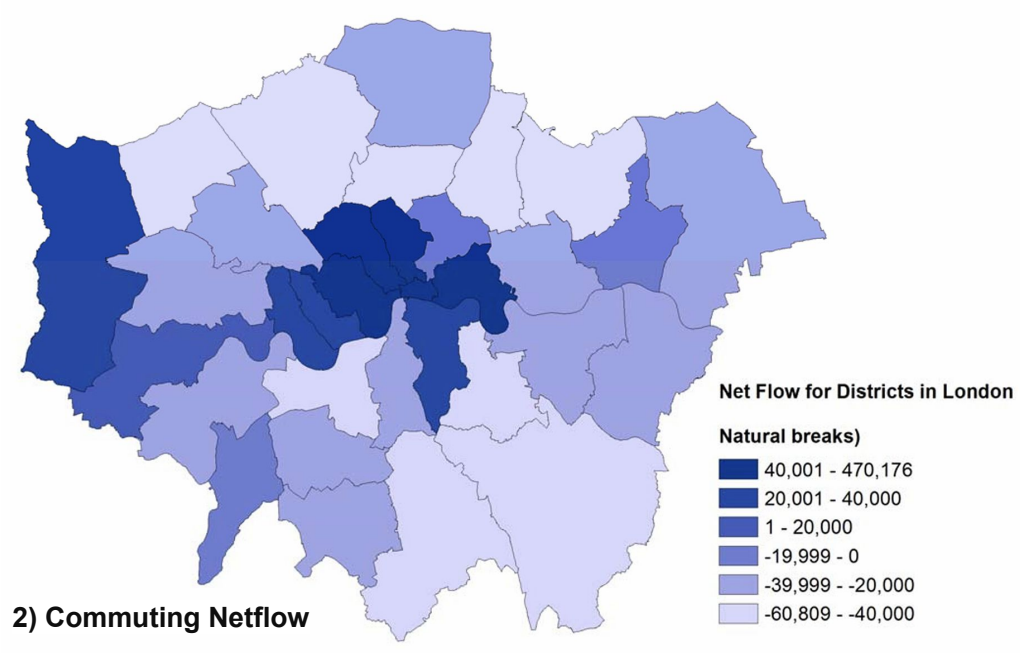
- Key findings (massive scale, smart technology and system integration; major hubs and fare zone; digital integration through real-time apps, connectivity gaps).

Recap of Project 2: Demographic System



1) Population Distribution

Figure 1: Net flow for districts in London



2) Commuting Netflow

- Key insights (population distribution; commuting and migration flows; major employment hub and outflowing borough).

Emergence of New System:

- characteristics of transit systems, such as their urban layout and service frequency, can create pockets of transport deprivation.

- Lack of access to transport can impact how individuals perceive their activity space, thus influencing the demographic system

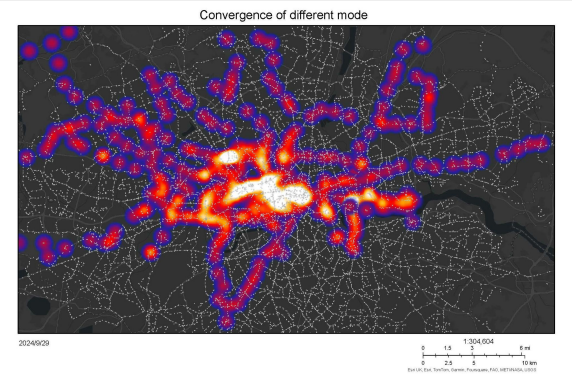
Transit-driven social segregation

a result of transportation systems that are designed in ways that limit access to jobs, education, and economic resources for people of color and low-income communities

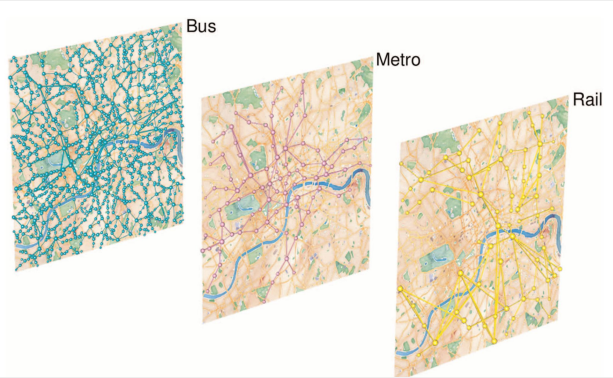
Emergence of New System:
Transit-driven social segregation

Here are some factors that contribute to transit-driven social segregation:

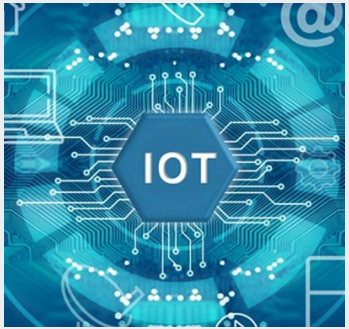
Infrastructure investments Disparity



Uneven Transit system layout



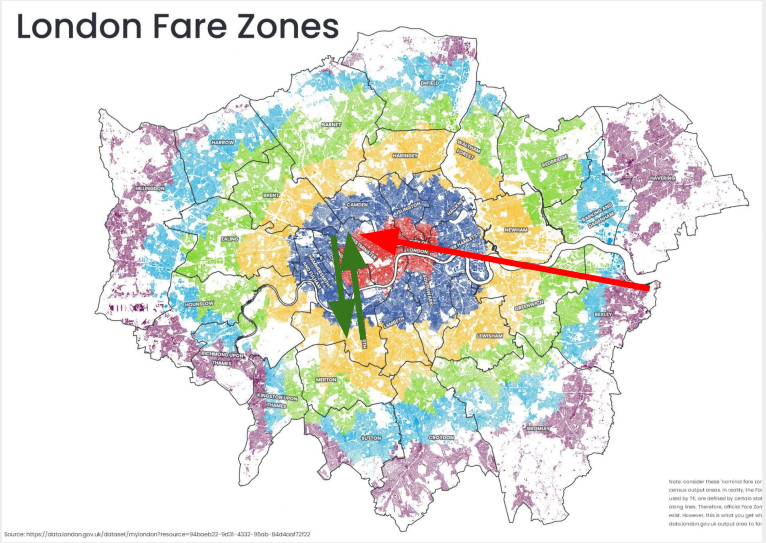
Digital Accessibility



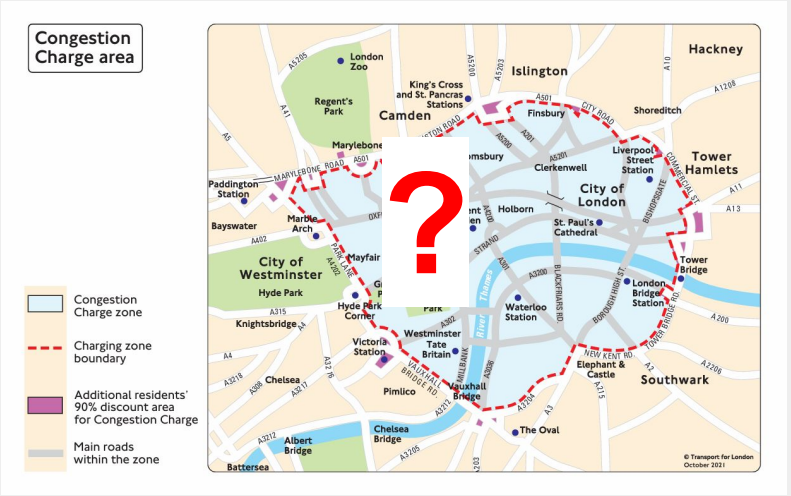
One Particular Urban Dynamics: Congestion Pricing System & Its particular impact on social segregation

Economic factors that contribute to transit-driven social segregation:

Public Transportation Fare
Zone 1 most expensive - Zone 6 cheapest



Road Vehicles Fare
Congestion Pricing System



Current Congestion Pricing System

The London Congestion Charge is a road pricing system designed to reduce traffic congestion and promote sustainable urban mobility in central London.

A. Background and Development
B. Congestion Pricing Zone and Rules
C. Current Challenges and Controversies

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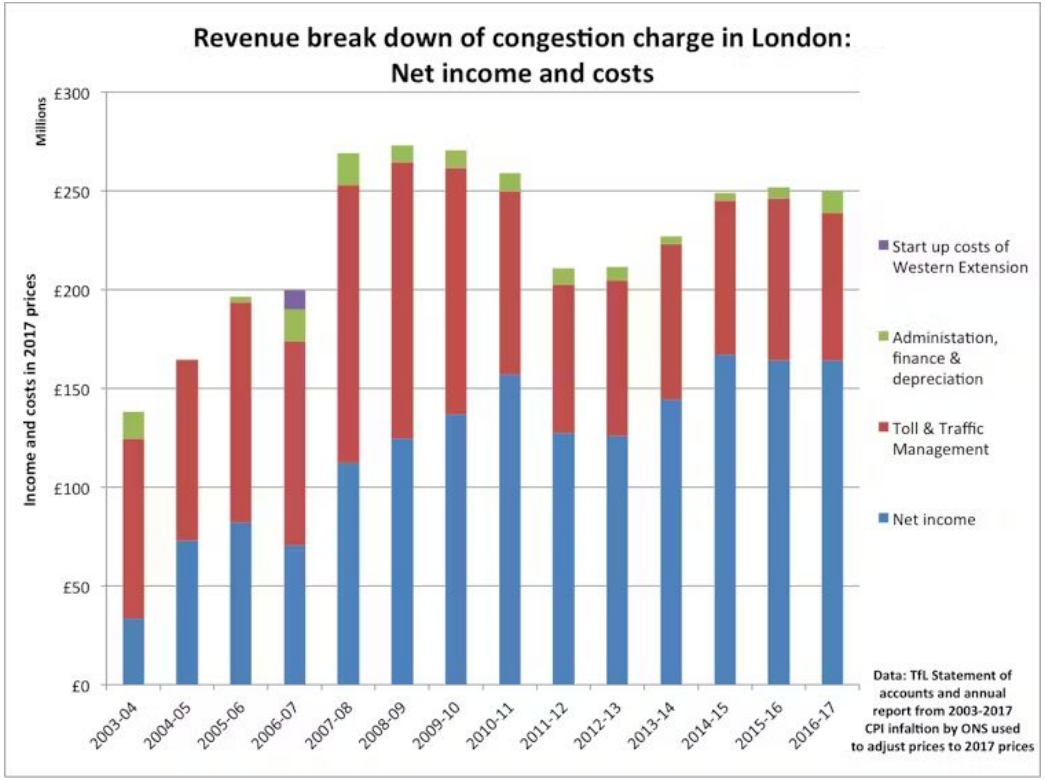
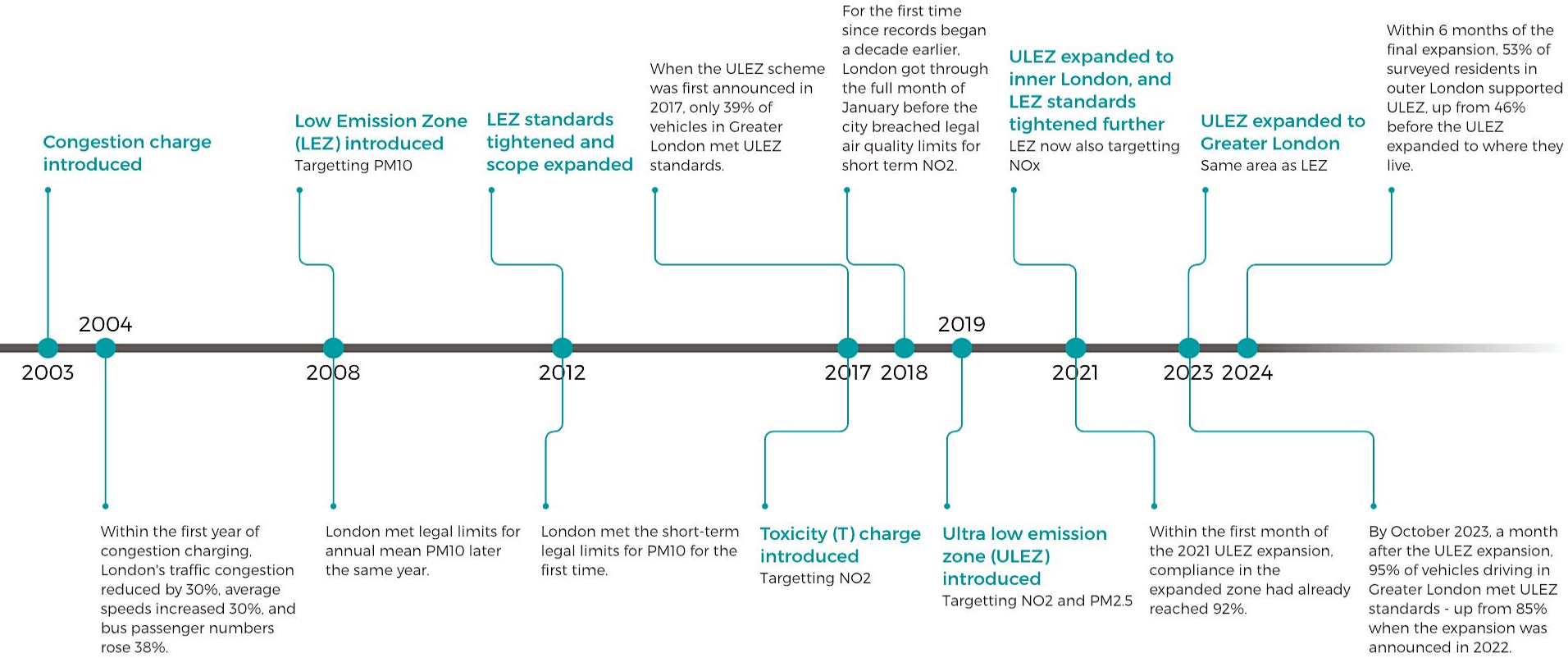
What is London Congestion Charge?

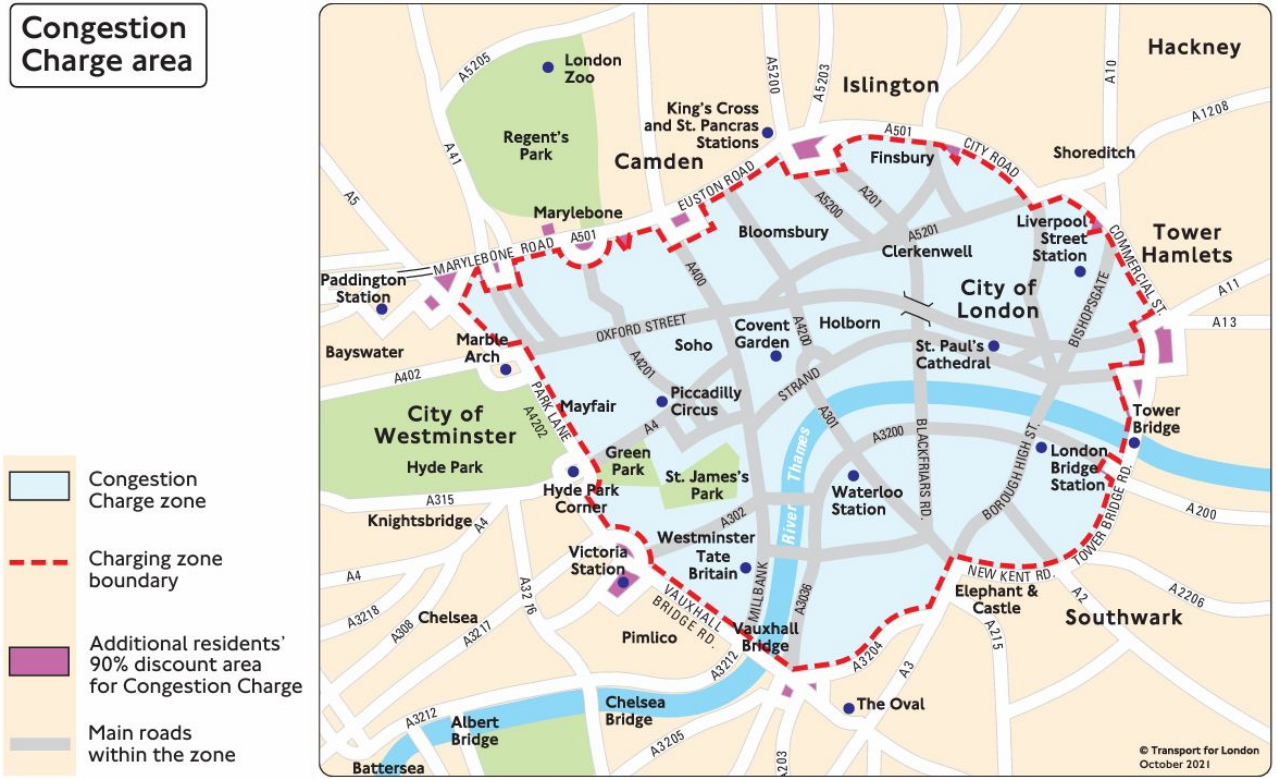
- A **traffic management policy** first introduced in 2003.
    - ***Operation:*** A **Congestion Charge Zone (CCZ)** has been set to charge vehicles during operating hours.
    - ***Objectives:*** reduce congestion, encourage sustainable transportation and improve air quality, and gain revenue.
- One of the most world-leading congestion pricing systems.



How has the congestion pricing system developed over time?



Congestion Charge Zone



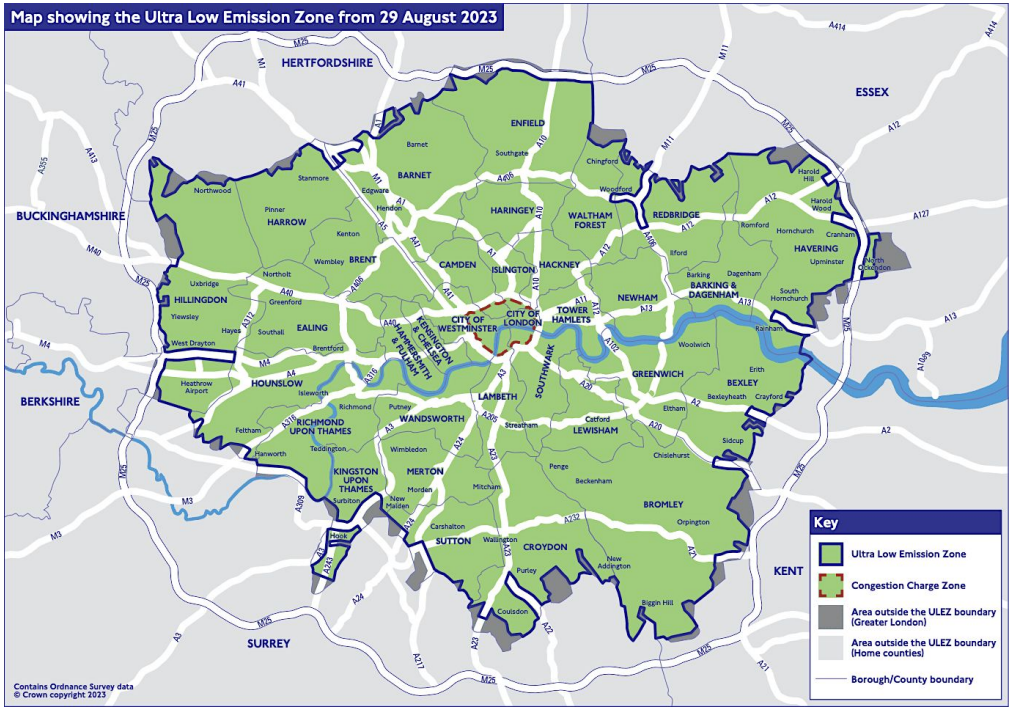
- ***Fare:***

  £15 daily (90% discount for residents)

- ***Operating Hour:***

  - 7:00-18:00 Monday-Friday
  - 12:00-18:00 Sat-Sun and bank holidays.

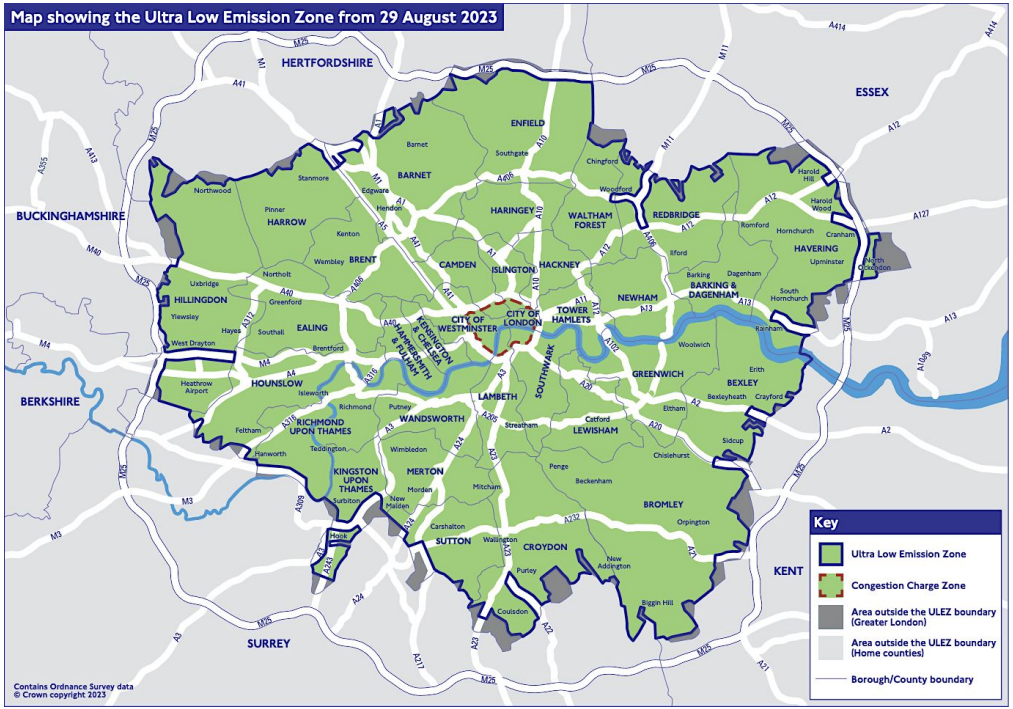
Low Emission Zone and Ultra Low Emission Zone



LEZ:

- ***Target***:
  - Heavy diesel vehicles such as trucks, buses, vans, and minibuses across Greater London.
- ***Fare***:
  - **£100 per day** for non-compliant larger vans and minibuses.
  - **£300 per day** for non-compliant heavier vehicles like lorries and coaches.
- ***Operating Hour***:
  - **24/7**, including weekends and public holidays.

Low Emission Zone and Ultra Low Emission Zone



ULEZ:

- **Target**:
  - A**ll vehicle types**, including cars, motorcycles, vans, and heavy vehicles.
- **Fare**:
  - **£12.50 per day** for cars, motorcycles, and vans.
  - **£100 per day** for heavier vehicles like lorries and buses.
- **Operating Hour**:
  - **24/7**, including weekends and public holidays.

Economic Equity became the Key:

- Does the high fee disproportionately restrict the mobility of low- and middle-income groups?
- How to balance congestion reduction and air quality improvement while ensuring equitable access to mobility?

The Impact of Congestion Pricing System

Discuss the impact of congestion pricing system from different aspects and analysis how they will affect the demographic equity.

A Impact on Air Quality

B Impact on Transport Modes

C Impact on Different Income

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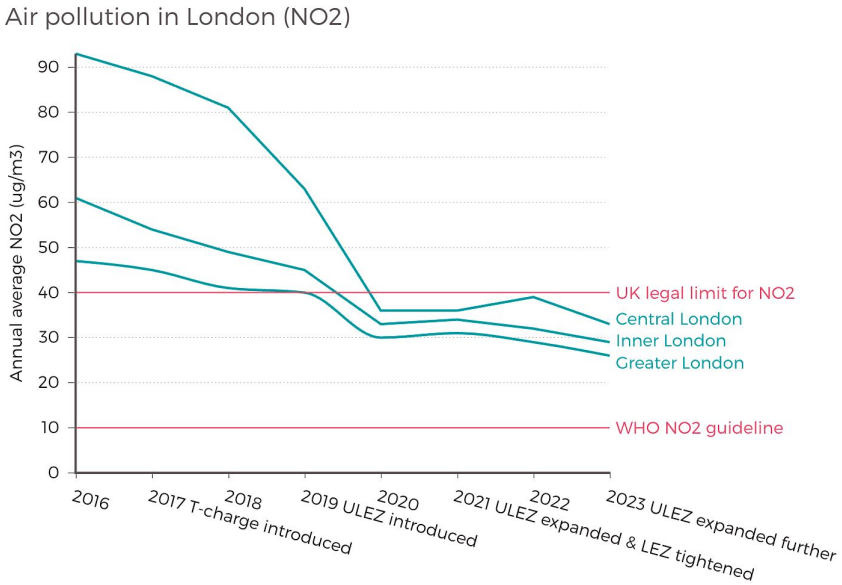
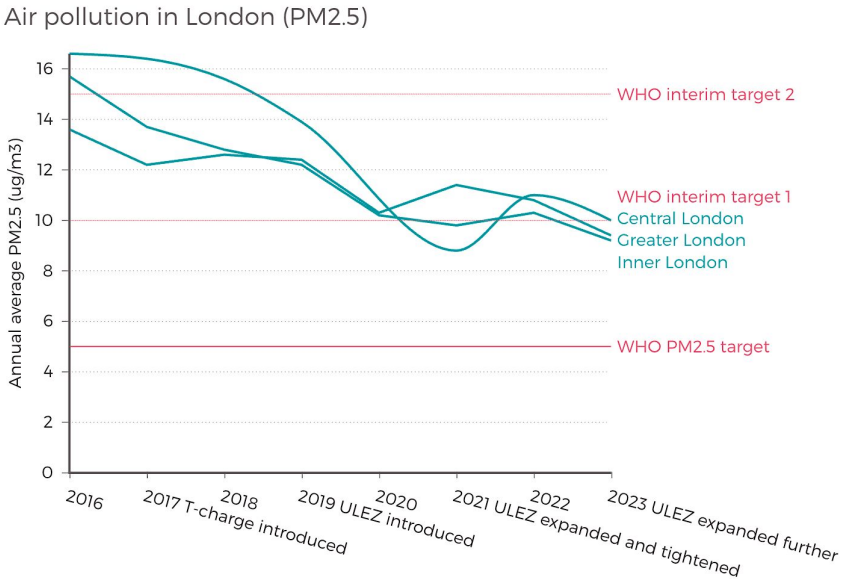
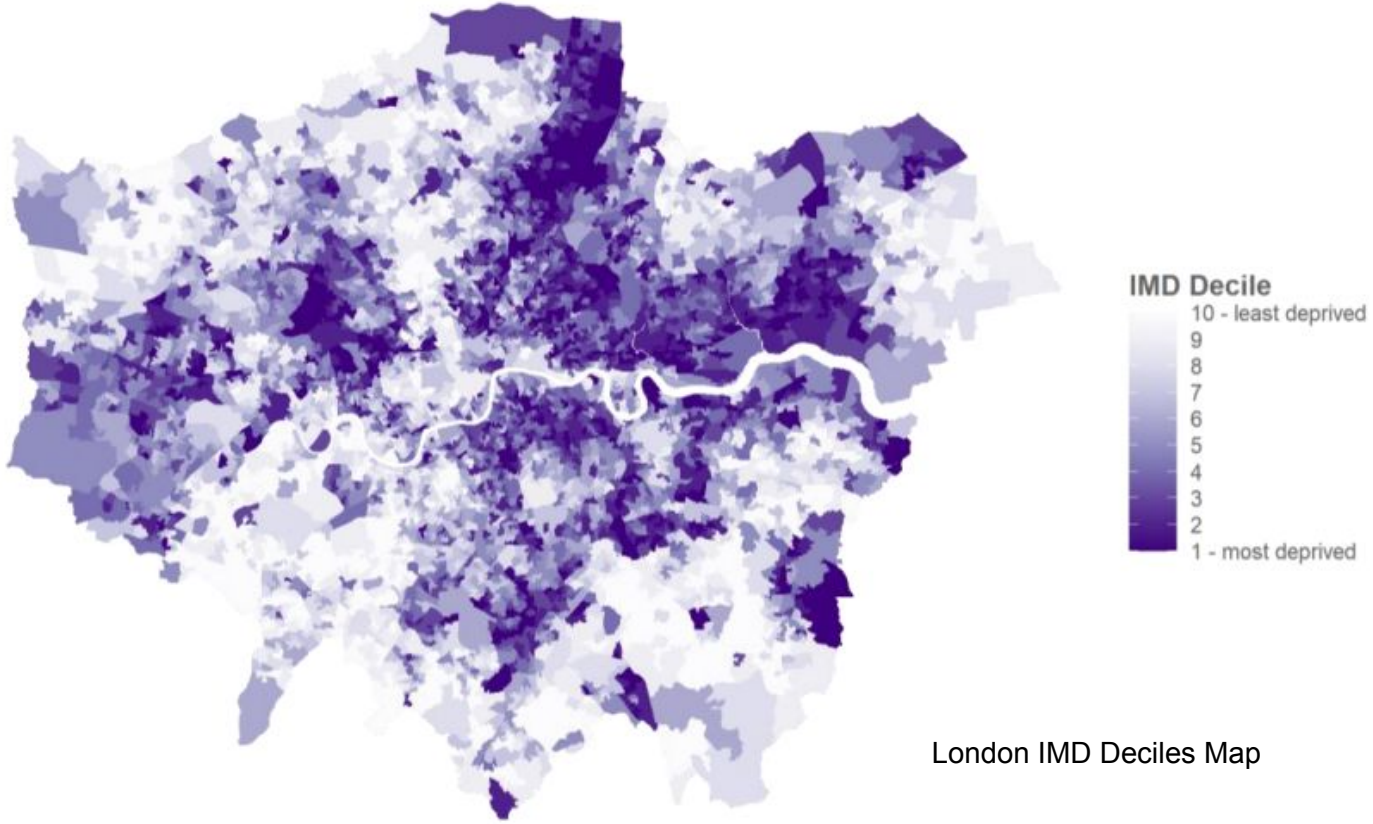
Impact on Air quality



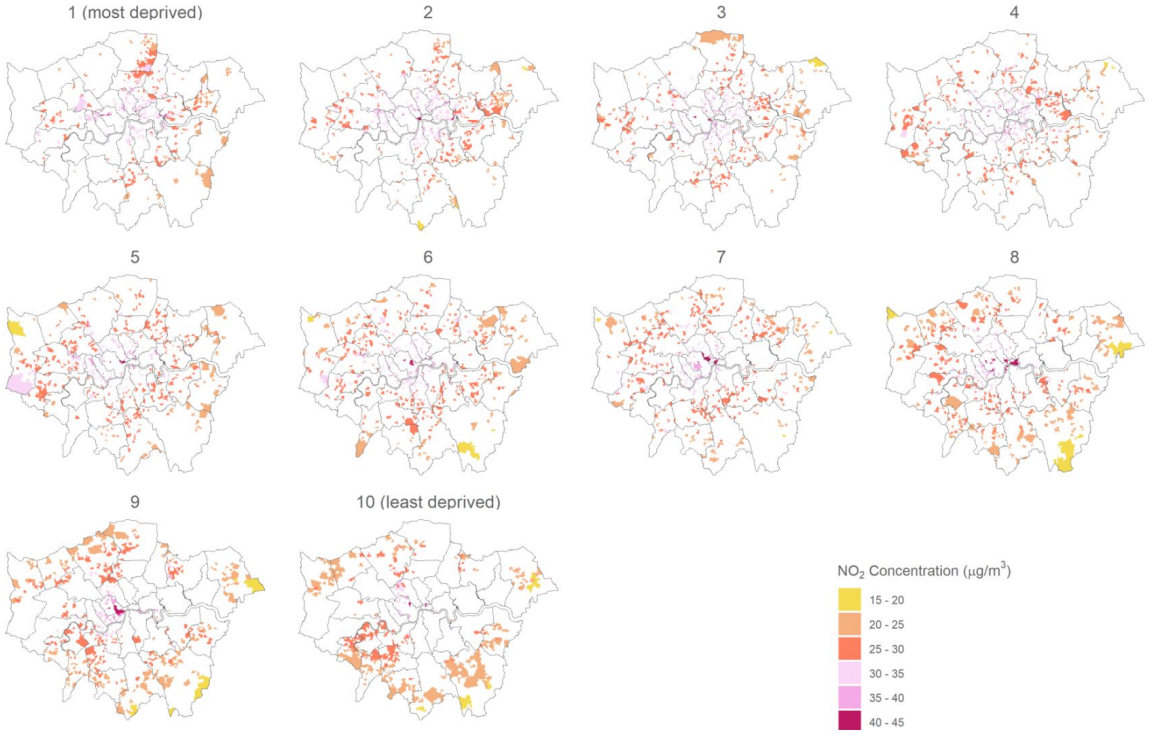


Air pollution exposure and deprivation

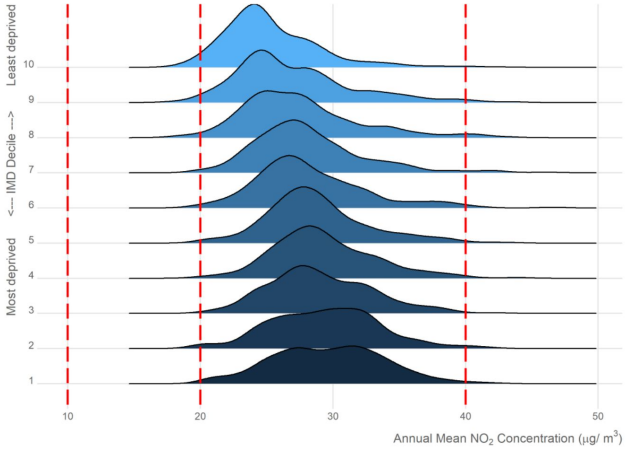


London IMD Deciles Map

Air pollution exposure and deprivation

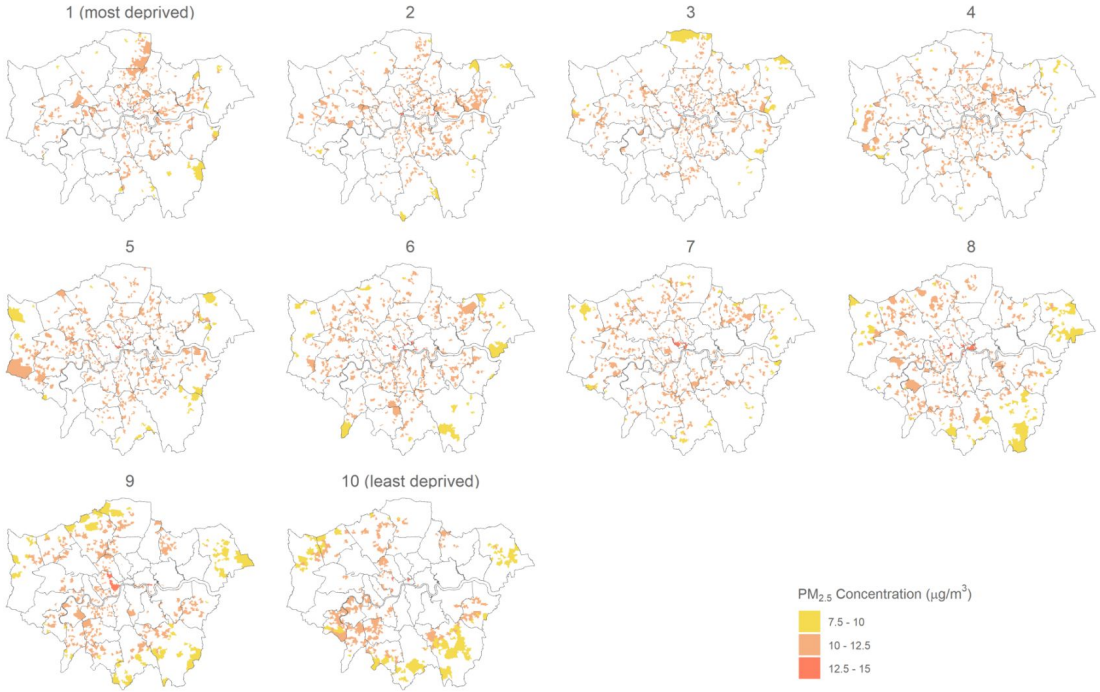


Maps for NO2 concentration within each IMD decile

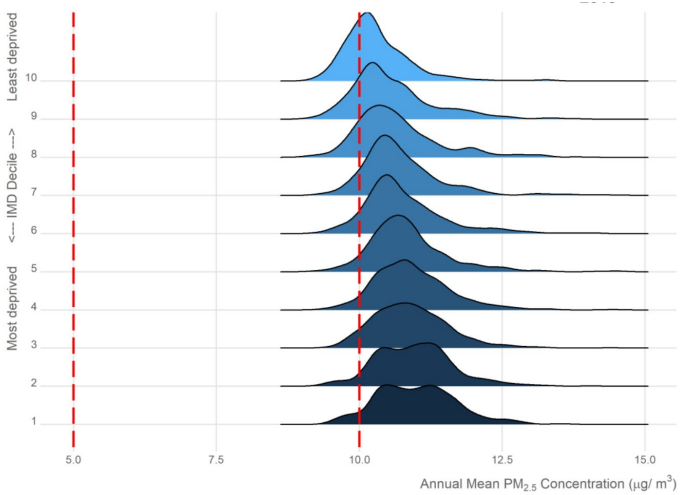


Average NO2 exposure distributions within IMD Deciles NO2 ; red dotted lines show current UK legal limit (40 µg/m3), WHO interim target (20 µg/m3) and WHO guideline (10µg/m3) levels.

Air pollution exposure and deprivation



Maps for PM2.5 concentration within each IMD decile



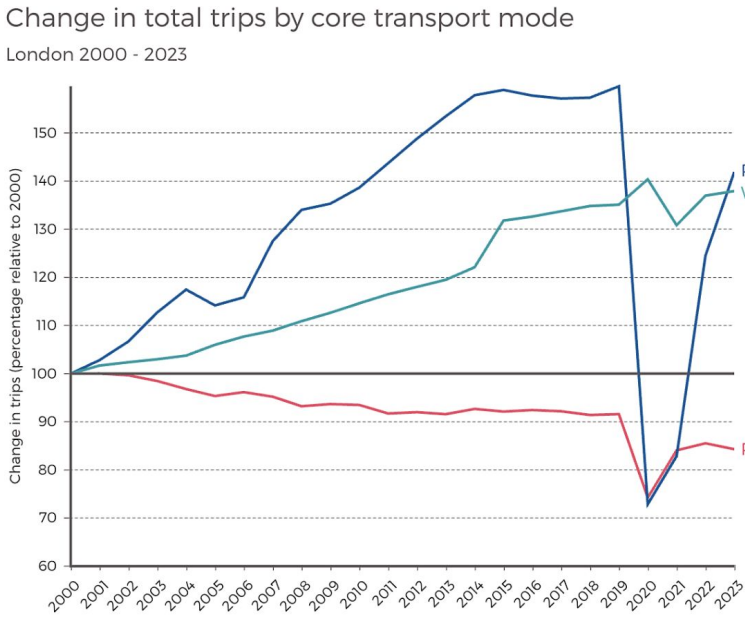
Average PM2.5 exposure distributions within IMD Decile ; red dotted line shows current WHO interim target (10 µg/m3) and WHO guideline (5 µg/m3) levels

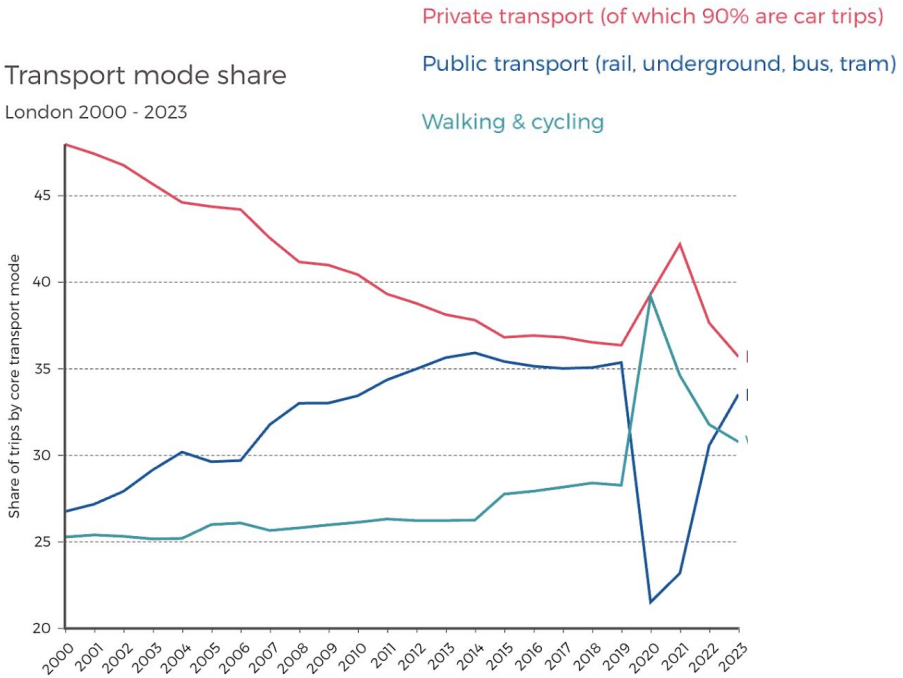
Air pollution exposure and deprivation

Pollutant	IMD decile										Difference, lowest to highest µg/m³ (%)
	1 (most deprived	2	3	4	5	6	7	8	9	10 (least deprived)	
NO_2											
2013	39.1	37.9	37.8	37.3	36.7	36.2	36.1	35.3	33.8	31.4	7.7
2016	39.0	37.8	37.7	37.3	36.7	36.3	36.1	35.4	34.2	32.0	7.0
2019	29.7	29.5	29.1	29.3	28.8	28.3	28.1	27.5	27.0	25.3	4.4
2025	20.9	20.8	20.6	20.8	20.4	20.0	19.9	19.5	19.1	18.1	2.8
2030	16.4	16.4	16.2	16.4	16.1	15.7	15.6	15.2	15.0	14.2	2.2
$PM_{2.5}$											
2013	16.3	16.2	16.1	16.1	16.0	15.9	15.9	15.8	15.7	15.4	0.9
2016	13.6	13.5	13.5	13.4	13.3	13.2	13.2	13.1	13.0	12.7	0.9
2019	11.0	11.0	10.9	10.9	10.9	10.8	10.7	10.7	10.6	10.3	0.7
2025	9.9	9.8	9.8	9.8	9.7	9.7	9.6	9.5	9.5	9.2	0.7
2030	9.0	9.0	8.9	8.9	8.9	8.8	8.8	8.7	8.6	8.4	0.6

Mean exposure (µg/m3) by deprivation (IMD) decile across all years for NO2 and PM2.5

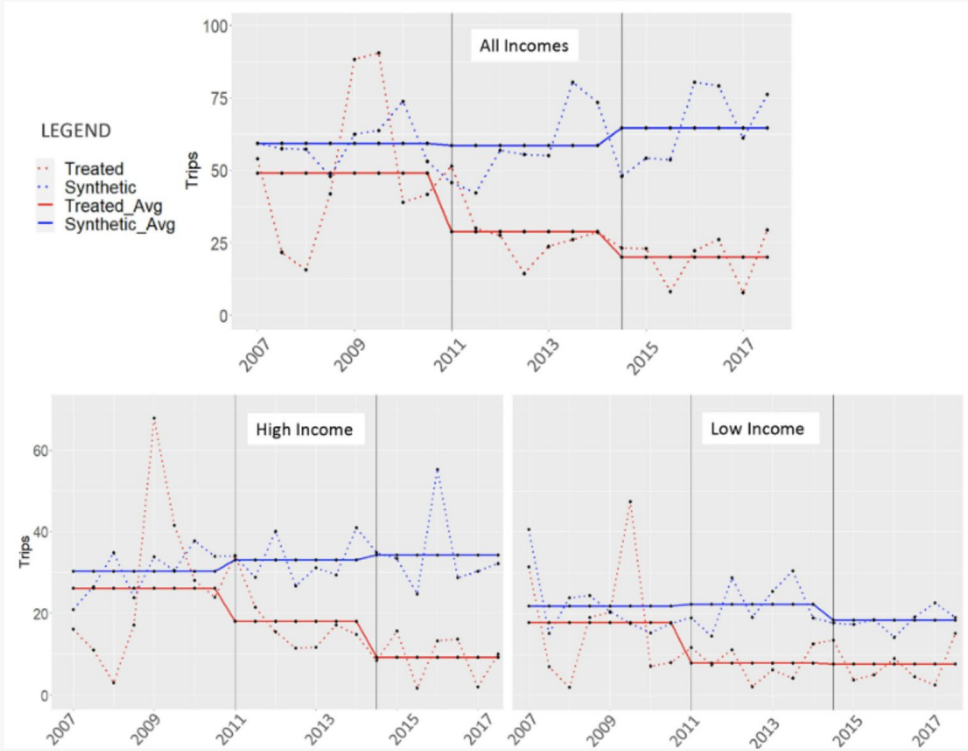
Impact on transport modes





Impact on different income

Using data from the UK National Travel Survey, MIT researchers found that London's congestion pricing disproportionately impacted high-income drivers, with 60% of revenue coming from the top 40% of earners. Low-income travelers were more likely to reduce trips, while high-income groups adapted by shifting modes of transport. After a 15% price increase in 2014, low-income trip levels remained unchanged, highlighting essential travel needs and raising equity concerns, suggesting the need for price-offset programs for low-income workers.



Trips eligible for congestion pricing surcharge shown over time. Each vertical line represents a price increase. Source: Craik & Balakrishnan, 2022.

Future and Conclusion

Analyzing the Emergence of a New System in a Smart City

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The Smart Evolution of Congestion Pricing

1.**Dynamic Pricing:**

Fees vary by time, location, and congestion levels,

similar to Singapore's ERP (**Electronic Road Pricing)**

(**ERP: a dynamic congestion management solution that uses **real-time pricing** to regulate traffic flow)*

2.**Income-Based Pricing:**

Sliding-scale fees to support low-income residents,

inspired by programs in New York.

3.**Green Vehicle Incentives:**

Exemptions or subsidies for electric and low-emission

vehicles, like California's rebate system.

Inclusive Mobility Policies

Subsidies for public transit and shared mobility services

Expansion of public transport routes in underserved areas

inspired by Croydon's bus expansion

Technological innovations like autonomous electric shuttles in low-income areas (Oslo)

Integrate case studies and policies to **London** Strategy

Income-based pricing system and **green vehicles incentives**
(demographic map in Soft System Presentation and impact part in Section 3)

Expanding public transport
(main commute-out districts in Section 3)

Adopting technological innovations
(complementing the congestion zone strategy outlined in Section 1&2)

From Policy to People: Creating an Inclusive Smart City

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