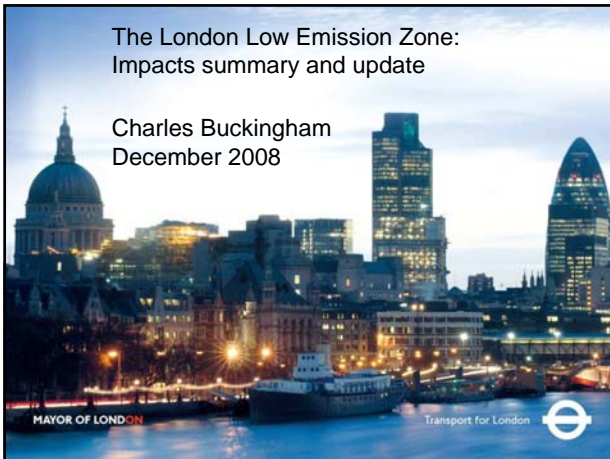


# Urban Low Emission Zones



### Why a London Low Emission Zone ?

- London's air quality among worst in UK.
- Exceedences of air quality objectives – PM<sub>10</sub> and NO<sub>2</sub>
- Concentrated in central/inner London alongside busy roads.
- Mayor's Air Quality Strategy – range of measures.
- LEZ identified as potentially most effective.
- TfL developed a scheme to be introduced from early 2008.

### Basis of scheme

- Operates 24/7 across Greater London.
- Minimum Euro emissions standards – or charge.
- Phased implementation – 2 phases in 2008.
- Targets higher-polluting diesel vehicles.
- Enforced by cameras.
- Comprehensive monitoring of effects.

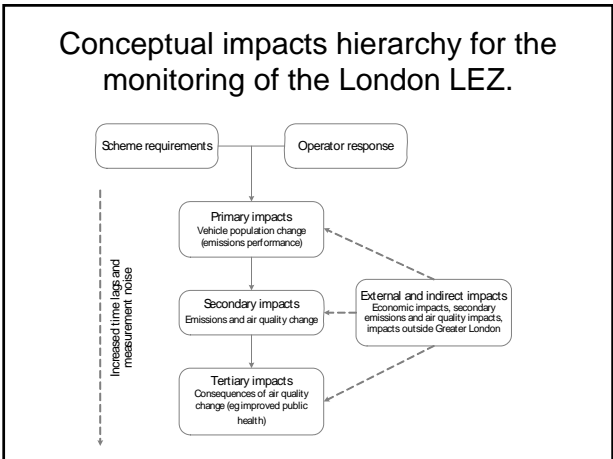
### Guidelines for vehicle compliance with the requirements of the London Low Emission Zone scheme.

Vehicle type and definitions	Date affected	Required emissions standards
<b>Heavy lorries:</b> Heavy diesel-engined motor vehicles exceeding 12 tonnes (gross vehicle weight), including goods vehicles, motor coaches, motorbuses, horse-drawn carriages and other specialised vehicles.	4 February 2008 Euro III for PM 3 January 2012 Euro IV for PM	<b>All Euro III vehicles meet the LEZ standard</b> From 4 February 2008 the LEZ emissions standard is Euro III for particulates (major PM). Vehicles first registered as new with the DVLA on or after 1 October 2001 are assumed to meet the standard. Vehicles not meeting the emissions standards could be made to do so by modifying them to meet the Euro III standard for PM. Vehicles not meeting the LEZ emissions standards will need to pay a daily charge if used within the LEZ.
<b>Lighter lorries:</b> Heavy diesel-engined vehicles between 3.5 and 12 tonnes Gross Vehicle Weight, including goods vehicles, motor coaches, motorbuses, horse-drawn carriages and other specialised vehicles.	7 July 2008 Euro III for PM	<b>From 7 January 2012 the required emissions standards are raised to Euro IV for PM. All Euro IV vehicles will meet the LEZ standards in 2012.</b> Vehicles first registered as new with the DVLA on or after 1 October 2004 are assumed to meet this standard. Vehicles not meeting the emissions standards could be made to do so by modifying them to meet the Euro IV standard for PM. Vehicles which do not meet the LEZ emissions standards would need to pay a daily charge if used within the LEZ.
<b>Buses and coaches:</b> Diesel-engined passenger vehicles with more than eight seats, plus the driver's seat, between 2.5 tonnes and 12 tonnes Gross Vehicle Weight.	3 January 2012 Euro IV for PM	<b>From 4 October 2010 the emissions standard is Euro III for PM.</b> Vehicles registered as new with the DVLA on or after 1 January 2002 are assumed to meet the standard. Vehicles not meeting the emissions standards could be made to do so by modifying them to meet the Euro III standard for PM. Vehicles which do not meet the LEZ emissions standards would need to pay a daily charge if used within the LEZ.
<b>Large vans:</b> Diesel-engined vehicles between 1.8 tonnes (gross vehicle weight) and 3.5 tonnes (gross vehicle weight) and motor coaches and motorbuses between 2.5 tonnes and 3.5 tonnes Gross Vehicle Weight.	4 October 2010 Euro III for PM	<b>From 4 October 2010 the emissions standard is Euro III for PM.</b> Vehicles registered as new with the DVLA on or after 1 January 2002 are assumed to meet the standard. Vehicles not meeting the emissions standards could be made to do so by modifying them to meet the Euro III standard for PM. Vehicles which do not meet the LEZ emissions standards would need to pay a daily charge if used within the LEZ.
<b>Motorbuses:</b> Diesel-engined passenger vehicles with more than eight seats, plus the driver's seat, below 3 tonnes Gross Vehicle Weight.		

\*L3: The vehicle weight is a guide only as to whether your vehicle is affected by the LEZ. If your type of vehicle does not appear here you should use the weight limit used for buses and large vans as a guide to whether your vehicle is affected or exempt from the LEZ.

### Expected impacts

- Targets reduced PM emissions to assist compliance with air quality objectives.
- But – PM very complex.
- And – path from 'intervention' to 'effect' also very complex.
- So, need to recognise complexity in interpreting scheme impacts.
- Range of other (non-PM) impacts.



# Urban Low Emission Zones

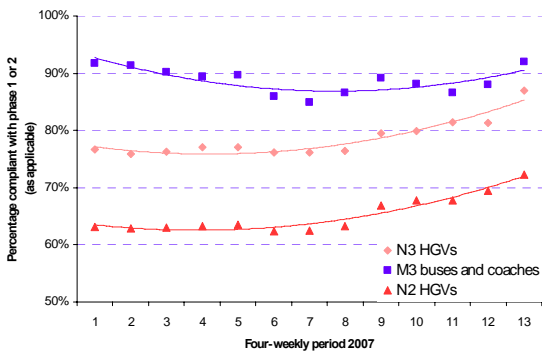
## Measuring traffic change

- Automatic Number Plate Reading Cameras (ANPR).
- Statistically-representative sample of 100 cameras.
- Monitor vehicles continuously.
- Interface to TfL's Scheme Compliance Database.
- Ascribe Euro emissions class to in-scope vehicles.
- Therefore, derive 'observed' vehicle stock profile in terms of Euro Class for in-scope (and potentially) other vehicles.

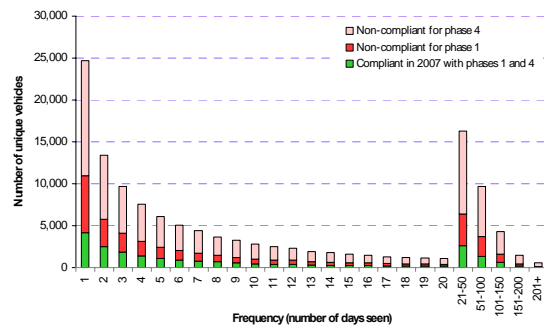
A typical semi-permanent automatic number plate recognition camera installation on a traffic signal head.



Trend in scheme compliance during 2007. Vehicle activity based estimate, 13 four-week periods, phases 1 and 2 of the scheme. ANPR camera data.



Annual frequency distribution for 2007 calendar year, N3 heavy goods vehicles. Showing established compliance with requirements of phases 1 and 4 of the scheme.



Estimates of change in compliance with the requirements of the scheme during 2007. Percentage point change, synthesis of various sources.

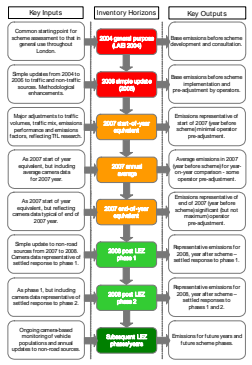
Data source/vehicle type	Gross annual change 2007	Estimated background change 2007	Estimated scheme-attributable change 2007
<b>N3 HGVs</b>			
- UK national fleet (licensing data)	7%	4%	3%
- London registered fleet (licensing data)	13%	4%	9%
- Camera data unique vehicles (annual)	10%	5%	5%
- Camera data vehicle-kilometres (annual)	10%	4%	6%
- LAE projected (on national fleet turnover)	8%	n/a	n/a
<b>N2 HGVs</b>			
- UK national fleet (licensing data)	7%	6%	1%
- London registered fleet (licensing data)	10%	8%	3%
- Camera data unique vehicles (annual)	9%	6%	5%
- Camera data vehicle-kilometres (annual)	9%	6%	4%
- LAE projected (on national fleet turnover)	8%	n/a	n/a
<b>M3 buses and coaches</b>			
- UK national fleet (licensing data)	5%	3%	-2%
- London registered fleet (licensing data)	2%	-4%	-6%
- Camera data unique vehicles (annual)	3%	-1%	3%
- Camera data vehicle-kilometres (annual)	0%	4%	-4%
- LAE projected (on national fleet turnover)	c. +2%	n/a	n/a

## Estimating emissions/air quality impacts

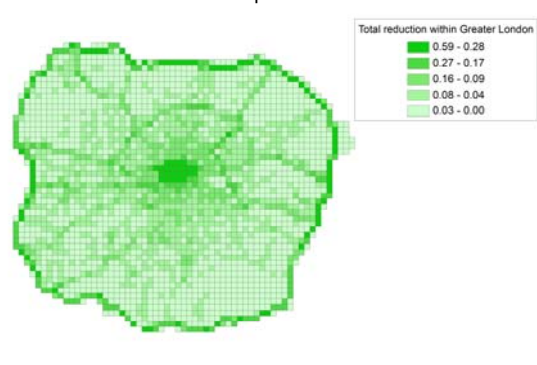
- Manipulate Euro Class profiles in emissions inventory.
- Hold other things constant or vary in controlled way.
- Therefore, can isolate impact.
- But there are a few complications !
- Then, use before/after emissions scenarios to generate air quality concentrations.

# Urban Low Emission Zones

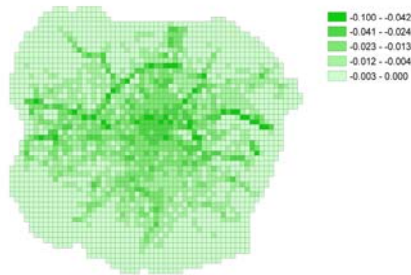
## Emissions assessment horizons for scheme impacts monitoring.



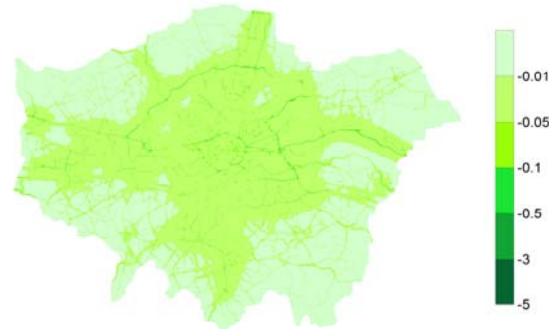
## Reduction in emissions of PM<sub>10</sub> during 2007. Road traffic sources only, total annual change (start vs. end of 2007). Tonnes per annum.



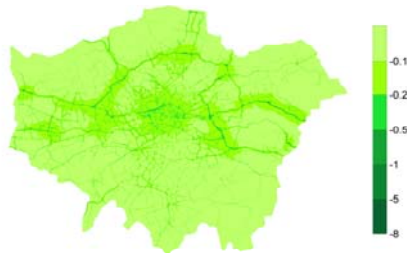
## Reduction in emissions of PM<sub>10</sub> during 2007. Road traffic sources only, scheme attributable change (start vs. end of 2007). Tonnes per annum.



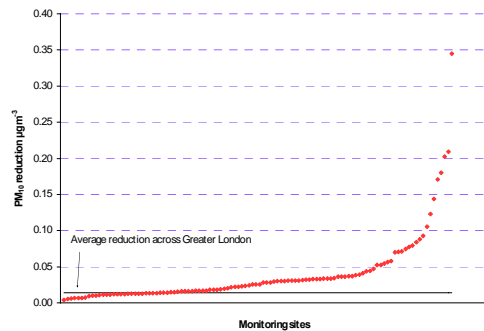
## Observed scheme-attributable changes in PM<sub>10</sub> annual mean concentrations (mg m<sup>-3</sup>). Start to end of 2007 with observed 2007 vehicle stock.



## Observed scheme-attributable changes in PM<sub>10</sub> annual mean concentrations (mg m<sup>-3</sup>). Start to end of 2007 with observed 2007 vehicle stock.



## Estimated scheme-attributable reductions in PM<sub>10</sub> at individual air quality monitoring sites, reflecting vehicle operator pre-compliance with requirements of phases 1 and 2 of the scheme during 2007 (mg m<sup>-3</sup>).

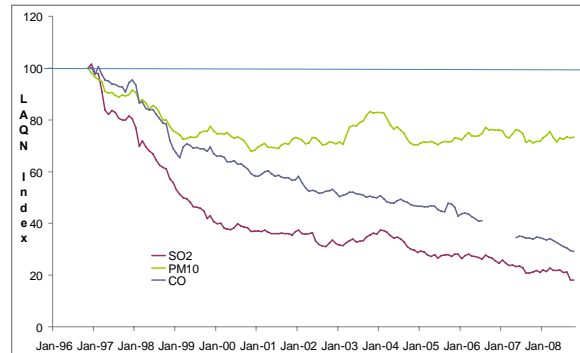


# Urban Low Emission Zones

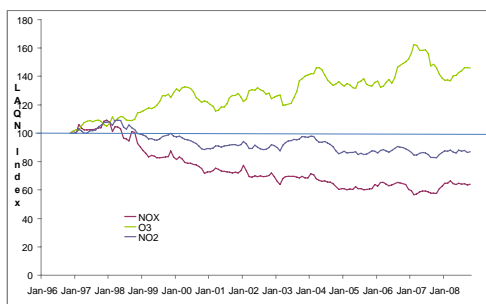
## Detecting an air quality response

- So far, so good. But should we expect to see a visible air quality response following introduction of scheme ?
- Not necessarily !
- Small scale of scheme impacts compared to natural variability of PM.
- Differential impacts on components of PM.
- Confounding factors and still very 'early days'.
- Therefore, need to be quite smart as to how measure and interpret trends in concentrations.
- But can probably conclude that air quality is better in *relative terms*.

## Long-run measured air quality (LAQN average values)



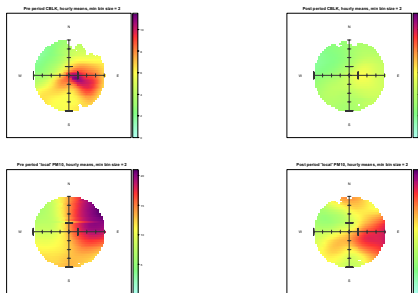
## Long-run measured air quality (LAQN average values)



## Available ambient monitoring data

- LAQN resource – sub-divisions by site type.
- LAQN 'Supersites' – relationships at local scale.
- Co-located traffic and air quality measures.
- Object not to 'detect' a scheme effect, but to help understand developing trends.
- Short-run timescale of 'post' measurements – but some potentially interesting emerging findings at lower end of PM size range (2.5 and black carbon/smoke).
- Extensive 'control' site comparisons (London and other cities) to contextualise impact of 'regional' trends in London.

## Some significant (?) changes in Black Smoke – Brent BT4



## Other work packages

- Vehicle emissions testing.
- Health impacts assessment.
- Economic impacts on vehicle operators.
- Wider research using new ANPR data (eg CO<sub>2</sub> profiles).

# Urban Low Emission Zones

