
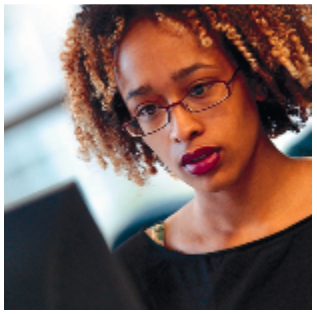

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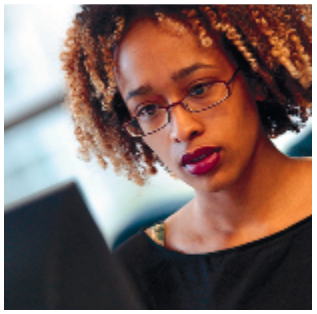
Trends in air pollution and emissions projections

Sean Beevers, Emily Westmoreland, Hrishi Mittal

And

David Carslaw

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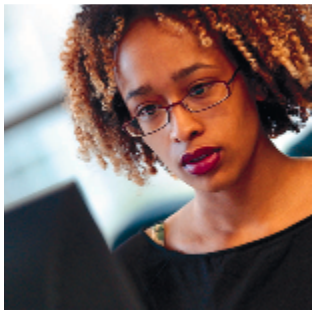
Talk summary

The problem with emissions forecasts?

What the problem could be?

What can we do about it?

What are the implications?

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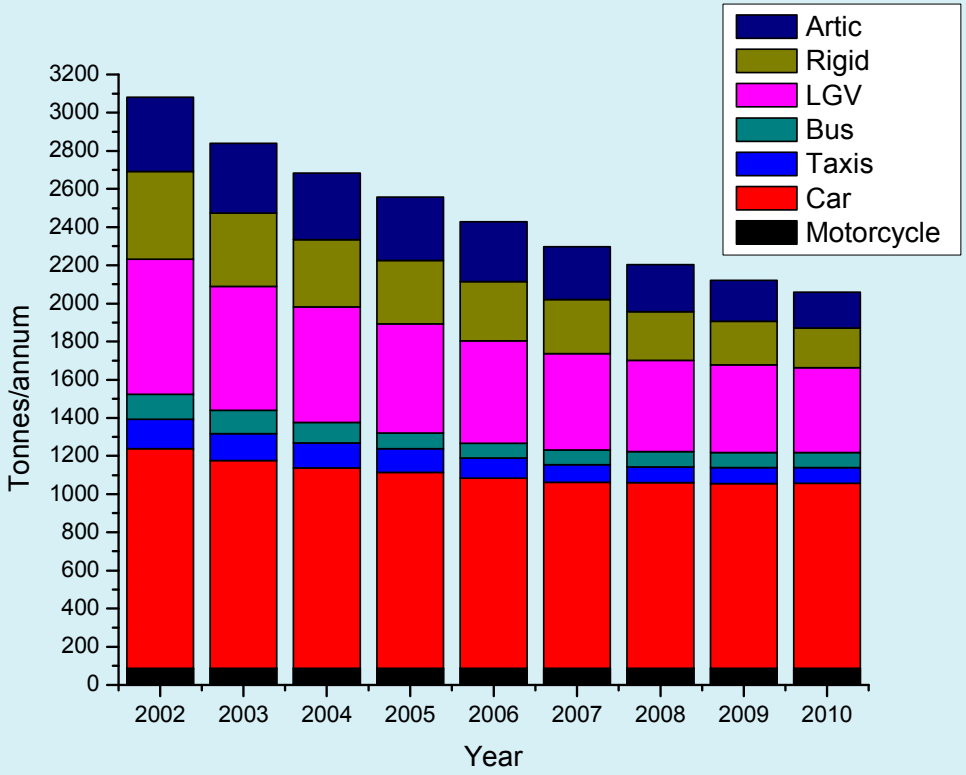
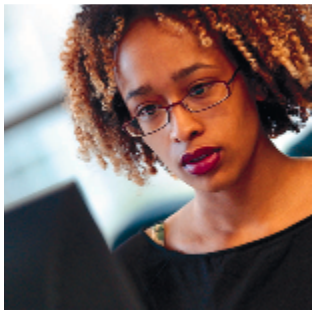


PM_{10} Road transport emissions

PM_{10} emissions (exhaust + Tyre and Brake wear) by vehicle type in the LAEI between 2002 and 2010.

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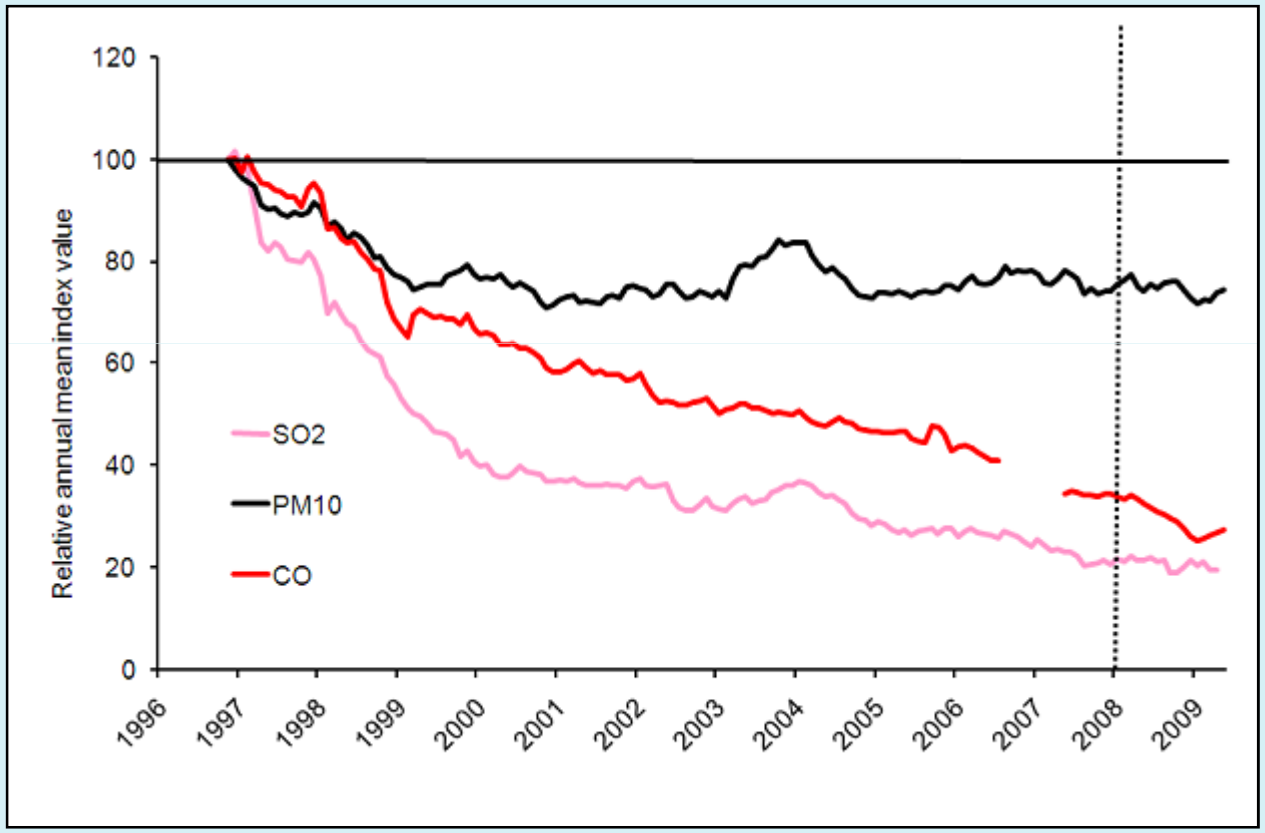
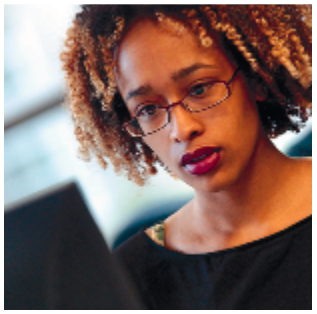
PM_{10} Air Pollution concentrations



Normalised $PM_{10}/SO_2/CO$ annual rolling mean concentrations.

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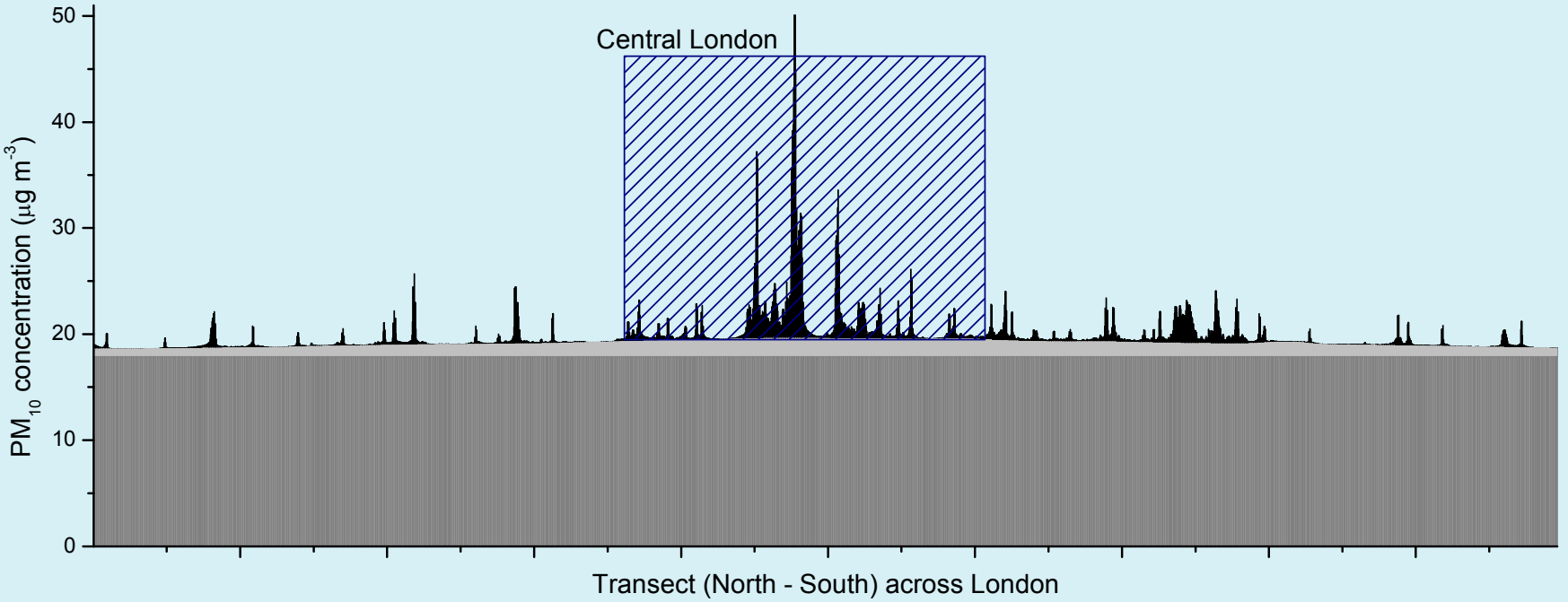
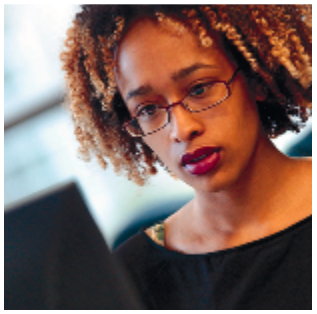
Long range transport? – we have looked at roadside in isolation (Fuller and Green, 2006).



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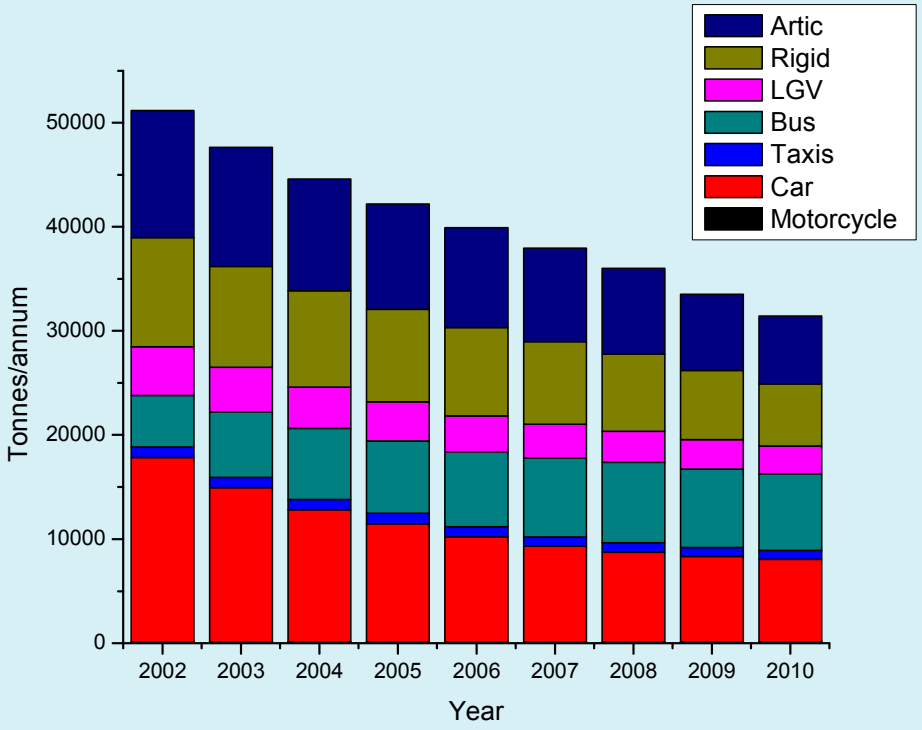
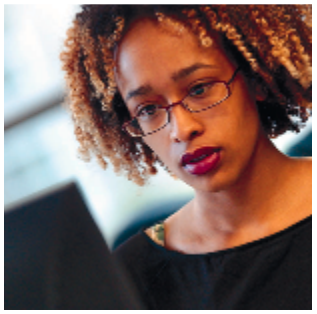
NO_X Road transport emissions



NO_X emissions by vehicle type in the LAEI between 2002 and 2010.

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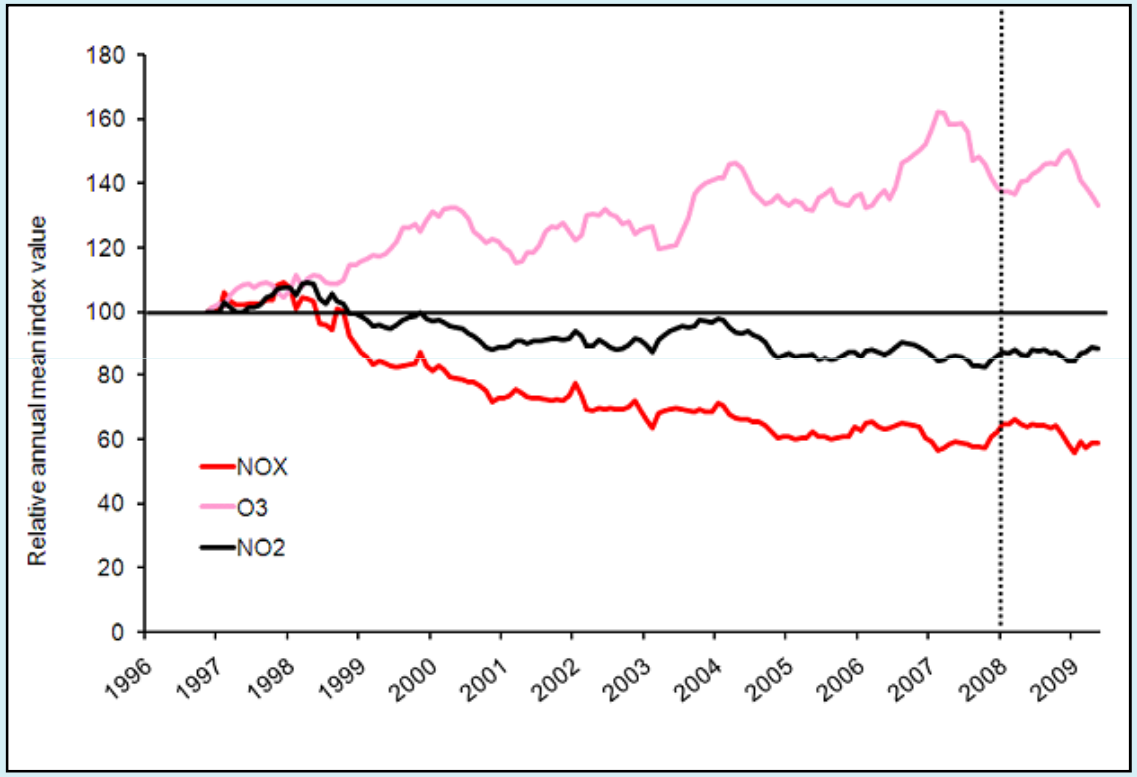
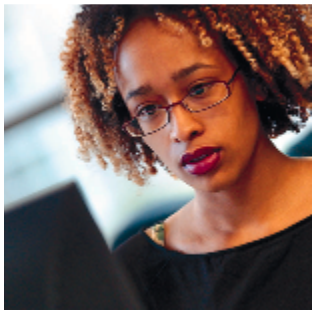


NO_X Air Pollution concentrations

Normalised $NO_X/NO_2/O_3$ annual rolling mean concentrations.

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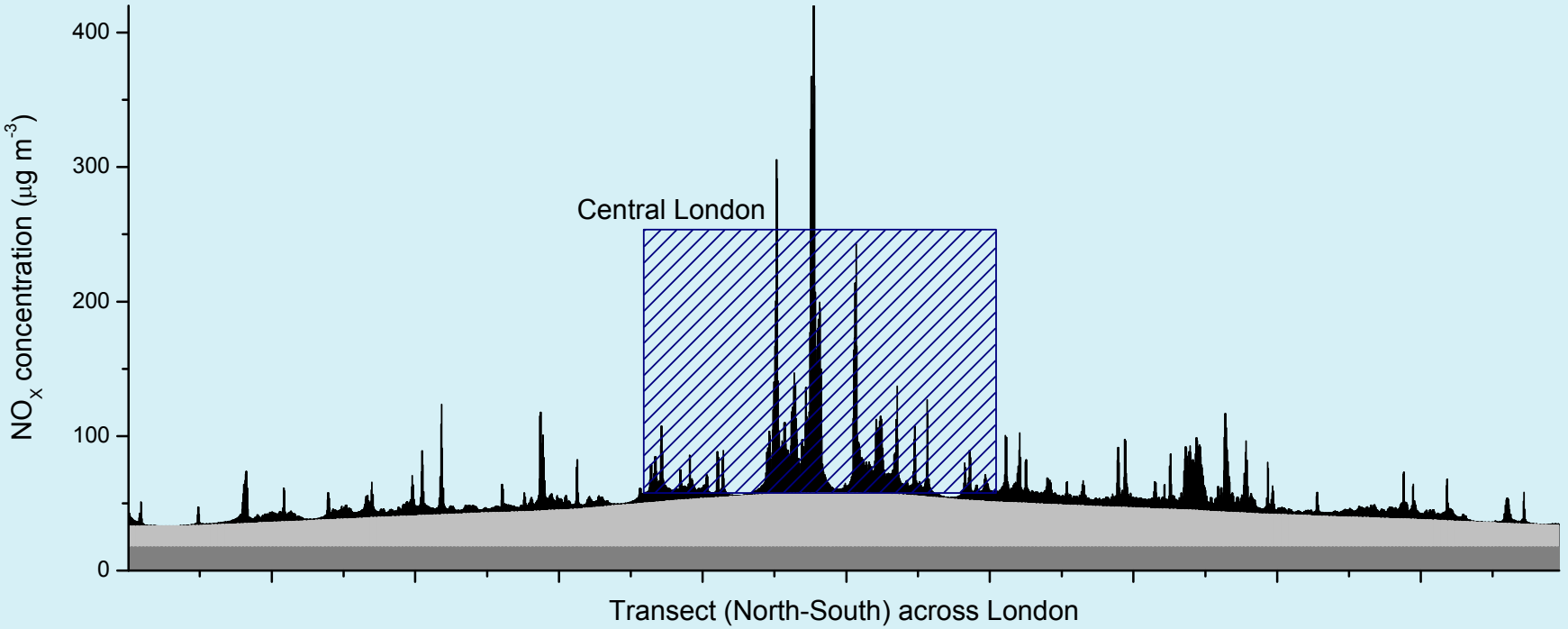
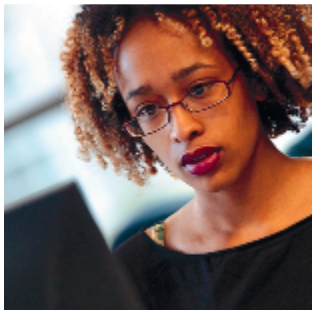
Not long range transport



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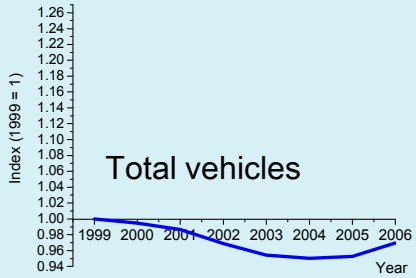
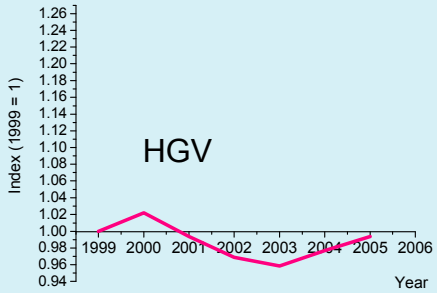
Is resuspension important?

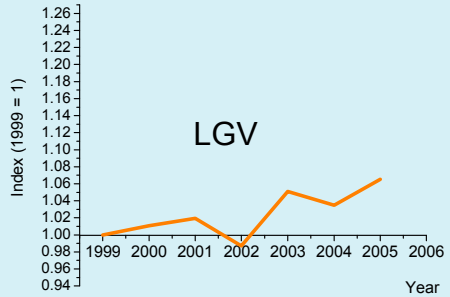
Harrison, 2004 doesn't suggest so but cannot be excluded from further study.

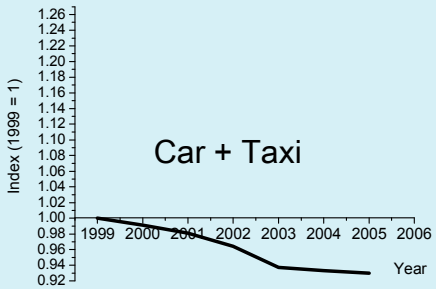
Met. effect in 2007?

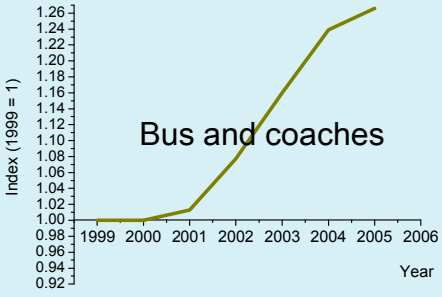


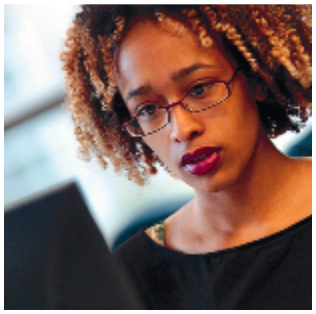


London traffic changes from 1999 to 2005/6. Index (1999) = 1. Total vehicle changes taken from LEZ monitoring report (TfL, 2008).







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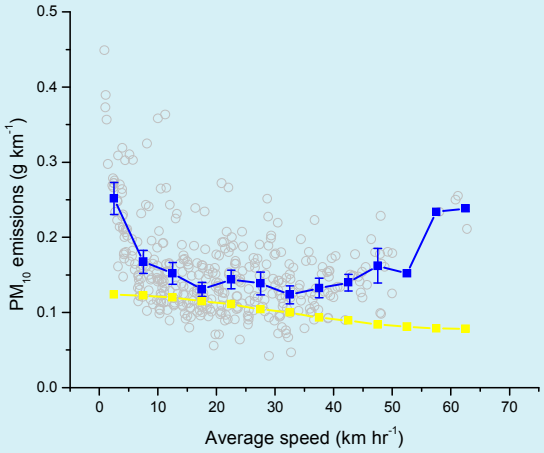
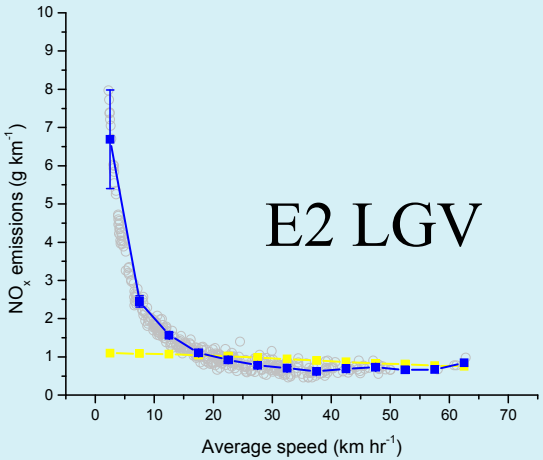
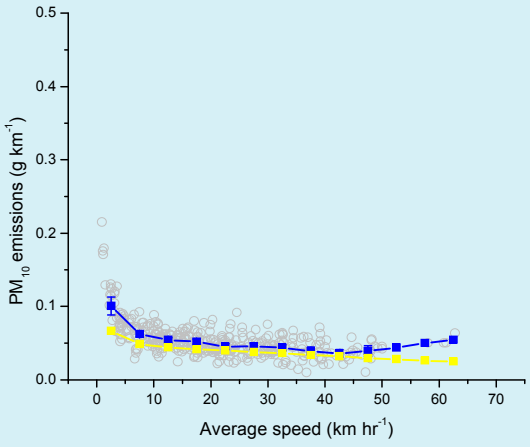
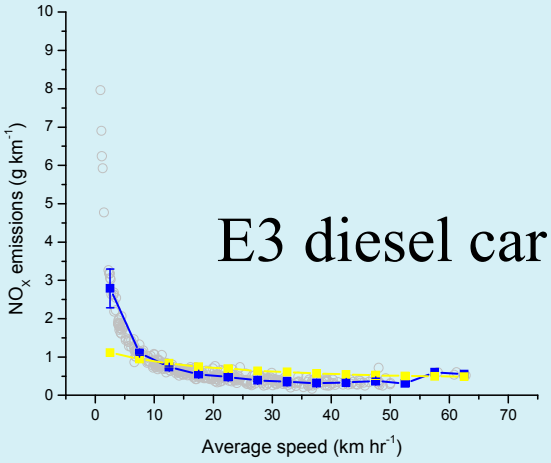




E2 LGV





E3 diesel car

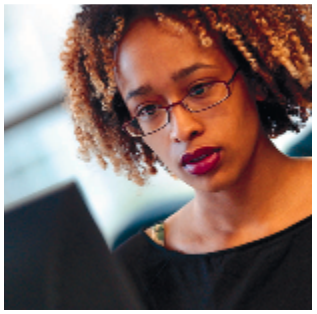
Primary Emissions - exhaust?

Driving dynamics

Modal models

Vehicle tests

Emissions over an hour?

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Non-exhaust emissions from transport?

Year	pollutant	Light Vehicles	HGV
2007	NOx	40	60
2007	TotalPM10	73	27
2007	Exhaust_PM10	67	33
2007	Tyre_brake_PM10	79	21

Year	Exhaust	Tyre and brake
2007	53	47

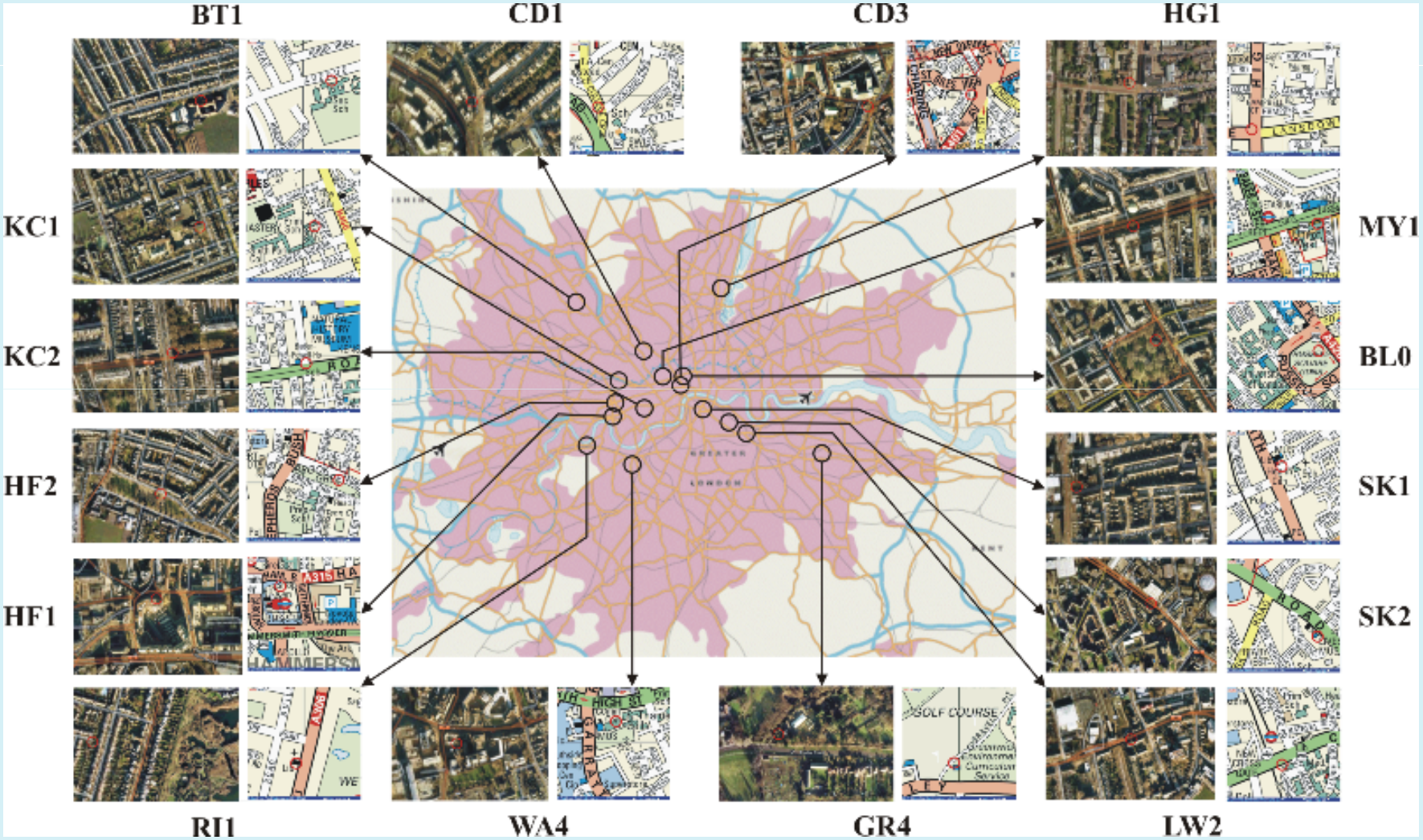
Much of the effort has been put into exhaust, yet increasingly non-exhaust emissions are important (toxicity).

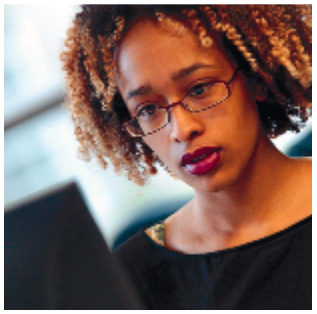
Very difficult to test and no standard method….

No technology in the emissions model (i.e. change in brake wear rates/composition etc).

Doesn't really depend on how much braking you do…(1Hz speed)

Within-City Spatial Variation in OP



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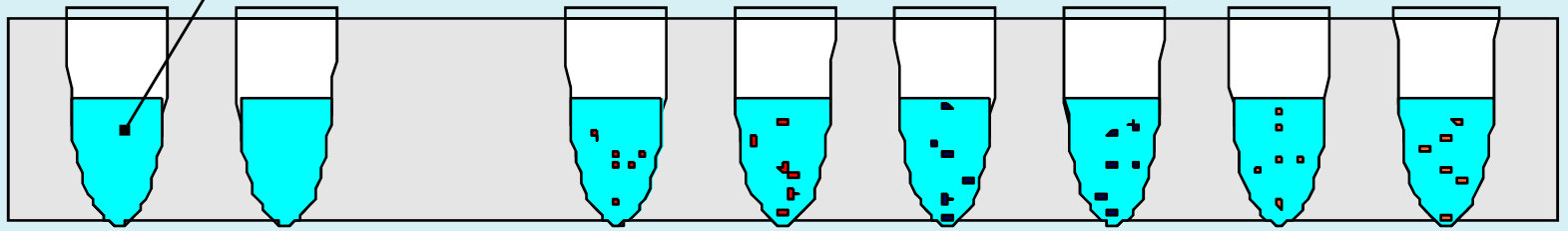
Particle Exposure Model

Spike with Conc. Antioxidant Solution

200 µM AA/UA/GSH (pH 7.4)

37°C



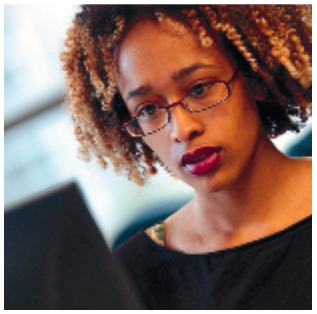
0h 4h — Control

0h 4h — Carbon black

0h 4h — ROFA

0h 4h — $PM_{2.5}$&$_{10}$

All incubations at 50µg/ml

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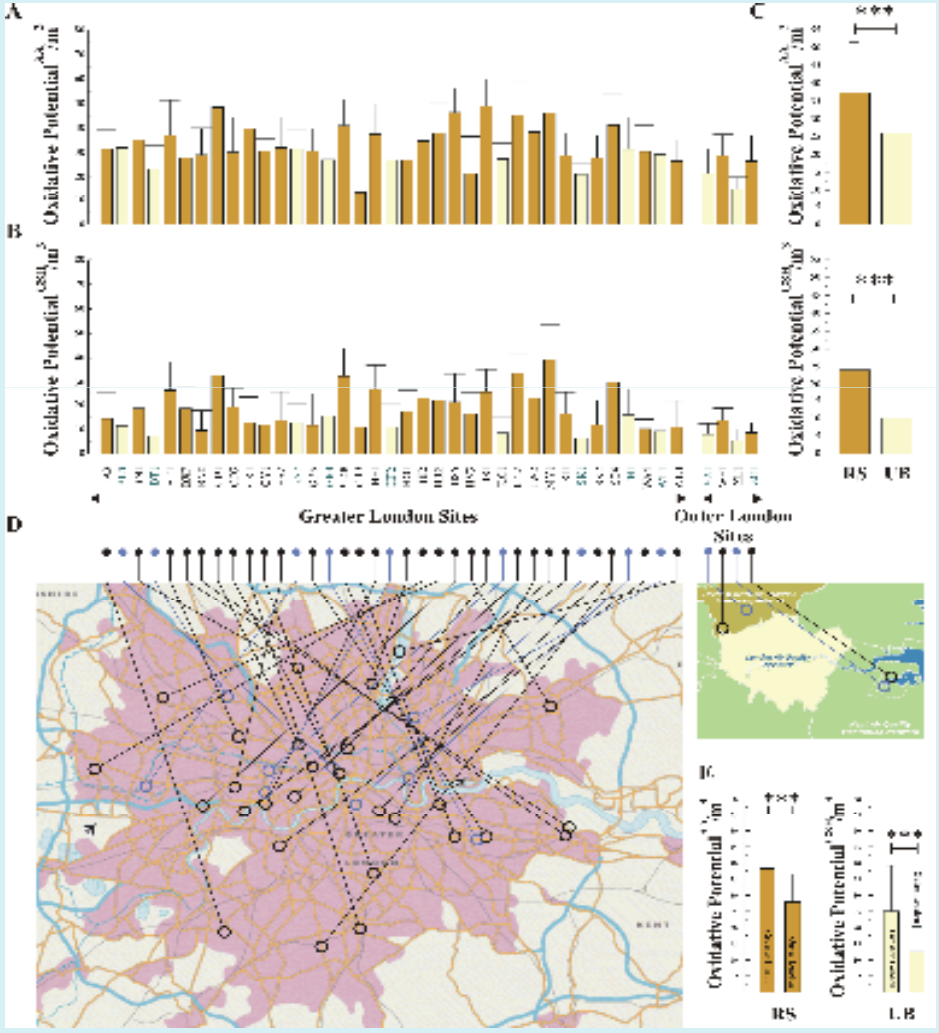
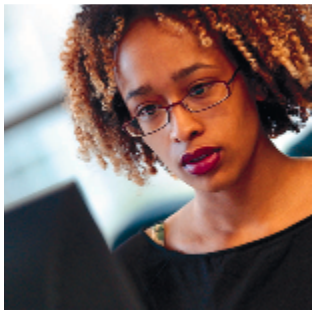


Toxicity (traffic):

Quinones and Metals

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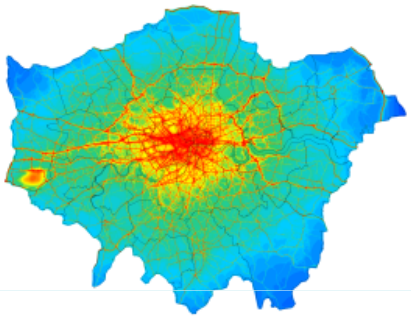
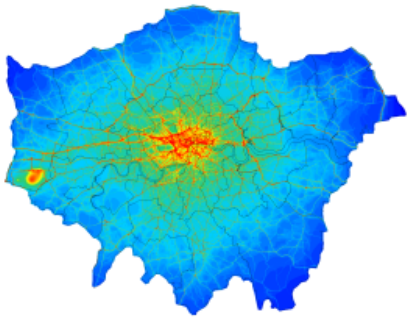
What are the consequences of not getting it right?

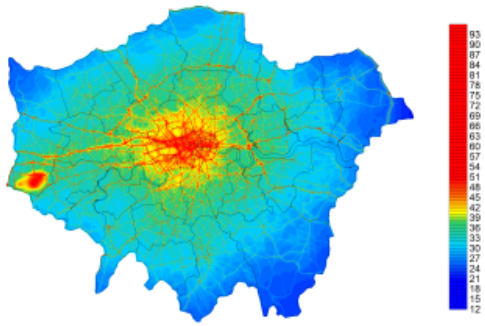


NO_2 2004 (04 met.)

NO_2 2004 (03 met.)



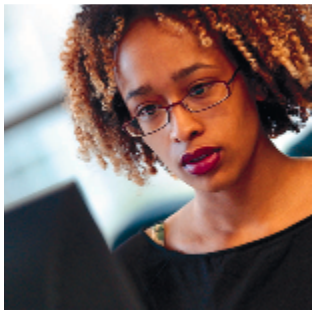
NO_2 2010 (04 met.)



NO_2 2010 (03 met.)

Figure 3 NO_2 concentration maps ($\mu g\ m^{-3}$)

Taken from the GLA report - LAEI 2004 model forecasts.

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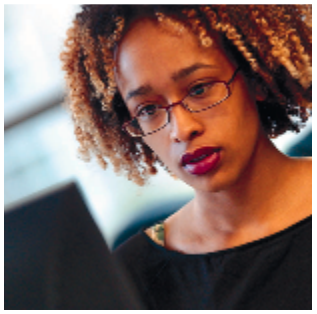
What are the consequences of not getting it right?

Population exposure (# people) for NO_2
(> 40 µg m^{-3}, > 60 µg m^{-3}, Population Weighted Average Concentration (PWAC - µg m^{-3}))

Year 2004 Met 2003			Year 2004 Met 2004			Year 2010 Met 2003			Year 2010 Met 2004		
40 µg m^{-3}	60 µg m^{-3}	PWAC	40 µg m^{-3}	60 µg m^{-3}	PWAC	40 µg m^{-3}	60 µg m^{-3}	PWAC	40 µg m^{-3}	60 µg m^{-3}	PWAC
3671821	17005	41	2249314	6839	38	1464769	1187	36	645000	402	34

Taken from the GLA report - LAEI 2004 model forecasts.

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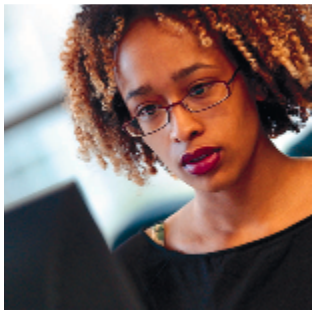
DEFRA research: What are we doing to study the problem?

Creating a hourly emissions inventory in London
Using ATC data, MCC data (12 and 24 hour) and ANPR
Trends between 2003 and 2007 c.f met. normalised measurements
Looking at diurnal profiles of emission and measurements by day of week
weekday and Sunday effects
Trends by day of week
Weekday vs weekend analysis provides an emissions ratio, by vehicle type

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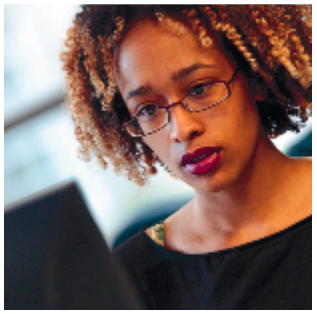
What more can we do?

More traffic measurements please!
Specific air pollution measurements - EC, metals (Cu, Antimony)
Direct measurements of brake particles
Dave/Gary's PM mass closure model – LEZ supersite measurements
Look at London's ANPR data and specifically at what is changing within vehicle categories (vehicle weight/size/diesel vehicle(%))
Better assessments of when vehicles are using their brakes.

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Thanks for your attention…

Thanks to:

DEFRA, Transport for London (TfL)/Greater London Authority, DfT and the HEI

Emily Westmoreland, Hrishi Mittal, David Carslaw, Frank Kelly, Ian Mudway, David Green and Gary Fuller