The PM and NO_x/NO_2 air pollution in Copenhagen and assessment of possible measures to reduce the air pollution

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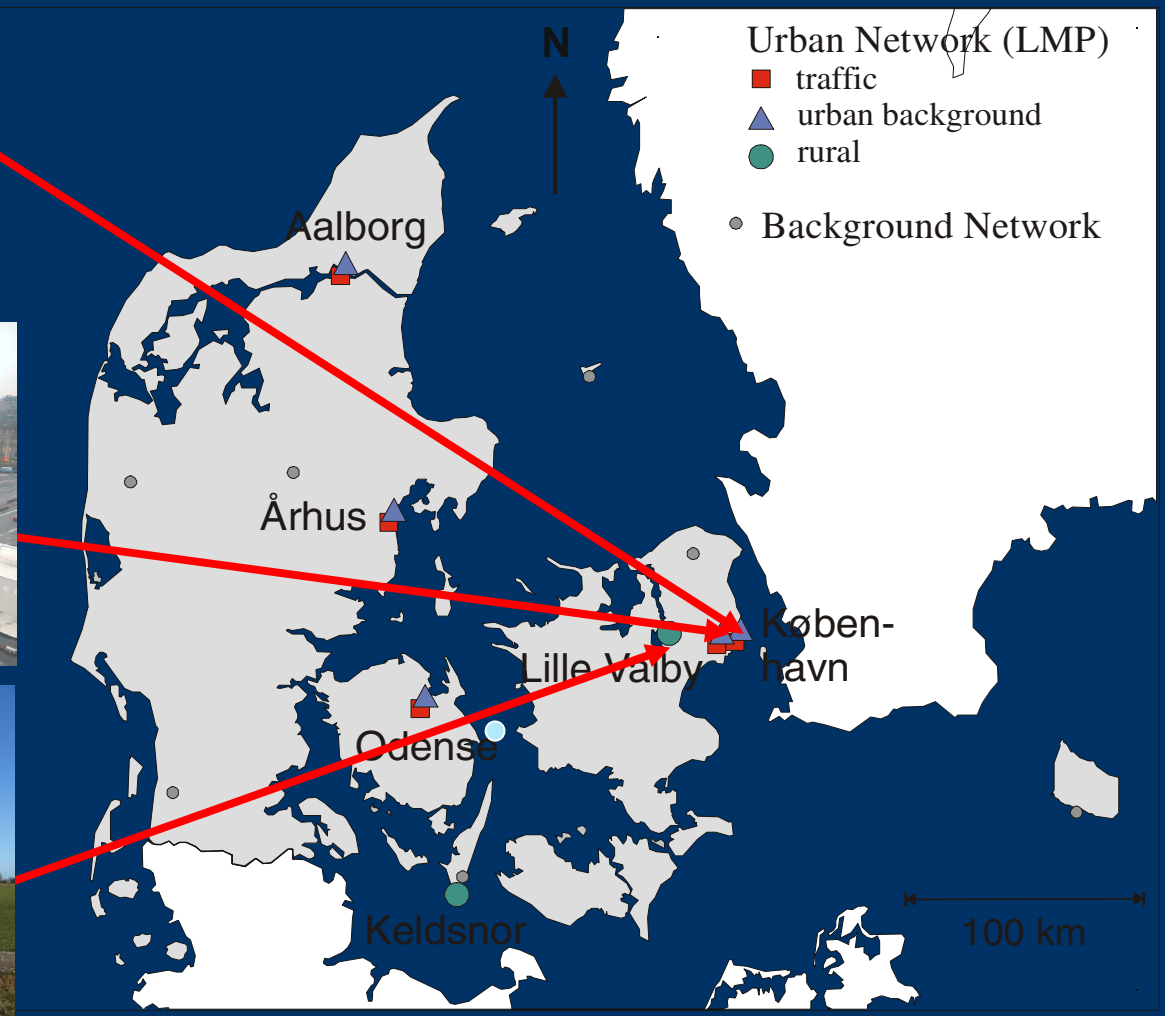
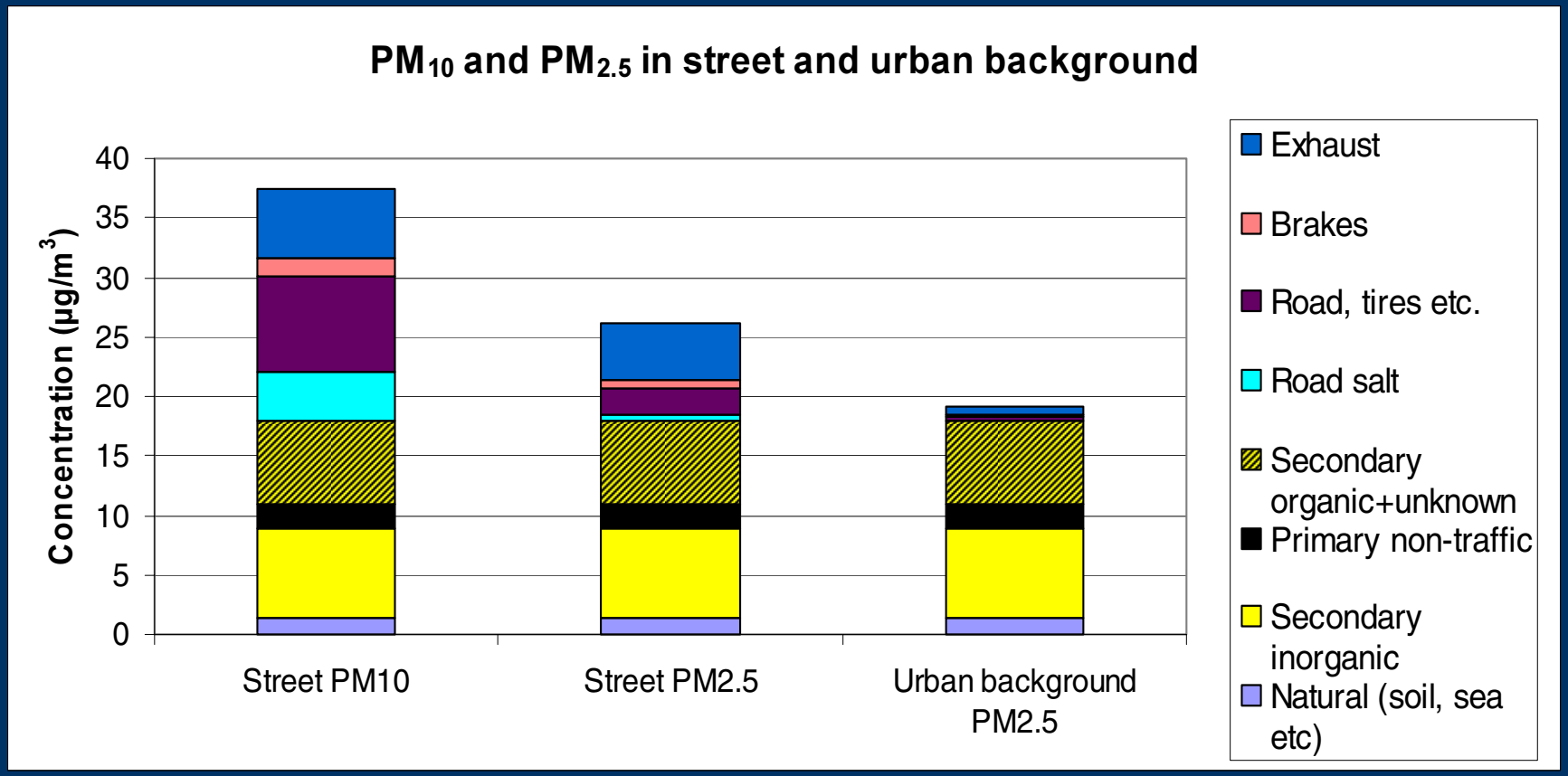
Presented at:
Ultrafine Particles in Urban Air 23 - 24-Oct-2007
Dresden/Germany

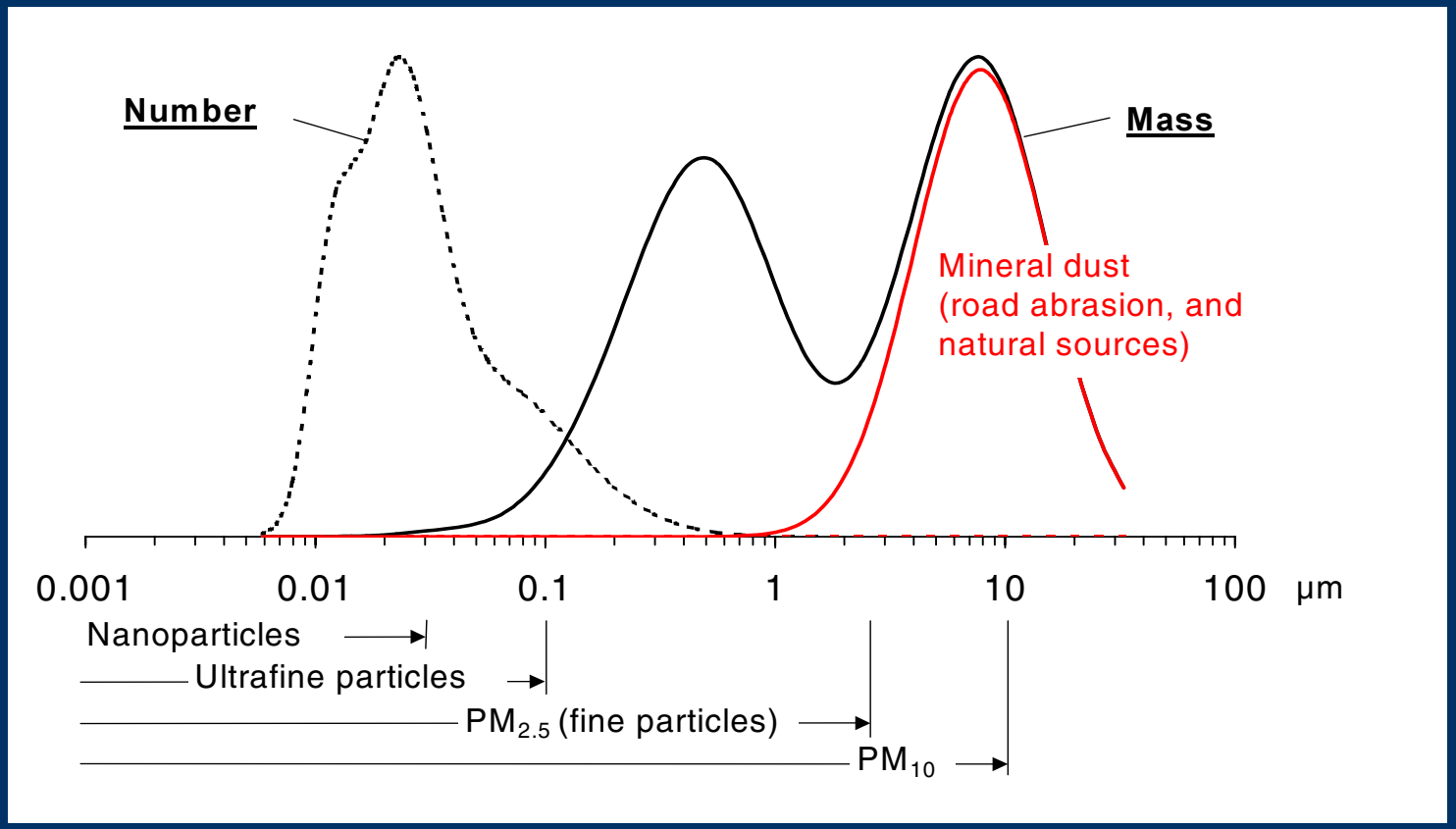
Monitoring strategy



PM in Copenhagen



Particle size distribution in a busy street in Copenhagen



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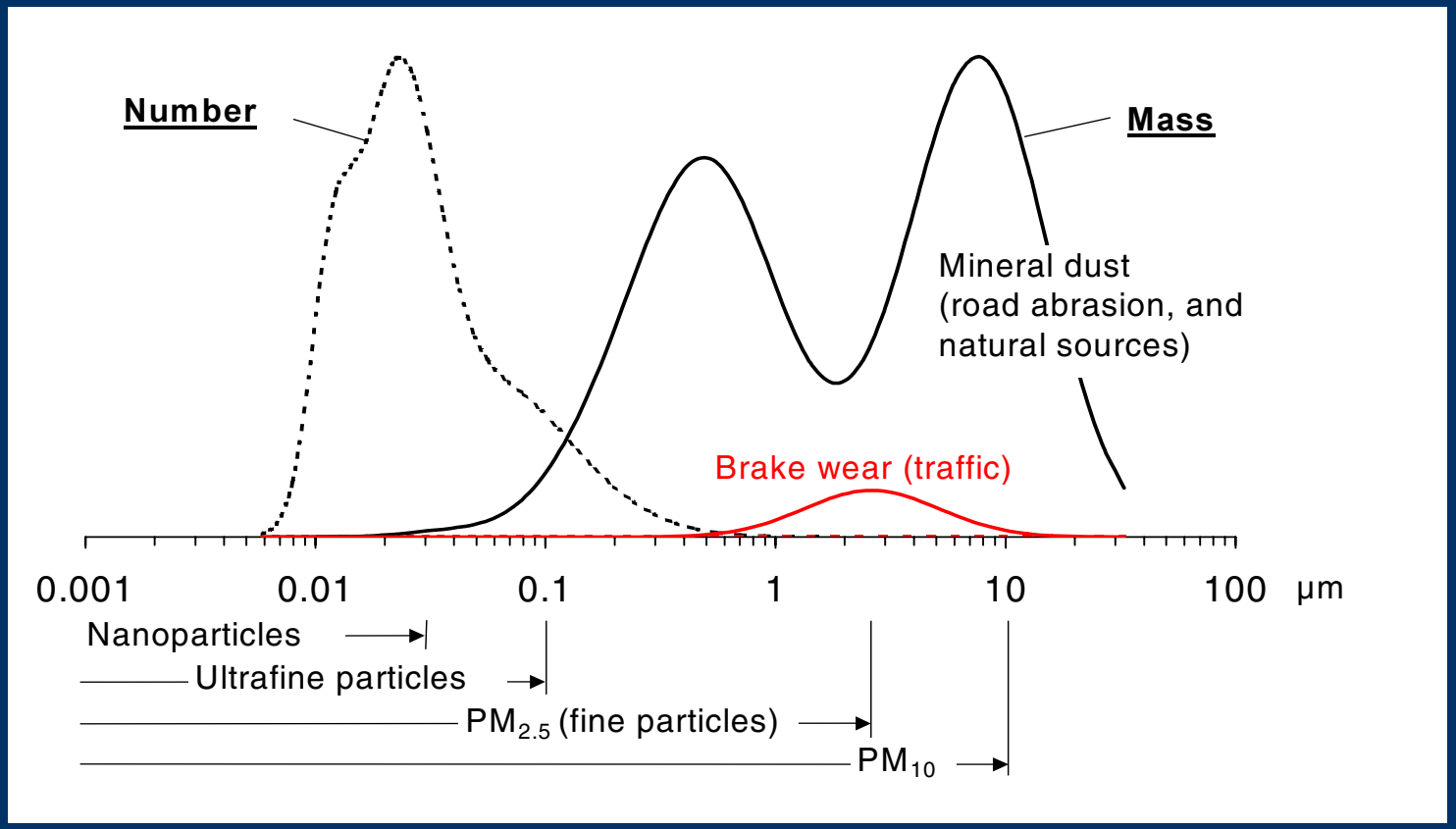

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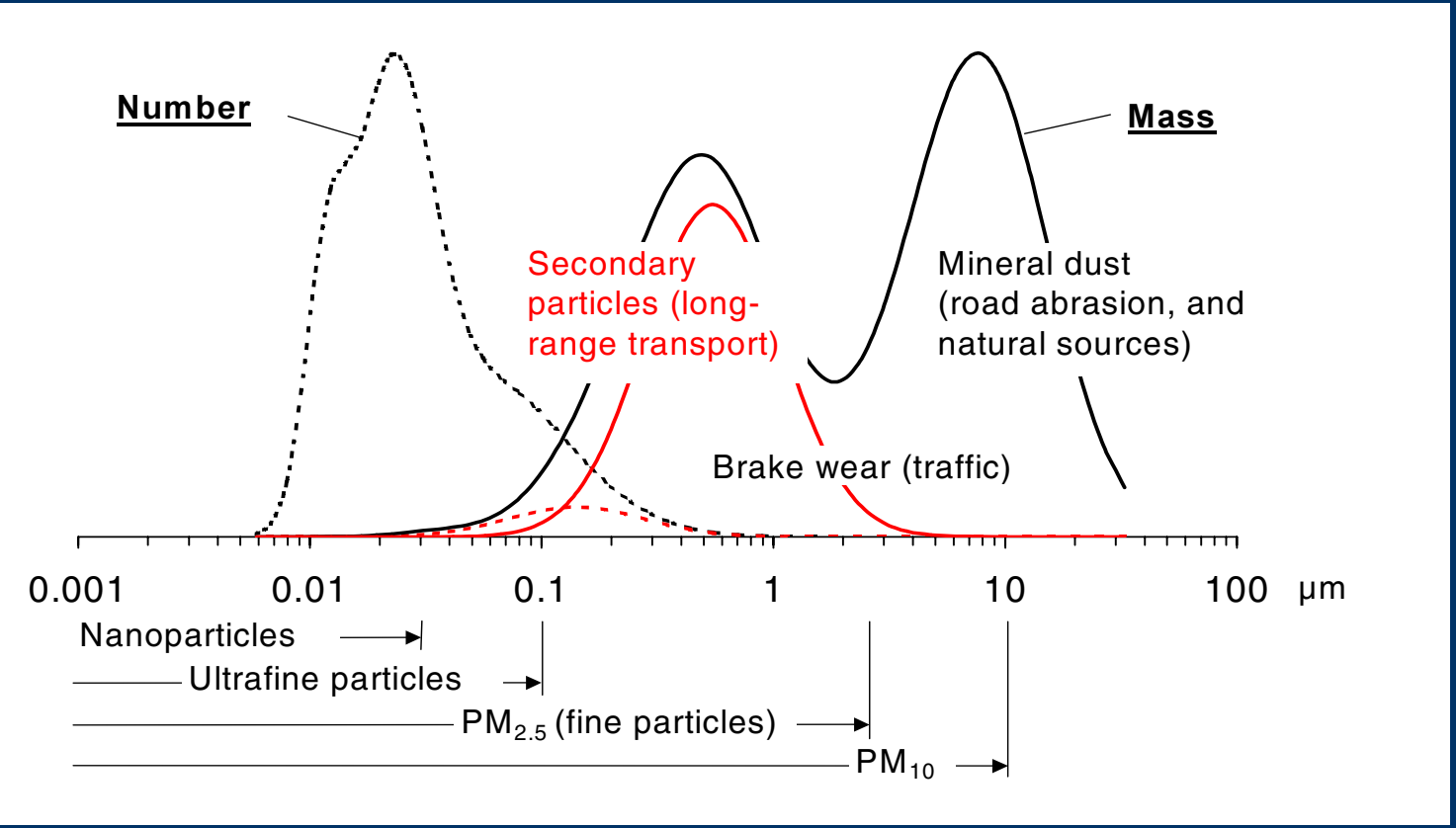

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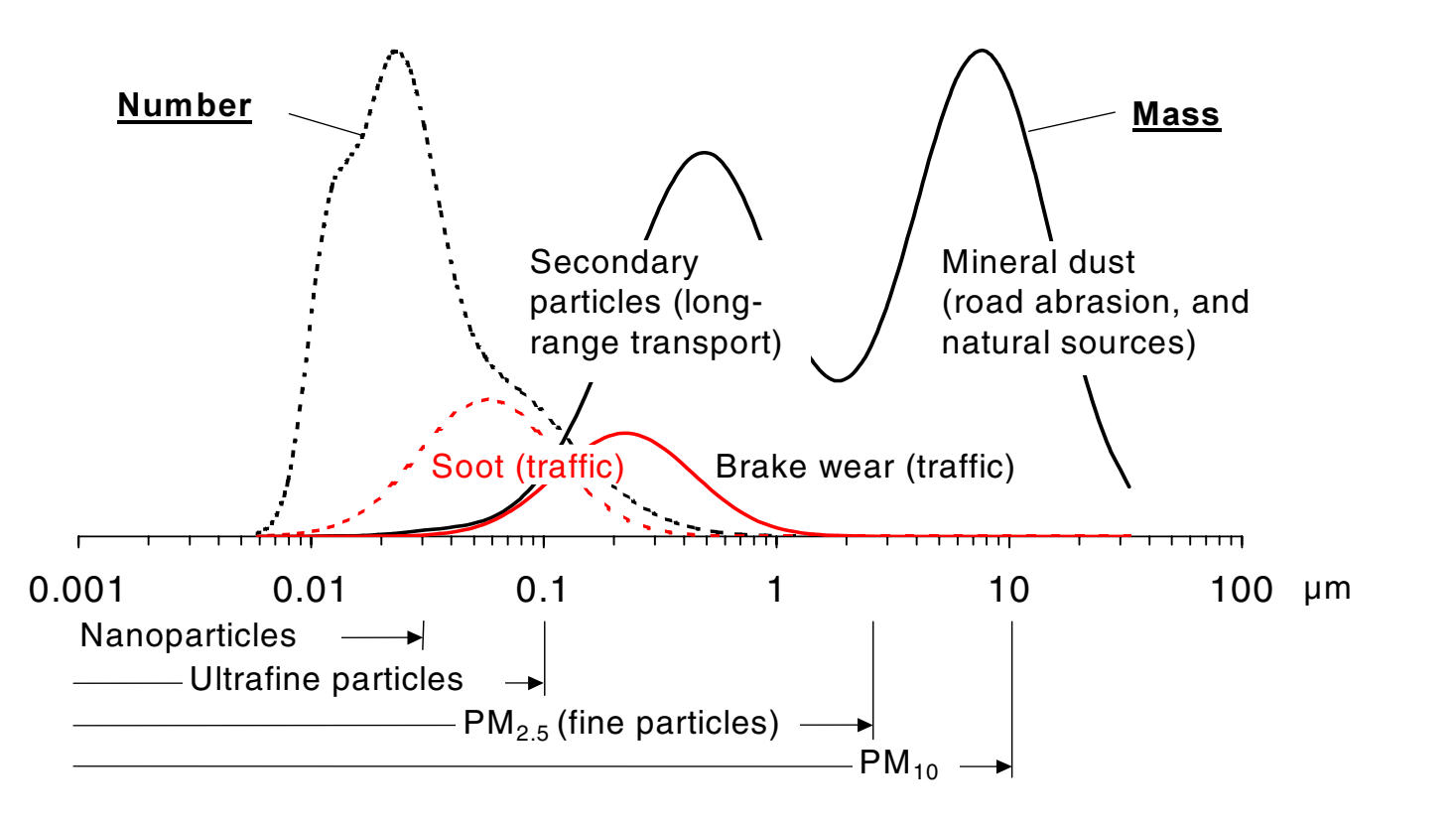

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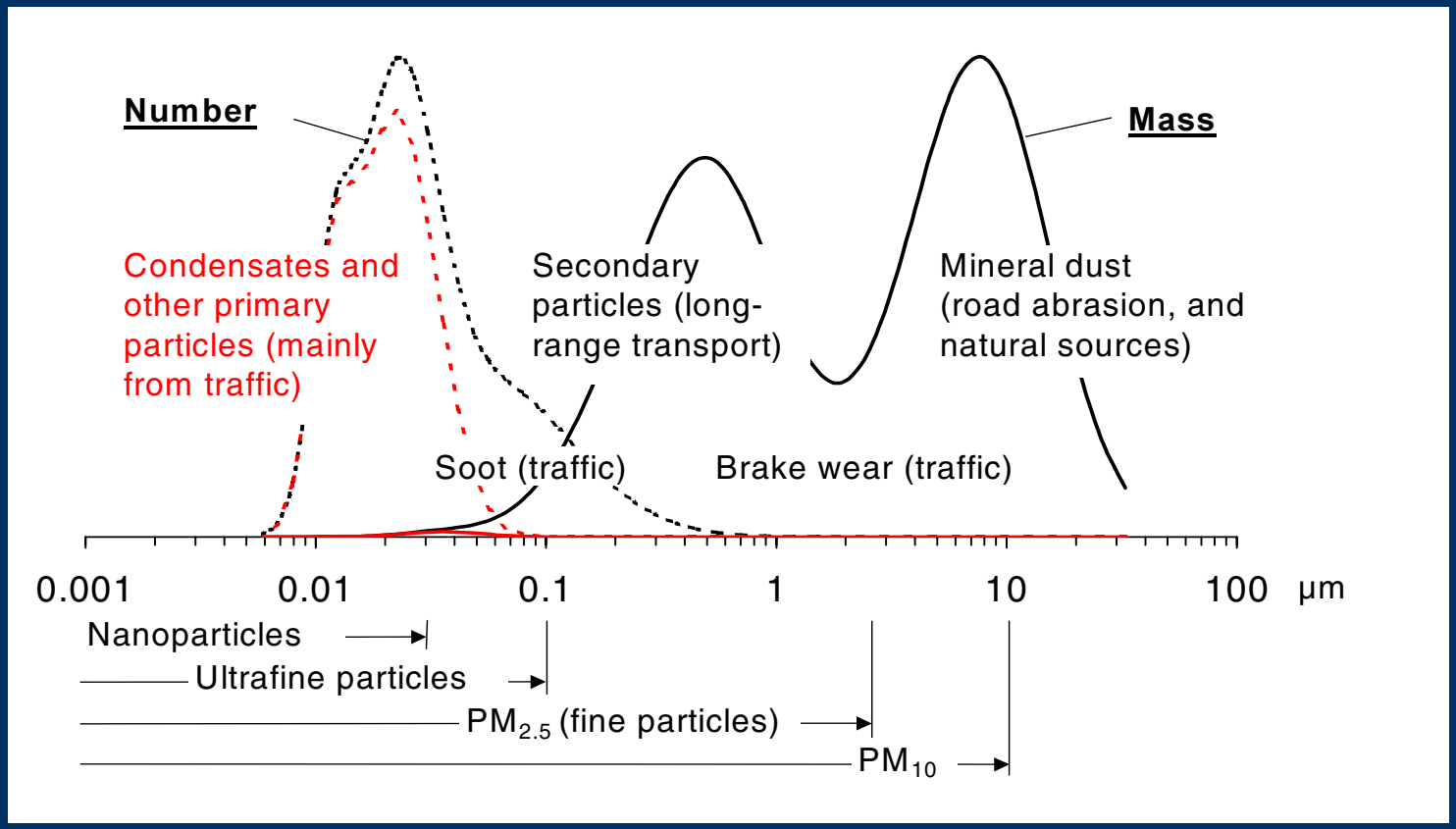
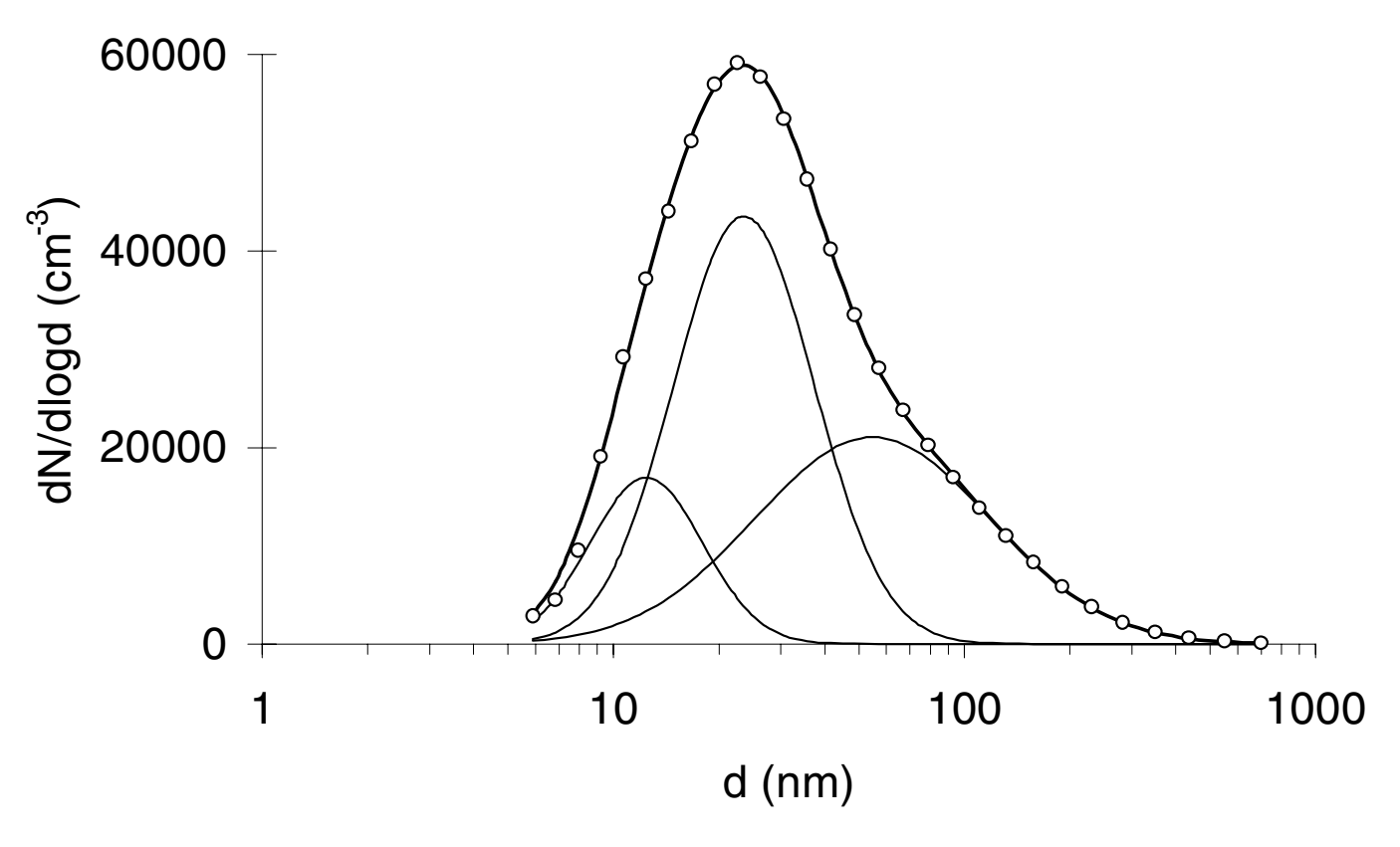


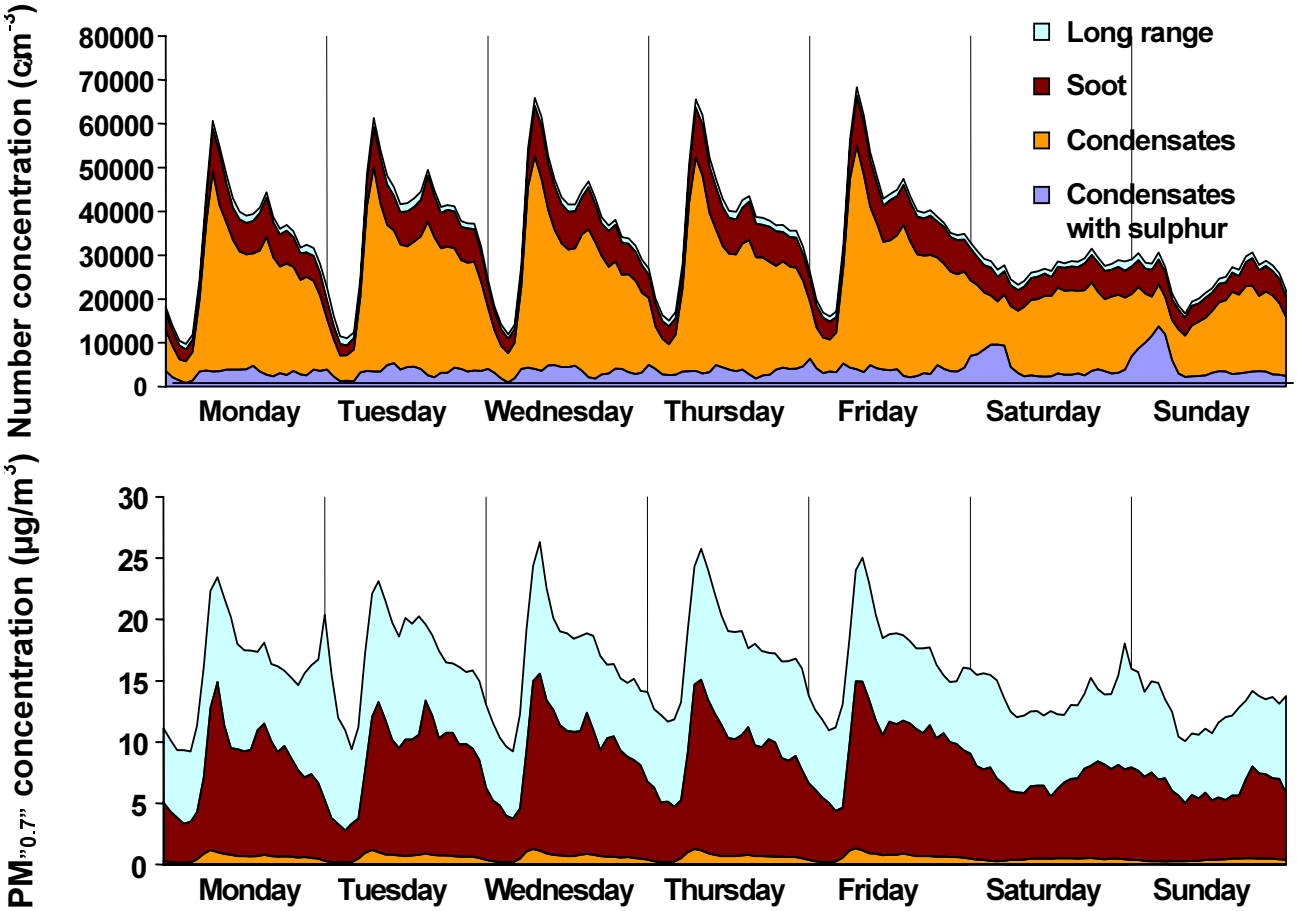
Three UF modes from traffic



Receptor modelling

- The following contributions to UFP were identified:
  - Nano particles (sulphur particles around 11 nm, number) emitted from modern diesel vehicles with oxidising catalysts,
  - ultrafine volatile particles (fuel and lubricant oil particles around 23 nm, number) from traditional diesel vehicles,
  - soot particles (around 60 nm, number) mainly from diesel vehicles and old petrol vehicles
  - fine long range transported particles (around 180 nm, number)

Ultrafine particles in Copenhagen



Possible reductions of traffic contributions to PM

- The traffic (exhaust) contribution to $PM_{2.5}$ in urban background is very small. Possible reductions are very small.
- Greater reductions are possible in streets.
- The traffic (exhaust) contributions to UFP (number) concentrations are significant. Possible reductions.

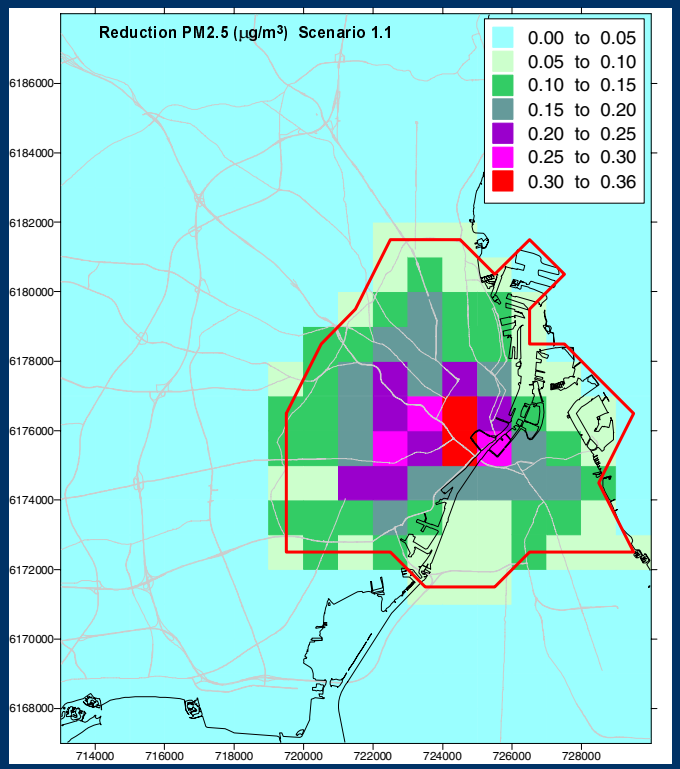
Environmental zones in Copenhagen

- Particle filters on all heavy duty vehicles with EURO III engines or older in the central part of the urban area (10*15 km^2)
- Other scenarios are considered.

Reduction of $PM_{2.5}$ and number concentration

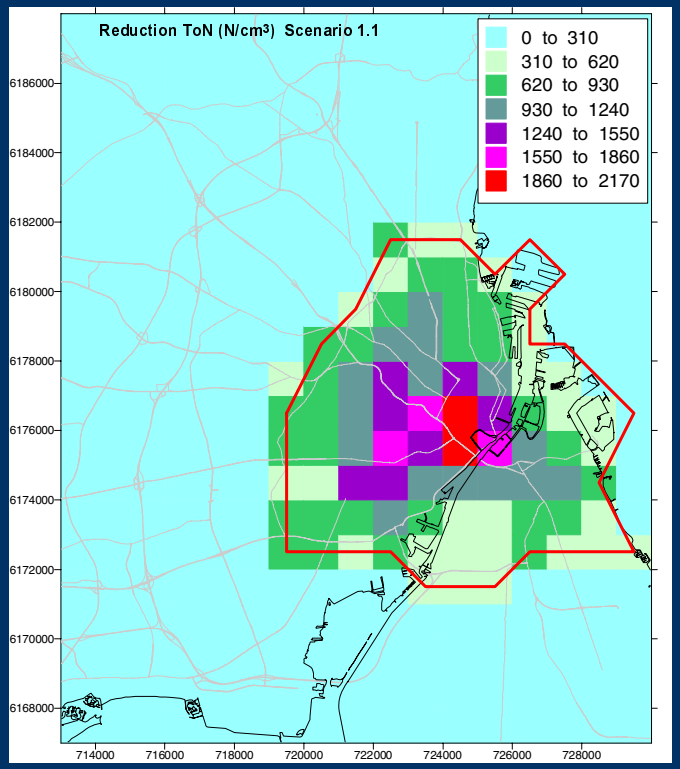
Background average 20 µg/m³

Reduction: 1.8 %



Background average 8,000 N/cm³

Reduction: 27 %

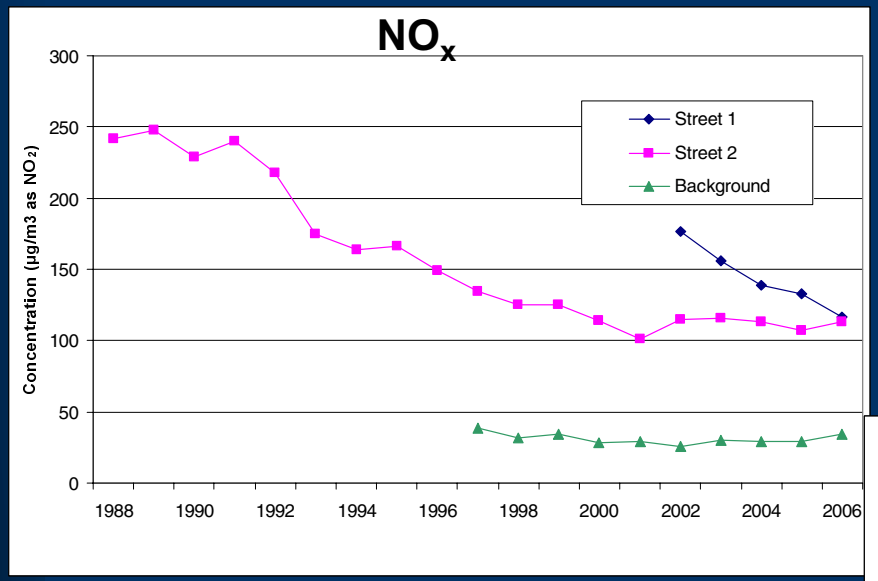


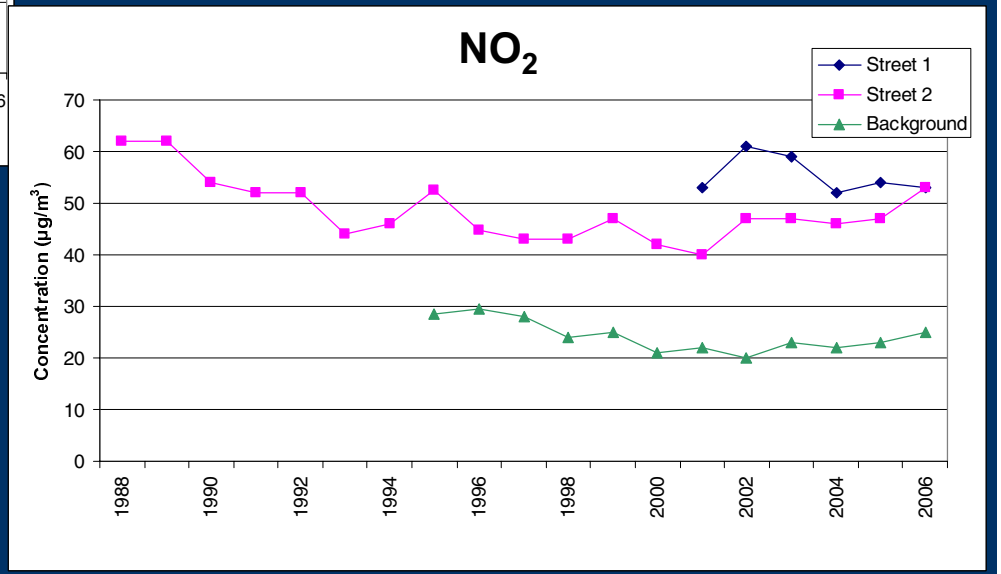
Problems related to the environmental zones

- Some filter technologies (CRT) could give more NO_2. How big is this problem?

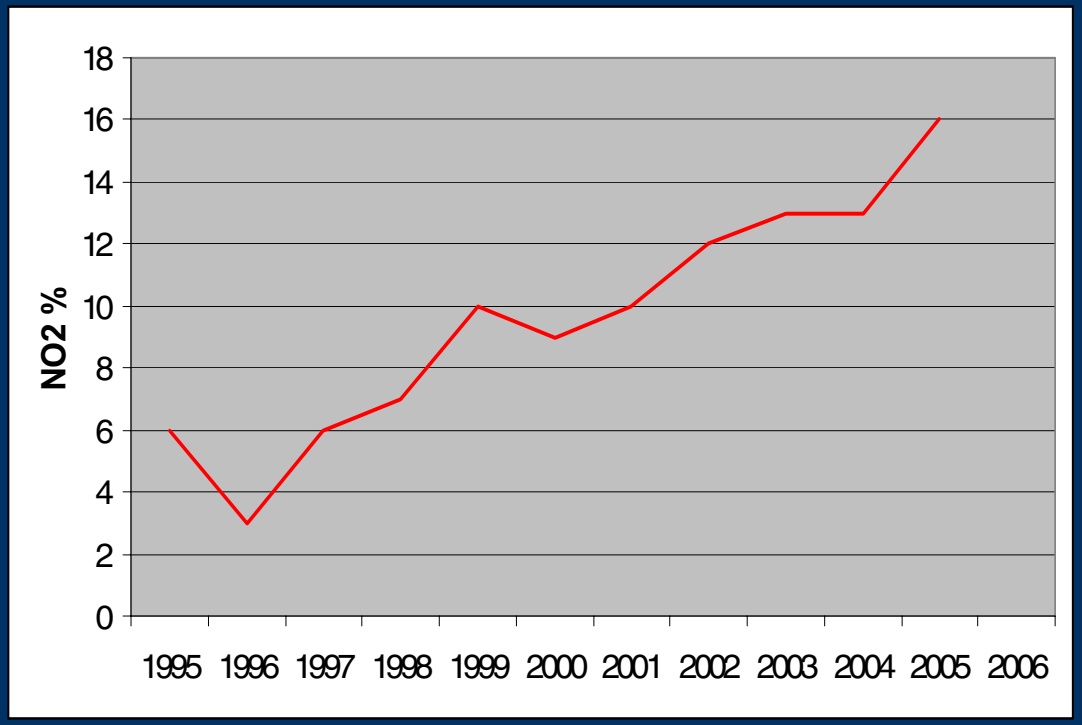
- More diesel passenger cars could also give more NO_2

NO_x and NO_2 trends in Copenhagen



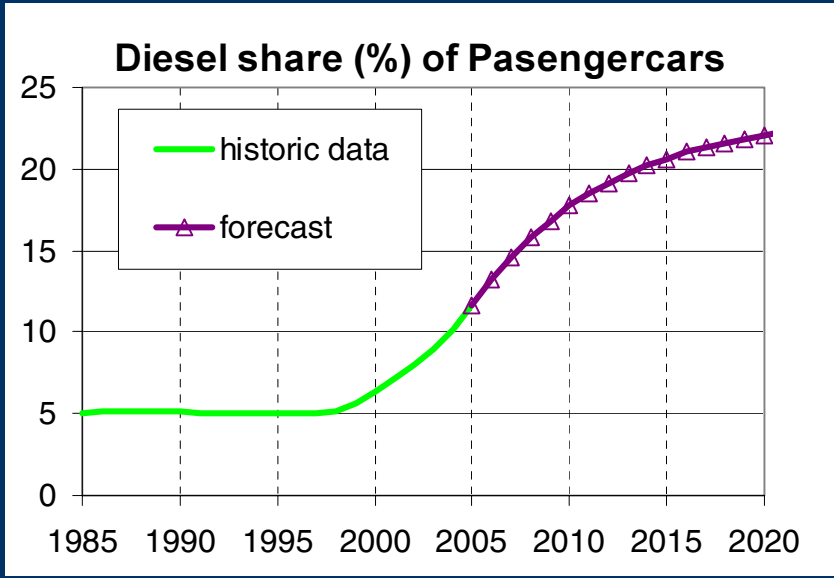


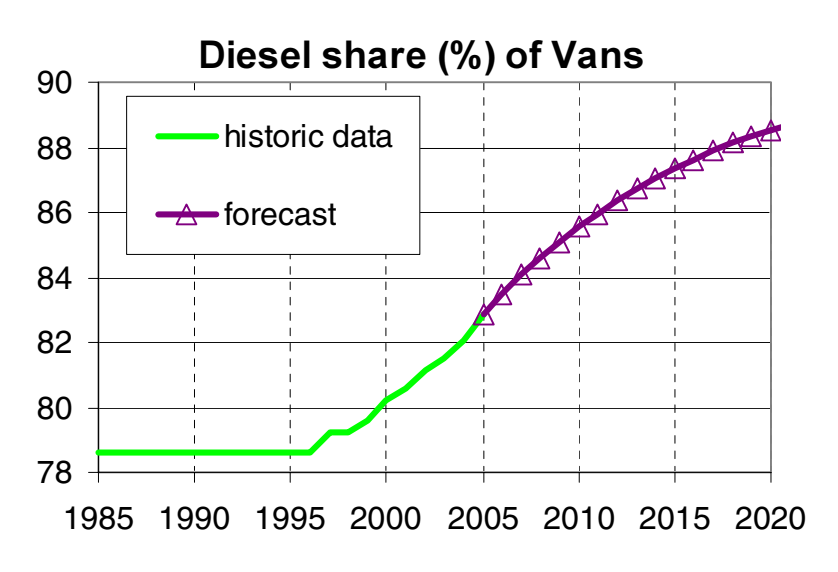
Direct NO_2 share of NO_x measured in Copenhagen



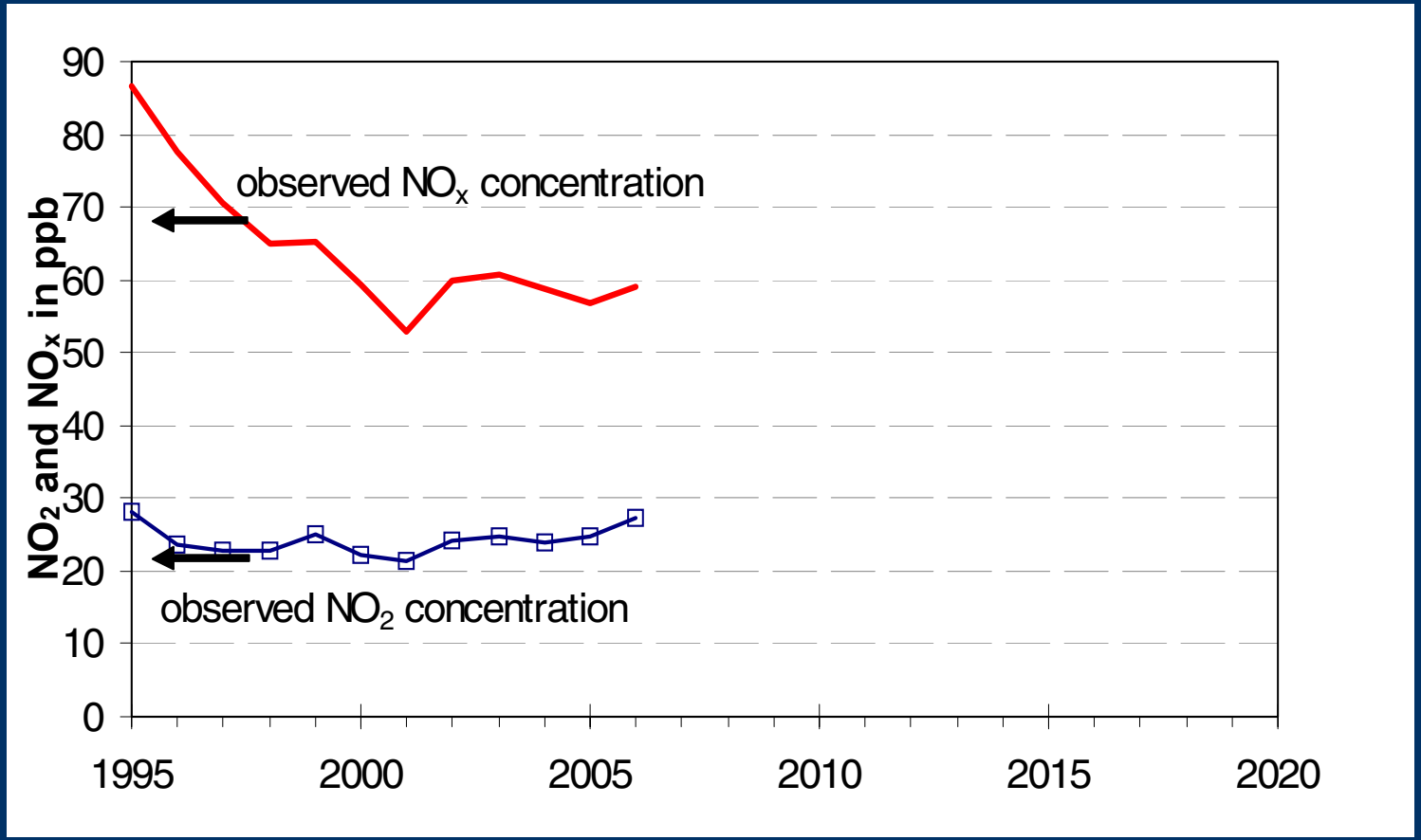
Year	NO_2 share (%)
1995	6
1996	3
1997	6
1998	7
1999	10
2000	9
2001	10
2002	12
2003	13
2004	13
2005	16
2006	18

Diesel share

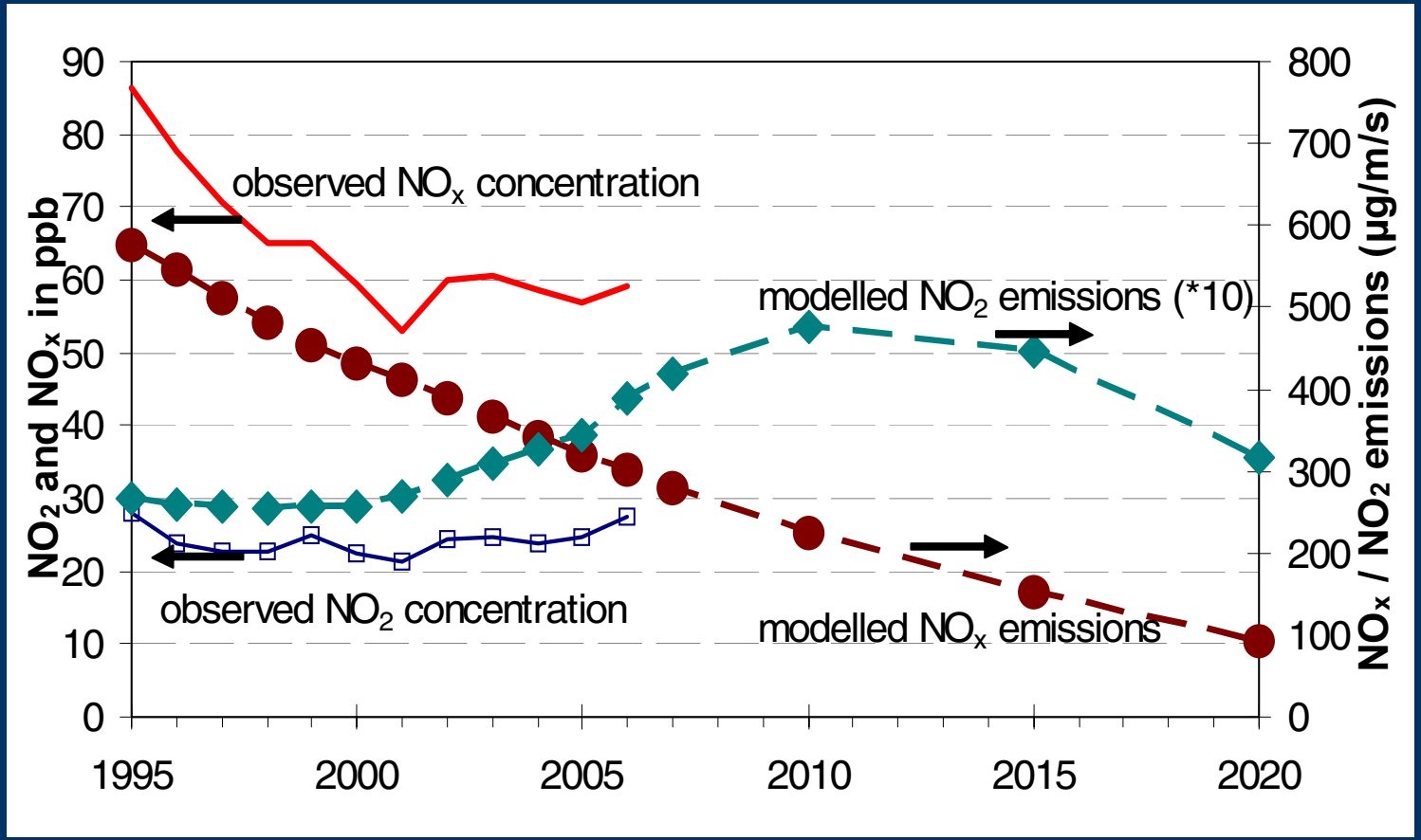




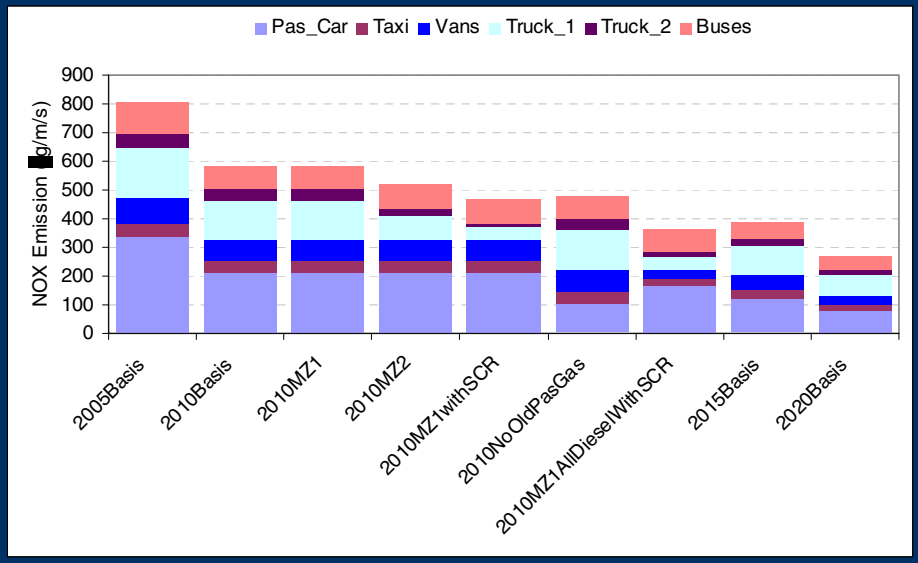
Observed NO_x and NO_2 concentrations

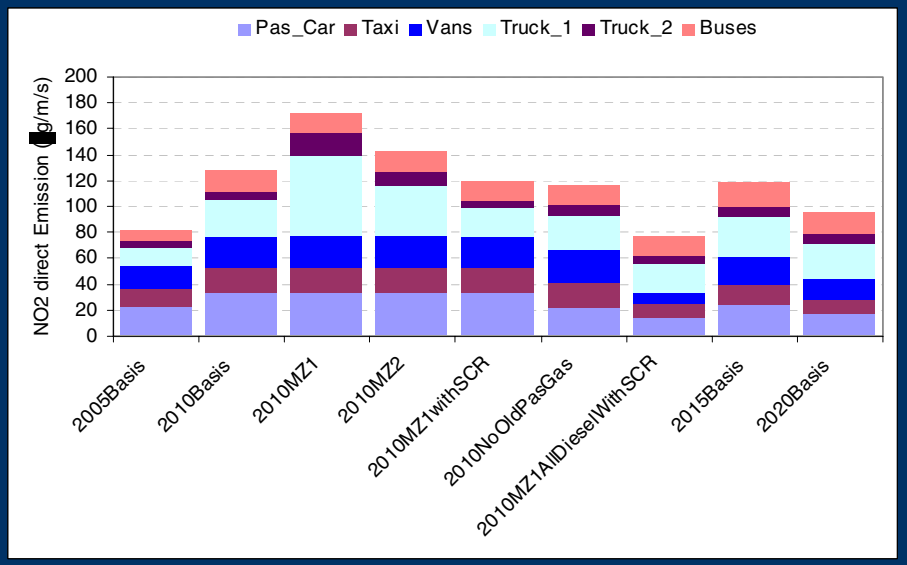


Observed NO_x and NO_2 concentrations and NO_x and NO_2 emissions

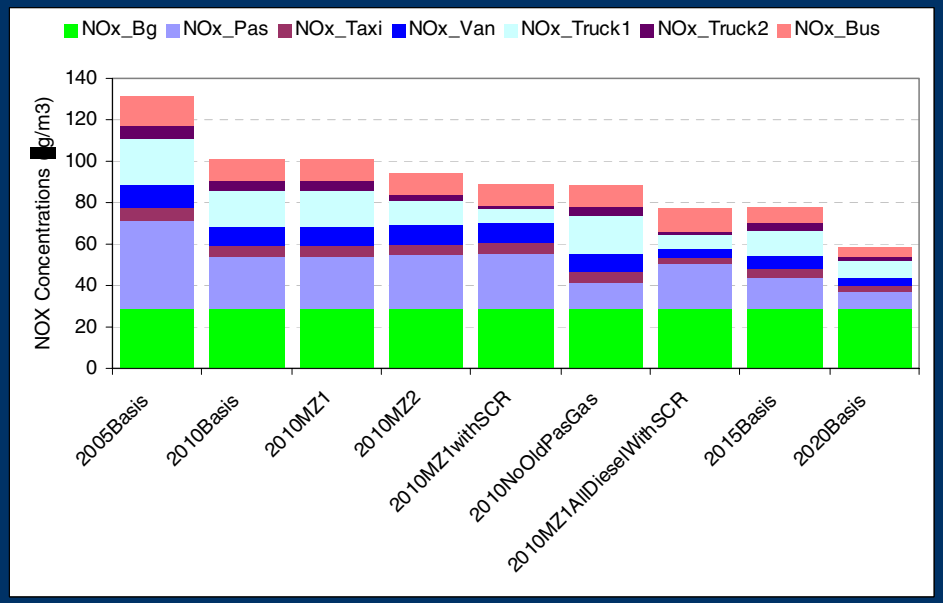


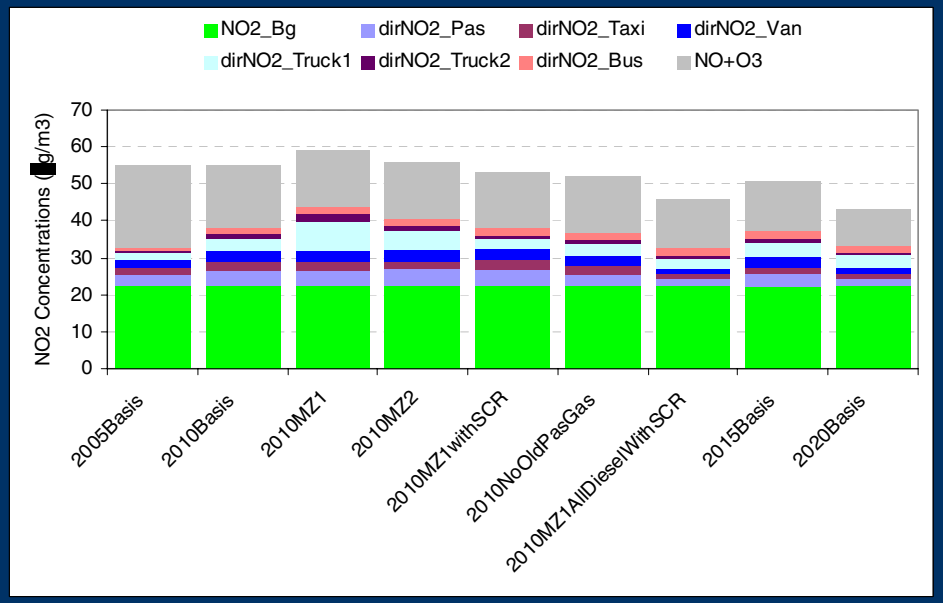
Emissions from different vehicle categories under different scenarios





Scenarios for H.C Andersens Boulevard in Copenhagen, annual average concentrations





Conclusions

- It is possible to attribute and quantify the different part of the particle pollution to the main sources
- This could give better data for health studies
- The following contributions to PM were identified:
  - Nano particles (sulphur particles around 11 nm, number) emitted from modern diesel vehicles with oxidising catalysts,
  - Ultrafine volatile particles (fuel and lubricant oil particles around 23 nm, number) from traditional diesel vehicles,
  - Soot particles (around 60 nm, number) from diesel vehicles
  - Fine long range transported particles (around 180 nm, number)
  - Fine particles from brakes (1-3 µm, mass)
  - Road abrasion and natural sources (>~2.5 µm, mass)
- Results were used for assessment of reduction scenarios, e.g. environmental zones in Copenhagen

Thank you!