Exhaust and non-exhaust PM emissions from road traffic

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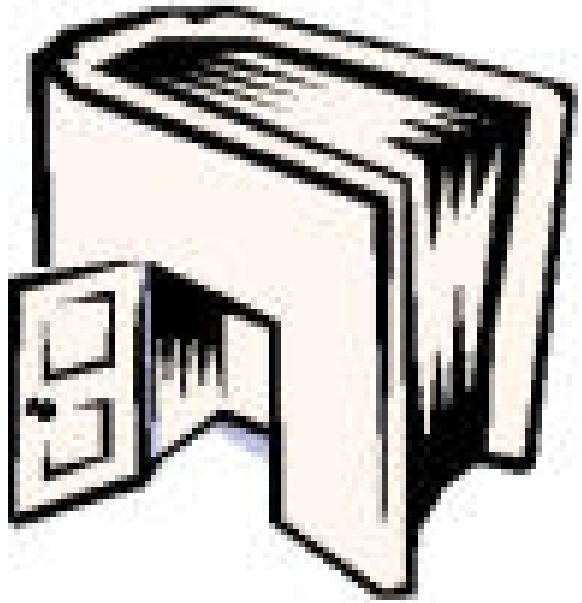
Content

1. Exhaust emissions
2. Monte Carlo analysis
3. Updates
4. Non-exhaust emissions
5. Conclusions



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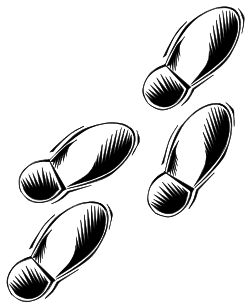
1. Exhaust emissions

Methodology



Emission

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Emission factor * Activity data

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1. Exhaust emissions

Data

- **Diesel vehicles: TEMAT model**
  - Emission factors: speed dependant functions
    - → vehicle type
    - → technology
    - → age
    - → road type
    - → traffic type
    - → cilinder capacity or weight of the vehicle
  - Activity data: total amount of covered kilometres
- **Petrol and LPG vehicles**
  - Emission factors: Literature
  - Activity data: TEMAT model

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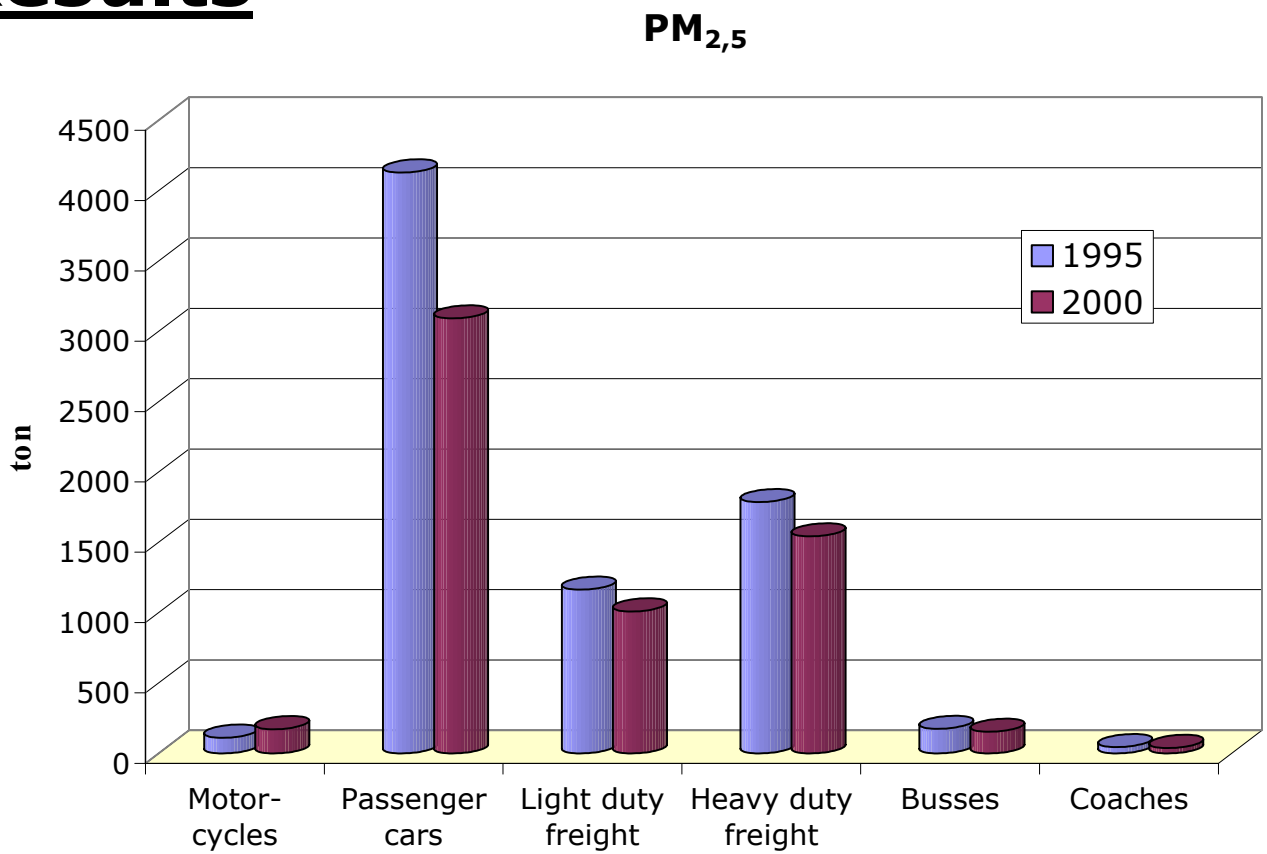
1. Exhaust emissions

Results



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2. Monte Carlo sensitivity-analysis

Monte Carlo

- **Different statistical techniques**
- **Estimated value → probability distribution**
- **Probability functions:**
  - Input parameters of emission factors
  - Activity data

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2. Monte Carlo sensitivity-analysis

Probability distributions

- **Emission factors (Diesel)**
  - Average speed
  - Fraction peak traffic
  - Fraction on urban roads
- **Emission factors (Petrol and LPG)**
  - Emission factor
  - Fraction un urban roads
- **Activity data**
  - Average travelled kilometres for the year 1995
  - The increase (percentage) of travelled kilometeres per year

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2. Monte Carlo sensitivity-analysis

Results

$PM_{2,5}$ (ton)	1995		2000	
	Value	**95% CI**	**Value**	**95% CI**
Total	5762	(7142 - 8022)	6284	(6008 - 6581)
Motorcycles	111	(90 - 133)	172	(140 - 204)
Passenger cars	4354	(3939 - 4820)	3304	(3037 - 3594)
Light duty	1187	(1118 - 1260)	1157	(1088 - 1231)
Heavy duty	1712	(1621 - 1812)	1479	(1414 - 1549)
Busses	155	(112 - 199)	136	(104 - 168)
Coaches	43	(38 - 47)	36	(33 - 39)

Emissions for passenger cars are the most difficult to define

- large 95% CI
- Due to the older diesel passenger cars
- 95% CI decreases between 1995 and 2000

→Replacement of old vehicles into the new generations of vehicle technologies

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2. Monte Carlo sensitivity-analysis

Decrease between 1995 and 2000

Statistics	1995-2000 (ton)
Average	1.276,47
Standard deviation	130,50
0,0 % percentile	880,78
2,5 % percentile	1.030,91
5,0 % percentile	1.062,61
50,0 % percentile	1.277,54
95,0 % percentile	1.492,59
97,5 % percentile	1.535,11
100,0 % percentile	1.746,17

Significant decrease in PM exhasut emissions from road traffic between 1995 and 2000

- Average decrease = 1 273 ton
- 95% CI shows there is significant decrease (1 062 ton – 1 493 ton)

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3. Updates

New insights

- **Amount of lorries per weight class**
  - Underestimation of the weight class 32 to 40 tonne in the past
- **Yearly driven kilometres**
  - Overestimated for the light duty vehicles for freight in the past
  - Total amount of vehicle kilometres driven overestimated with 15% in the past
- **Emission factors have been reviewed**
  - PM: did not change a lot
  - NO_X: higher than expected
- **TEMAT: only diesel PM**
  - PM emissions from diesel-fuelled vehicles decrease in time
  - PM emissions from vehicles driven on petrol, LPG, … become more import in the future

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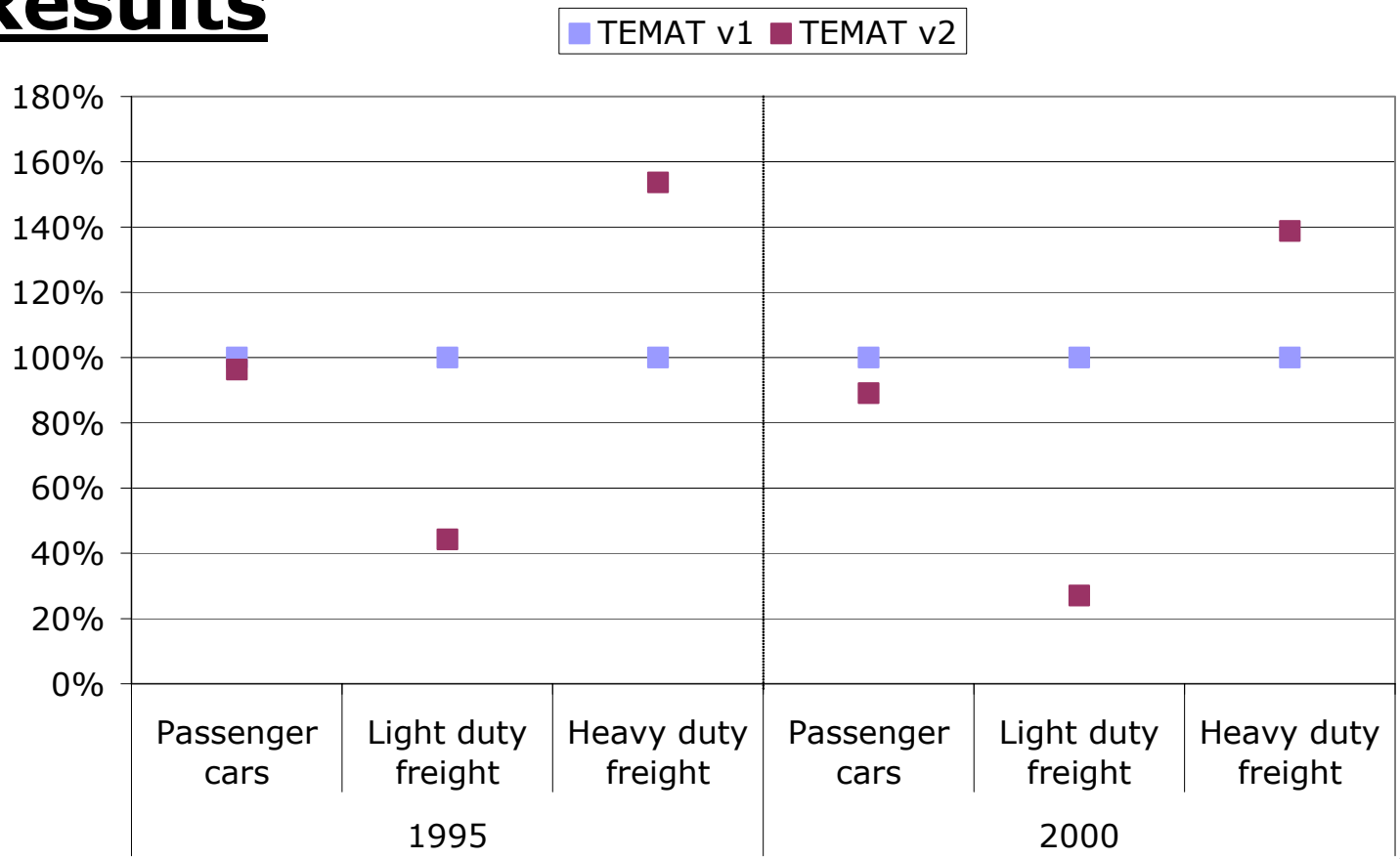
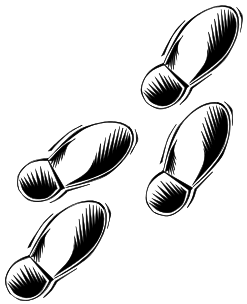
3. Updates

Results



4. Non-exhaust emissions

Methodology



Emission

= Emission factor * Activity data

- **Only limited information is available**
  - → General emission factors were used
- **Dependent on the circumstances**
  - → Normal or peak traffic
  - → Speed
  - → Weather
  - → …

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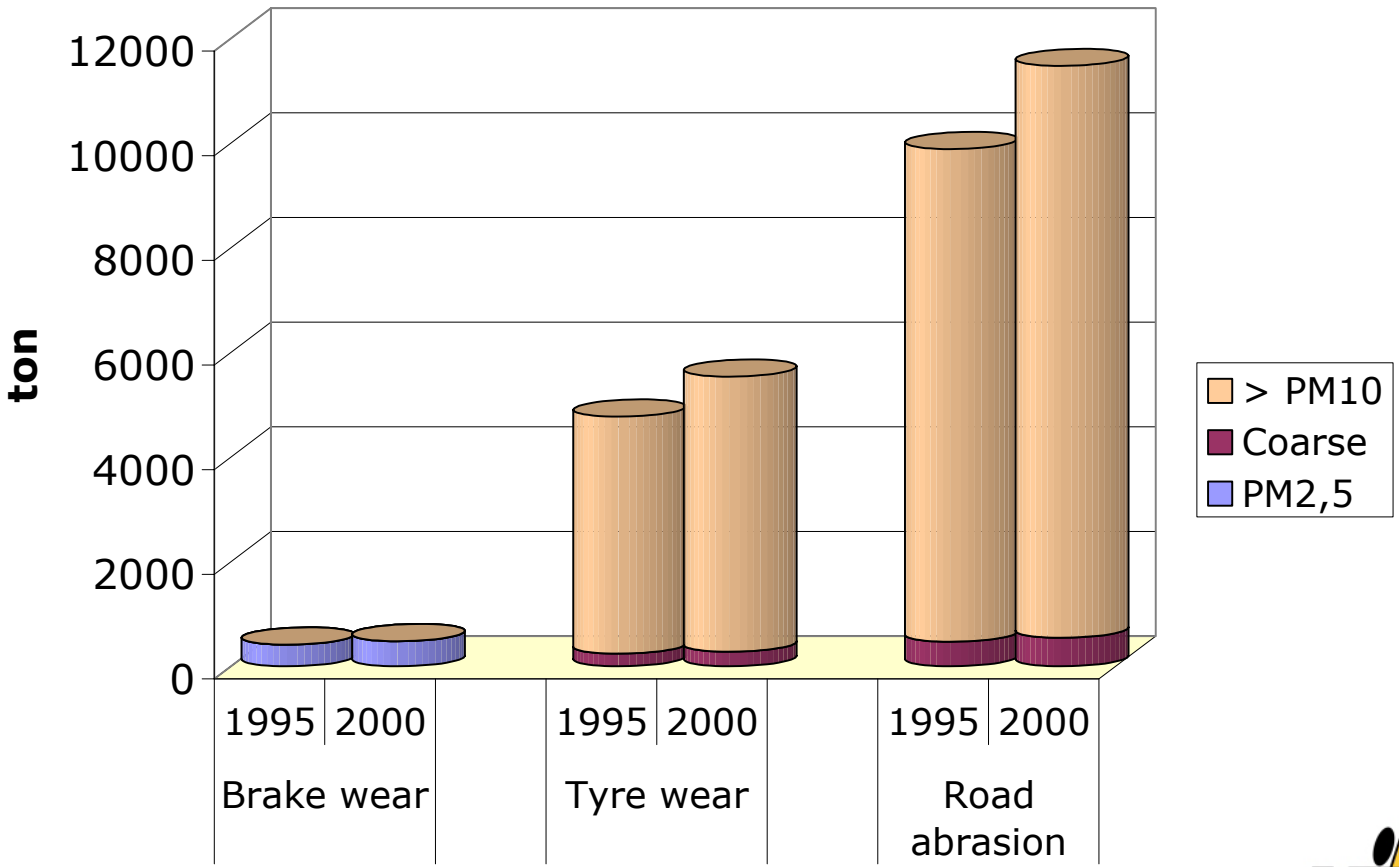
4. Non-exhaust emissions

Results



4. Non-exhaust emissions

Research

More research is necessary

→ Extensive measuring programs
→ Inventory of statistical data
→ Possible reduction measures
- Materials for road surface
- Materials for tires
- Materials for breaks

→ Health implications

5. Conclusions

- **Large reductions** have been achieved between 1995 and 2000 for exhasut PM emissions from road traffic
- **Further reduction** is still necessary
- The **uncertainty** on the total of the calculated emissions will **decrease** in time due to the introduction of cleaner passenger cars
- **Refinement of statistical data** is very important for the results of the calculated PM exhaust emissions
- More attentions has to be made on PM emission factors for **vehicles driven on petrol, LPG, …**
- Contribution of **non-exhaust emissions** will become **more import** in the future
- **More research** needs to be done for the non-exhaust emissions

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Questions?

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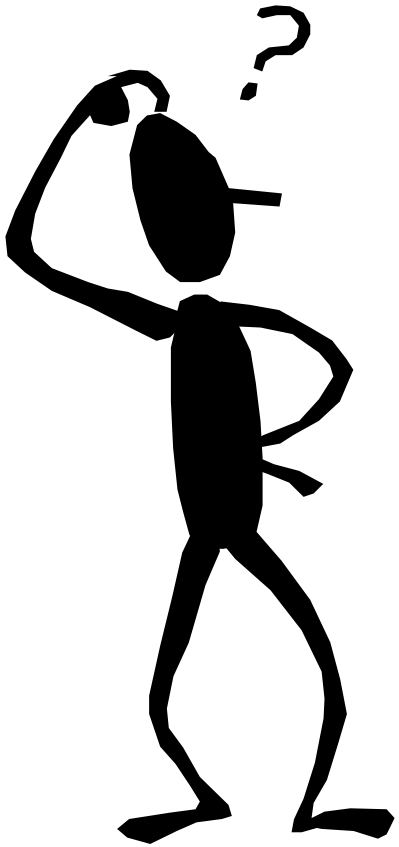

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