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Quantification of the emissions from personal mobility

Estimation based on general mobility surveys

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OVERVIEW

1. Aim and objectives
2. Data sources
3. Methodological approach
4. Main results
5. Other application examples
6. Concluding remarks

1. AIM AND OBJECTIVES

Aim:

- Develop a methodology in order to estimate the environmental effects associated to daily personal mobility at two time points (before and after the economic downturn)
- Estimates from general mobility surveys and GIS-based traffic models

Objectives:

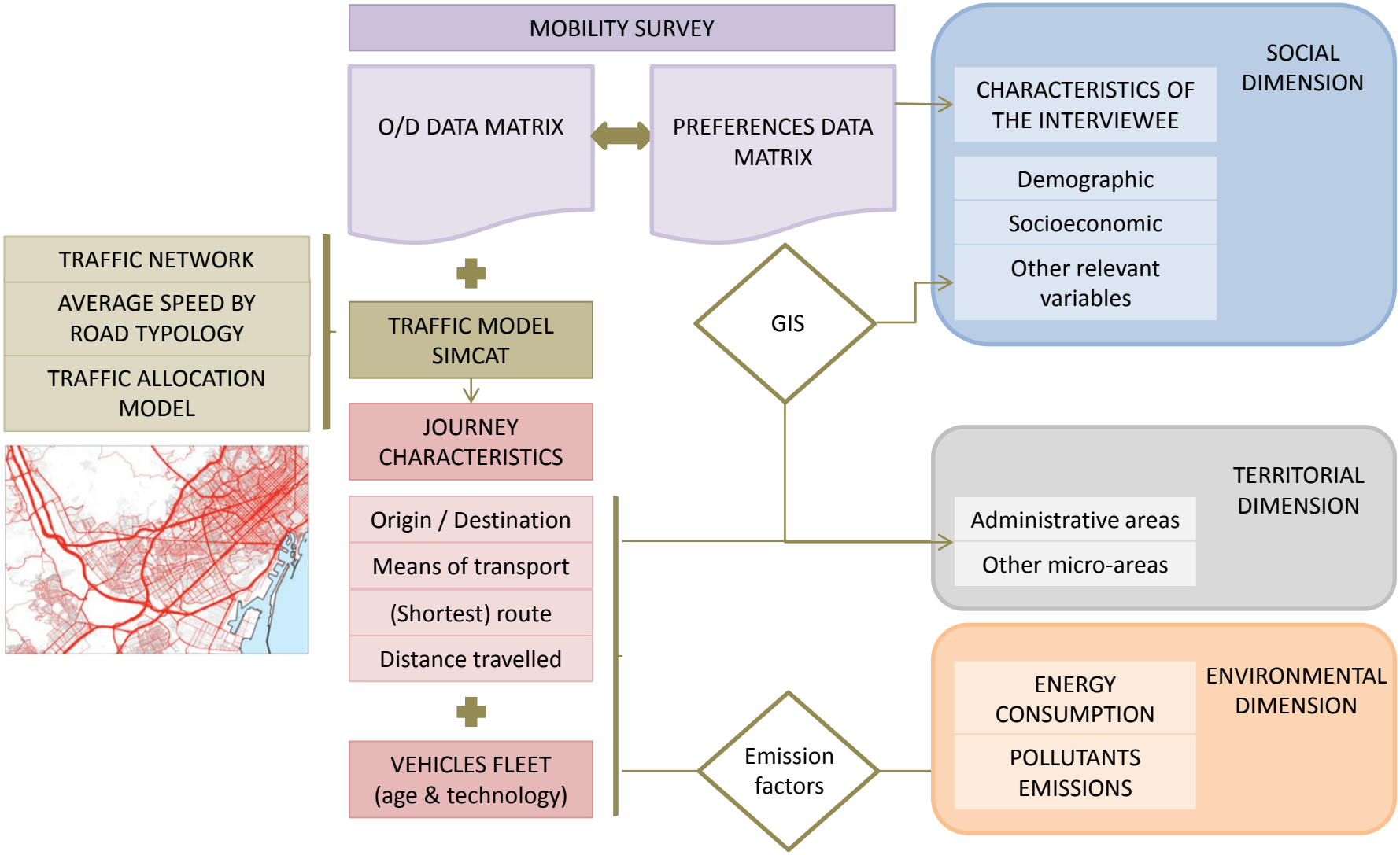
- Estimation for each journey chain of associated energy consumption (goe or g)
- Estimation for each journey chain of associated emissions of CO_2, CO, NOx, NO_2, PM_{10} (g/day)
- Comparison of energy consumption and emissions of daily personal mobility at two time points

2. DATA SOURCES

- General mobility surveys (Catalonia & Barcelona's metropolitan region):
  - Survey of Daily Mobility of Catalonia 2006 (EMQ 2006) (before)
  - Metropolitan Mobility Database 2011/13 (BBDDMM 2011/13) (after)
- Traffic model SIMCAT (Modelling and Information System for Regional Policy Evaluation in Catalonia)
- EMEP/EEA CORINAIR (Core Inventory of Air Emissions)

3. METHODOLOGICAL APPROACH

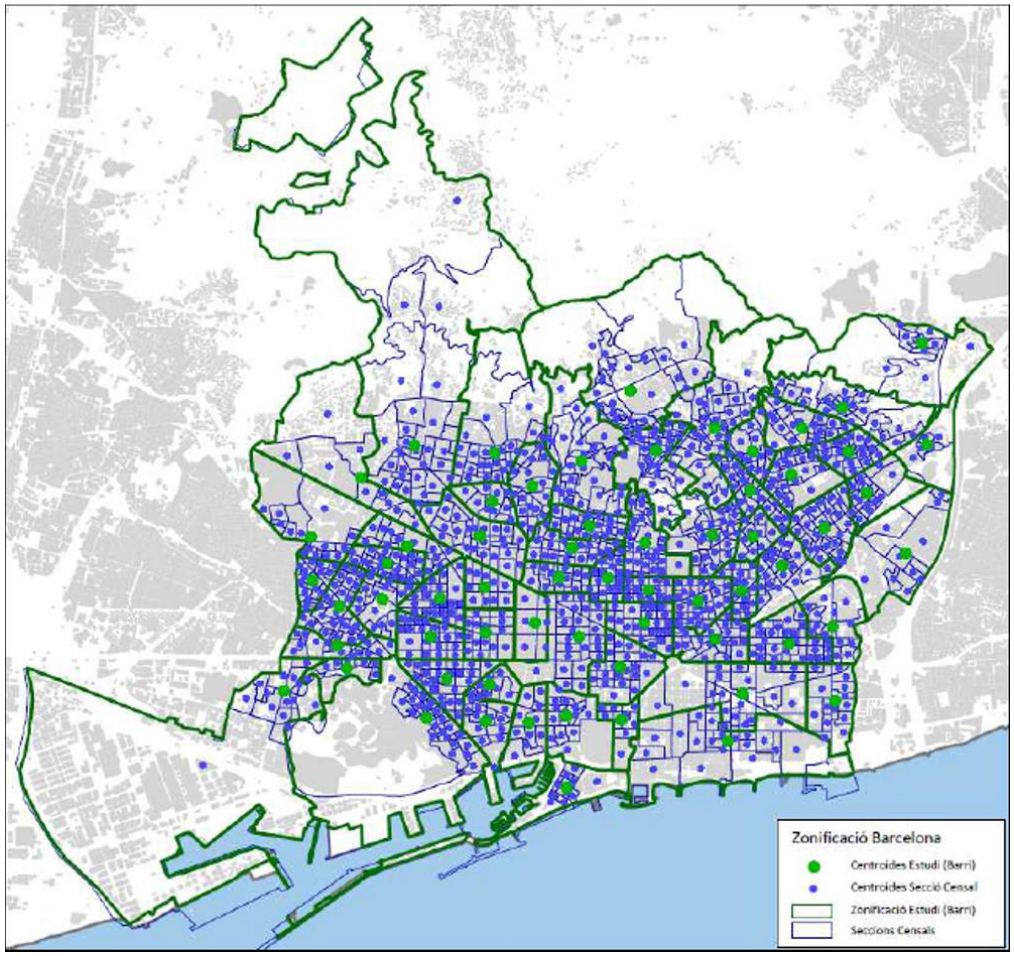
The approach in a nutshell:



3. METHODOLOGICAL APPROACH

1. Preparation of the databases of the mobility surveys

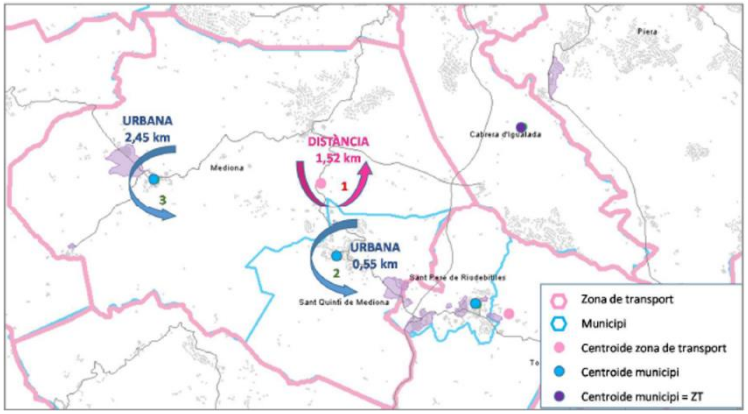
- Homogenization of the study units from the 2 mobility surveys (transport areas of different sizes)
- Selection of comparable study populations
  - Individuals aged over 15 years
  - Living within the RMB



3. METHODOLOGICAL APPROACH

2. Estimation for each O/D of: journey length, travel time, fuel consumption and emissions for the minimum path through (shortest route)

- Between transport zones
- Within transport zones



$$Cost = L \cdot CO + Peatge \cdot L + T \cdot VT$$

Where:

L: journey length (km)

CO: Operating costs (0,09 €/km)

Peatge: Kilometer toll (€/km)

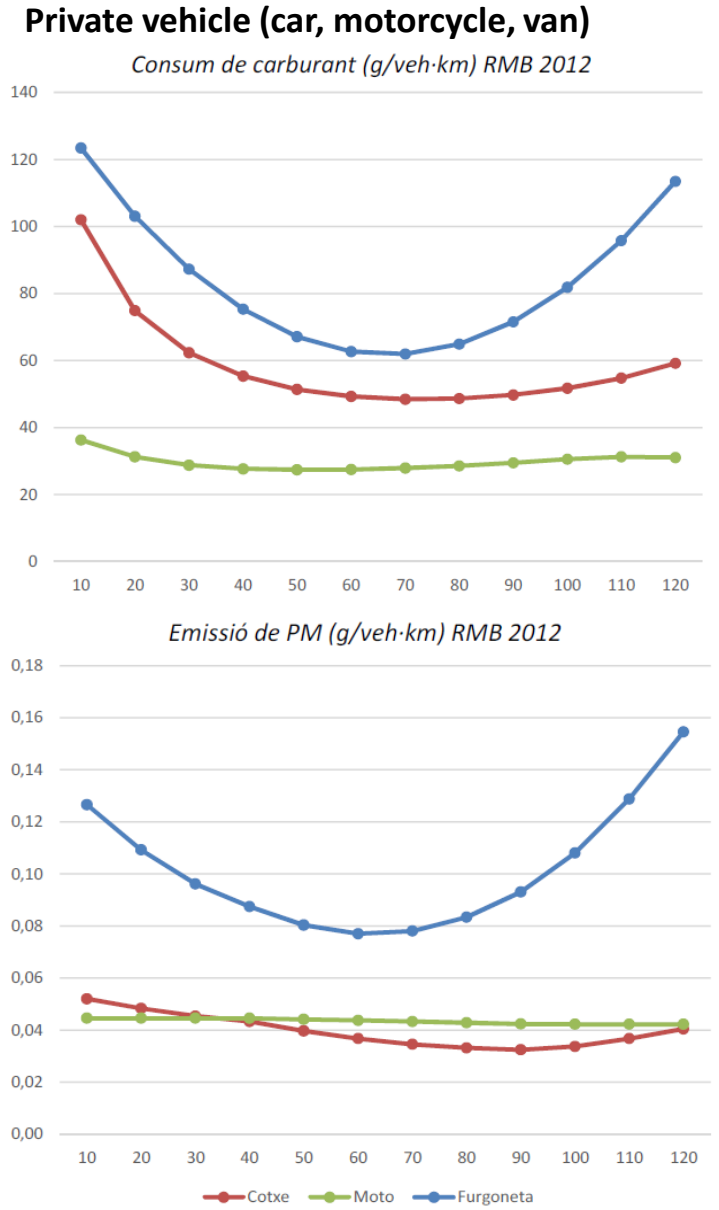
T: Travel time (h)

VT: The value of time (9,85 €/h)

3. METHODOLOGICAL APPROACH

3. Determination of energy consumption and emissions emitted in urban areas

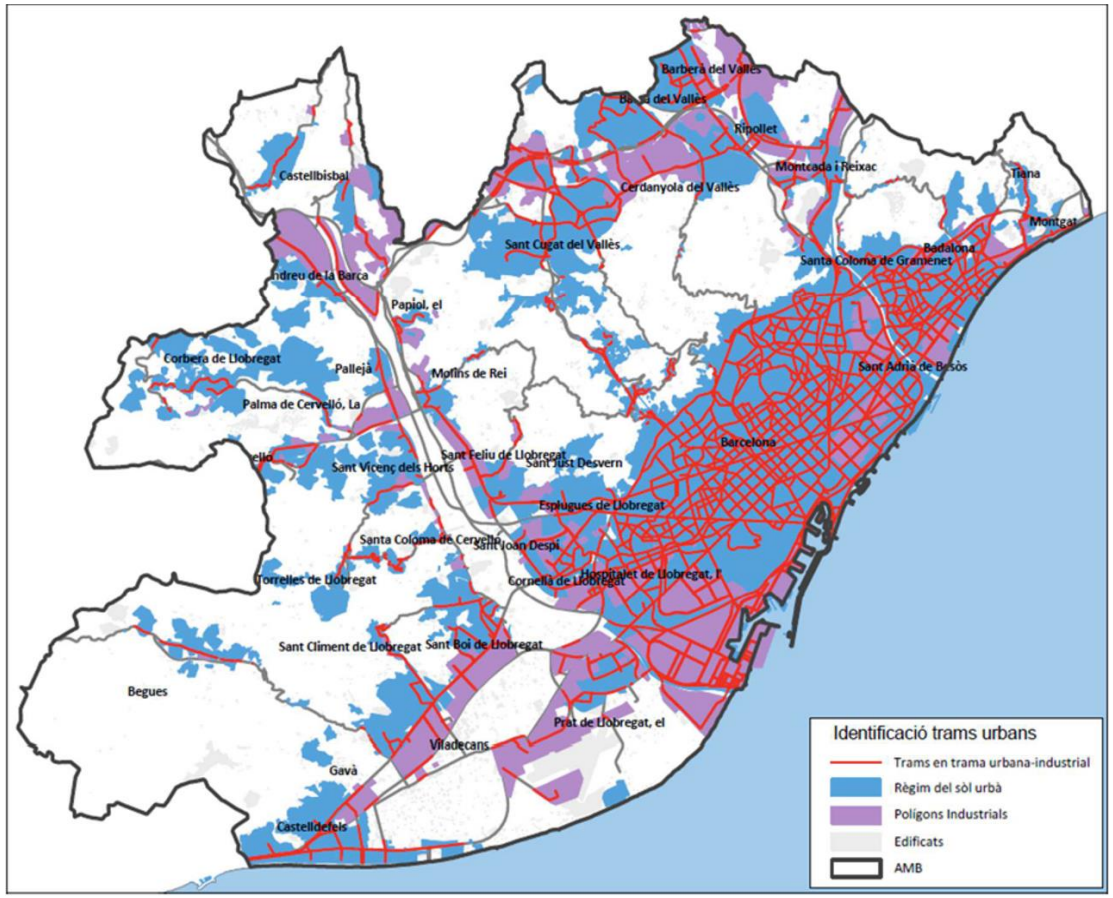
- Consumption and emission factors



3. METHODOLOGICAL APPROACH

3. Determination of energy consumption and emissions emitted in urban areas

- Overlay of the GIS layers road graph & land uses (urban land & industrial parks included)



4. MAIN RESULTS

Comparison between mobility in workdays, before and after the economic downturn (2006 & 2011/13):

- Journeys per day were similar (Δ=-0.2%)
- CO_2, NOx, PM and CO emissions per day decreased in 2011/13
- NO_2 emissions per day increased in 2011/13

TOTAL	Journeys	Energy consumption	CO2	NOx	PM	CO	NO2
Before	6,203,807	3,565,144	10,847,157	40,230	2,987	118,219	6,358
After	6,189,254	3,158,242	9,029,495	30,249	2,364	66,078	7,429
% Difference	-0.2%	-11.4%	-16.8%	-24.8%	-20.9%	-44.1%	16.8%

CAR	Journeys	Energy consumption	CO2	NOx	PM	CO	NO2
Before	4,505,488	3,073,367	9,161,685	35,988	2,298	75,450	5,811
After	4,496,126	2,764,163	7,803,574	27,459	1,908	36,927	7,055
% Difference	-0.2%	-10.1%	-14.8%	-23.7%	-17.0%	-51.1%	21.4%

MOTOCYCLE	Journeys	Energy consumption	CO2	NOx	PM	CO	NO2
Before	581,997	106,396	316,541	601	220	39,065	20
After	582,986	115,245	342,882	565	170	27,786	19
% Difference	0.2%	8.3%	8.3%	-6.0%	-22.7%	-28.9%	-5.0%

VAN	Journeys	Energy consumption	CO2	NOx	PM	CO	NO2
Before	137,541	199,248	600,863	2,954	326	3,704	527
After	75,929	108,941	300,872	1,396	136	1,365	355
% Difference	-44.8%	-45.3%	-49.9%	-52.7%	-58.3%	-63.1%	-32.6%

PUBLIC TRANSPORT	Journeys	Energy consumption	CO2	NOx	PM	CO	NO2
Before	978,781	186,133	768,068	687	143	-	-
After	1,034,213	169,893	582,167	829	150	-	-
% Difference	5.7%	-8.7%	-24.2%	20.7%	4.9%	-	-

CO & NO_2 emissions are only available for private transport

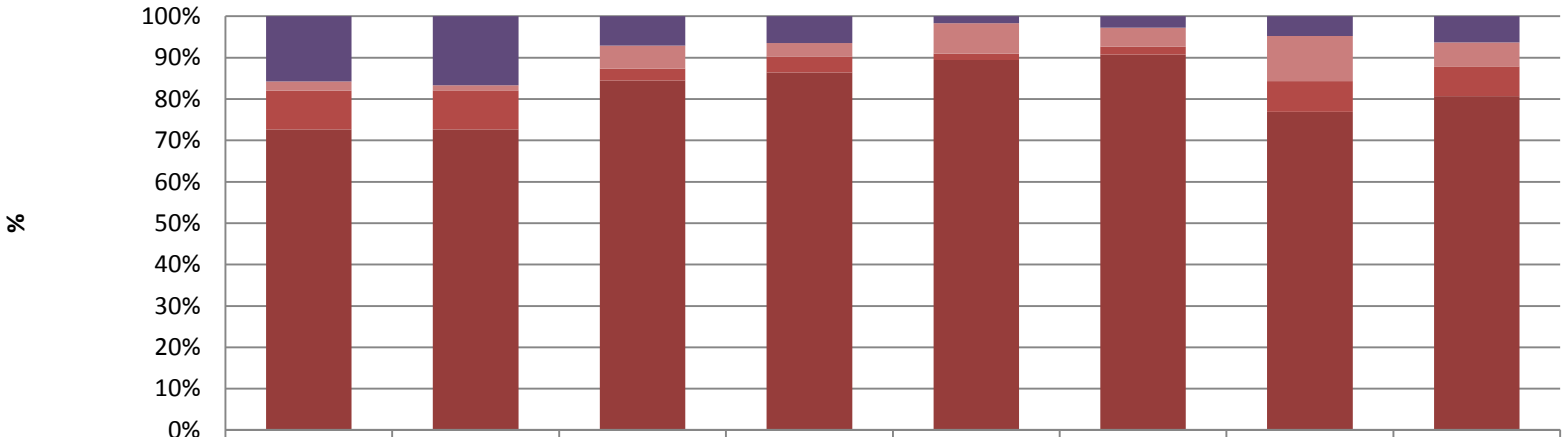
Public transport: bus + railway

Units (energy consumption & emissions): kg/day

4. MAIN RESULTS

- The largest share of emissions is attributable to cars at the two time points (2006, 2011/13)
- Emission from light duty vehicles have decreased in 2011/13, as well as the number of journeys
- The share of public transport has however increased

Journeys and emissions per means of transport (%), 2006 & 2011/13



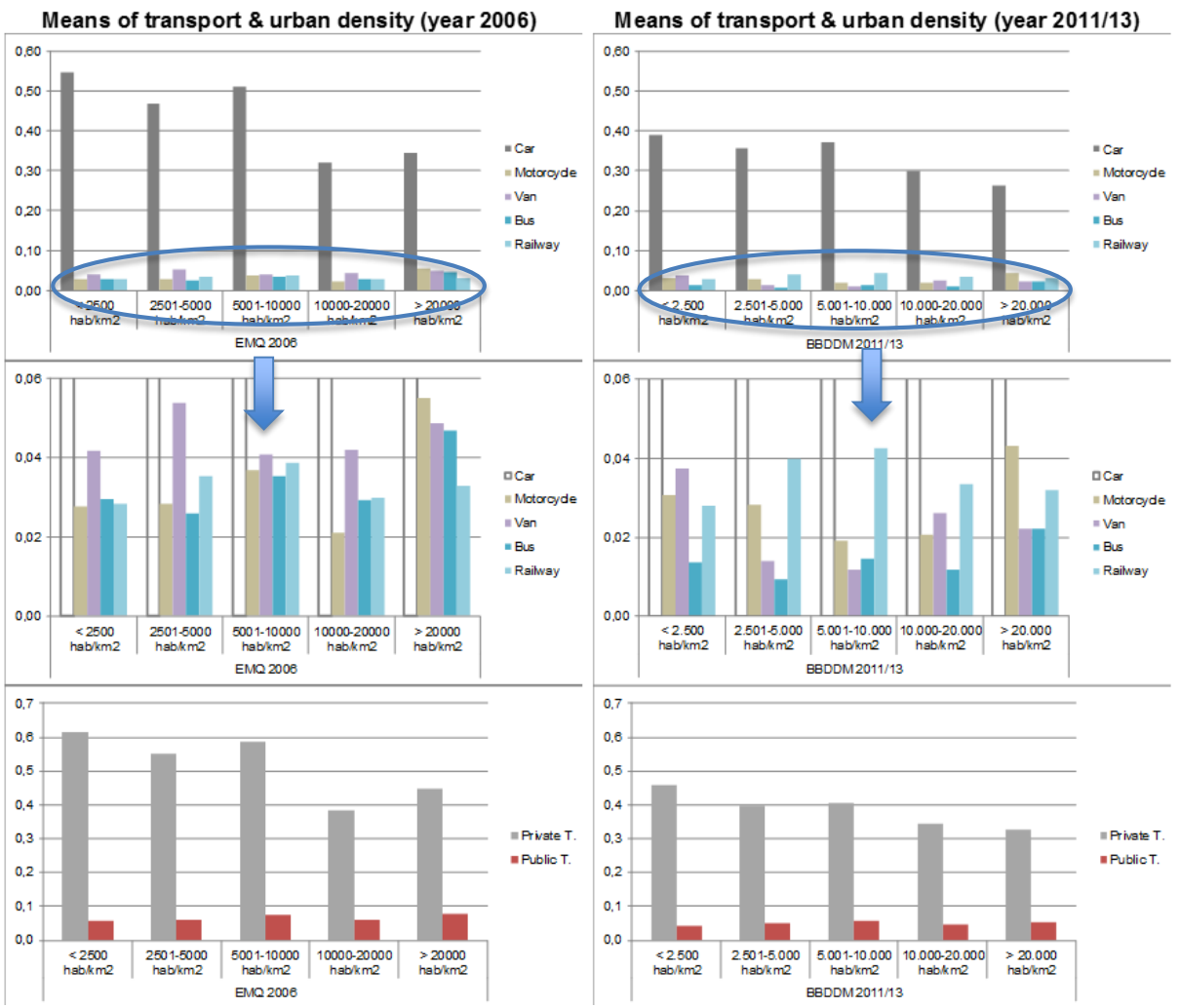
	Journeys		CO2		NOx		PM	
	Before	After	Before	After	Before	After	Before	After
Public Transport	15,78%	16,71%	7,08%	6,45%	1,71%	2,74%	4,79%	6,35%
Van	2,22%	1,23%	5,54%	3,33%	7,34%	4,62%	10,91%	5,75%
Motocycle	9,38%	9,42%	2,92%	3,80%	1,49%	1,87%	7,37%	7,19%
Car	72,62%	72,64%	84,46%	86,42%	89,46%	90,78%	76,93%	80,71%
TOTAL	4,505,488	4,496,126	9,161,685	7,803,574	35,988	27,459	2,298	1,908
VARIATION(%)	Δ=-0.2%		Δ=-10.1%		Δ=-23.7%		Δ=-17.0%	

5. APPLICATION EXAMPLES

PM emissions per capita associated to the daily mobility of RMB residents who travel through the AMB according to means of transport and urban density of the municipality of residence

Data in grams/inhab. day

Years 2006 and 2011/13



5. APPLICATION EXAMPLES

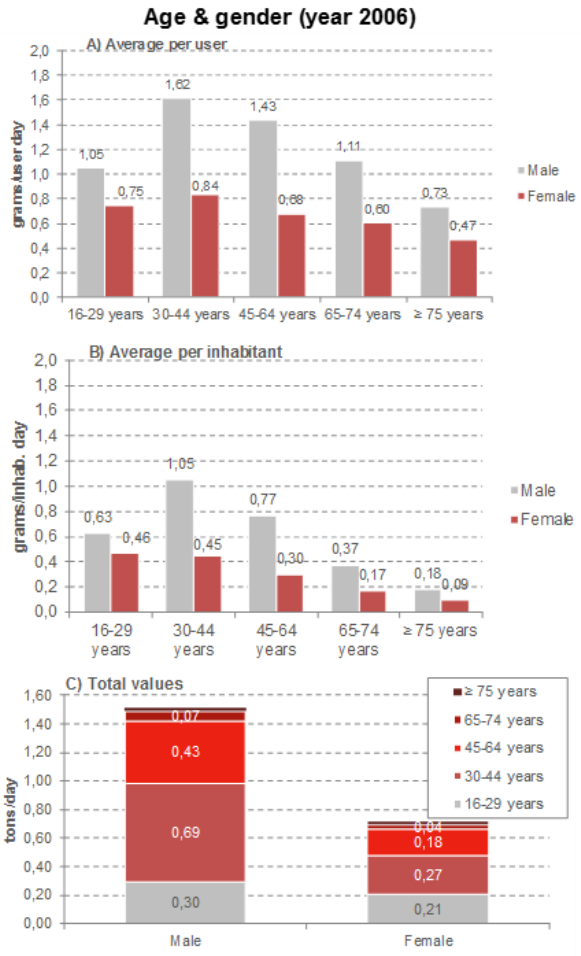
PM emissions associated to the daily mobility of RMB residents who travel through the AMB according to sex and age

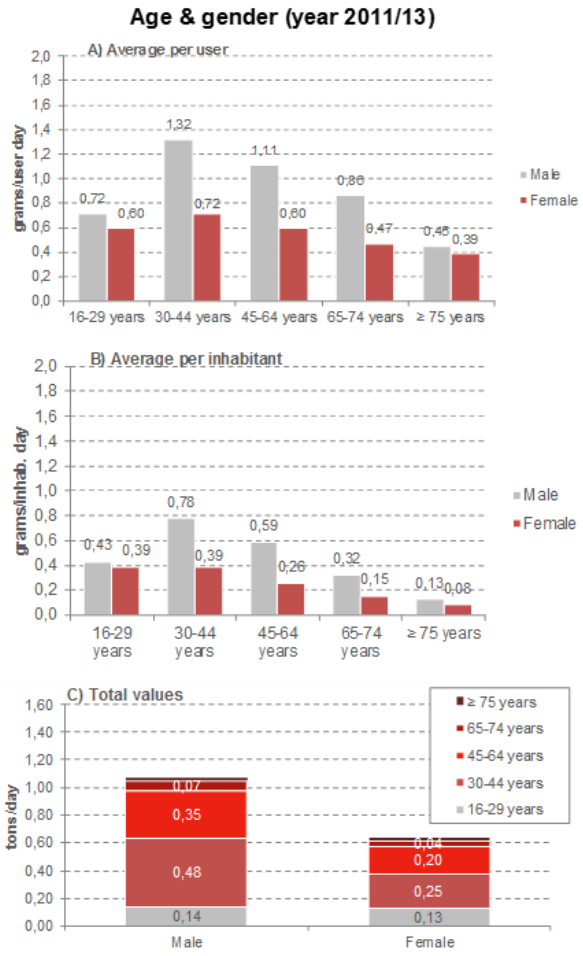
Average per user (grams/user day)

Average per inhabitant (grams/inhab. day)

Total values (tons/day)

Years 2006 and 2011/13





6. CONCLUDING REMARKS

- Mobility and emissions decreased in the period studied (2006-2011/13)
- The theoretical emission factors have improved compared to 2006 (except NO_2)
- This tool assists the design of environmental-transport policies through:
  - The drawing of a fairly complete profile of gross polluters, including personal mobility, urban/residential features & socioeconomic profile variables
  - The building of scenarios by changing one or some of the variables or dimensions
  - The identification of the most problematic transport corridors

Quantification of the emissions from personal mobility

Estimation based on general mobility surveys

Thank you for your attention!

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