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ESTIMATION OF ANNUAL TRAFFIC VOLUMES

A Model for Portugal

LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL

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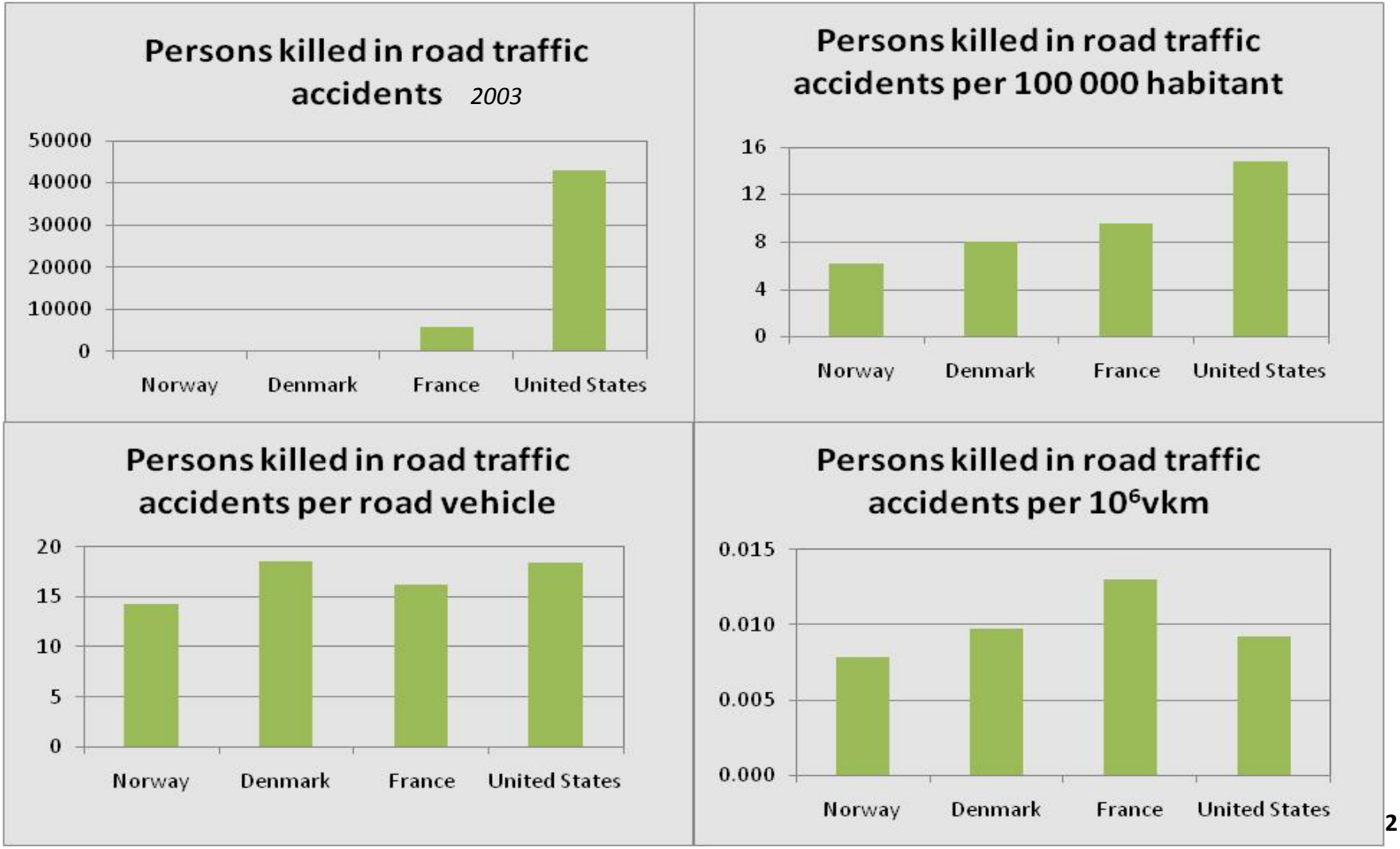
Introduction



Classification of existing methods

Handbook on Statistics on Road Traffic – UNECE

- **Traffic counts**

Data **available in many countries**

Spatial & temporal **sample**

Impossibility of collecting data about the driver characteristics and travel purposes

Allows the disaggregation of VKT **by type of road, vehicle attributes, time periods or regions**

$$VKT_j = \left(\sum_{n=1}^{N} \left(AADT_n \times L_n \right) \right) \times \frac{L_{TOT\,j}}{\sum_{n=1}^{N} L_n} \times 365$$

Classification of existing methods

Handbook on Statistics on Road Traffic – UNECE

- Traffic counts

- **Driver surveys**

Can reach a high level of **detail and flexibility** in the collected data

Diferent types of surveys

Sampling errors, response bias and estimation **errors**

High implementation **costs**

Classification of existing methods

Handbook on Statistics on Road Traffic – UNECE

- Traffic counts
- Driver surveys
- **Fuel consumption**

Balance between road transportation fuel consumption and national sales

Need **multiple data sources**

Estimation of **foreign vehicle consumption** in the national network and vice-versa

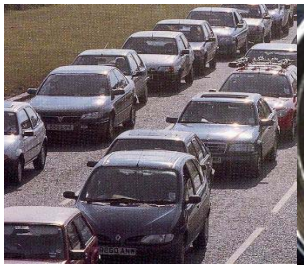
Need average **consumption models**

$$n \times dist_{avg} \times cons_{avg} = FC \Leftrightarrow FS$$

Classification of existing methods

Handbook on Statistics on Road Traffic – UNECE

- Traffic counts
- Driver surveys
- Fuel consumption
- **Odometer readings**



Only record of traveled distances available for the majority of the vehicles

Impossibility of VKT disaggregation **by region**

Usually limited to the inspected vehicles

Reading **errors,** limitation o the number of digits and ilegal modification of odometer records

$$VKT_i = \left(\left(\sum_n \frac{\left(R_{T+\Delta T} - R_T \right)}{\Delta T} \right) \times \frac{F}{N} \right) \times 365$$

Available Data Sources in Portugal

Used Data Sources

- Odometer Readings (inspections)
- Inspected vehicles attributes
- Data on the National Vehicle Fleet
- Traffic and geometric characteristics of the NRN
- Traffic counts in the NRN

Traffic counts in the NRN

Heavy vehicles survey

5 030 034 Vehicles
1 342 links 14 358 km

560 traffic counts (2000-2003) representing a sample of **7 346 km** of the NRN

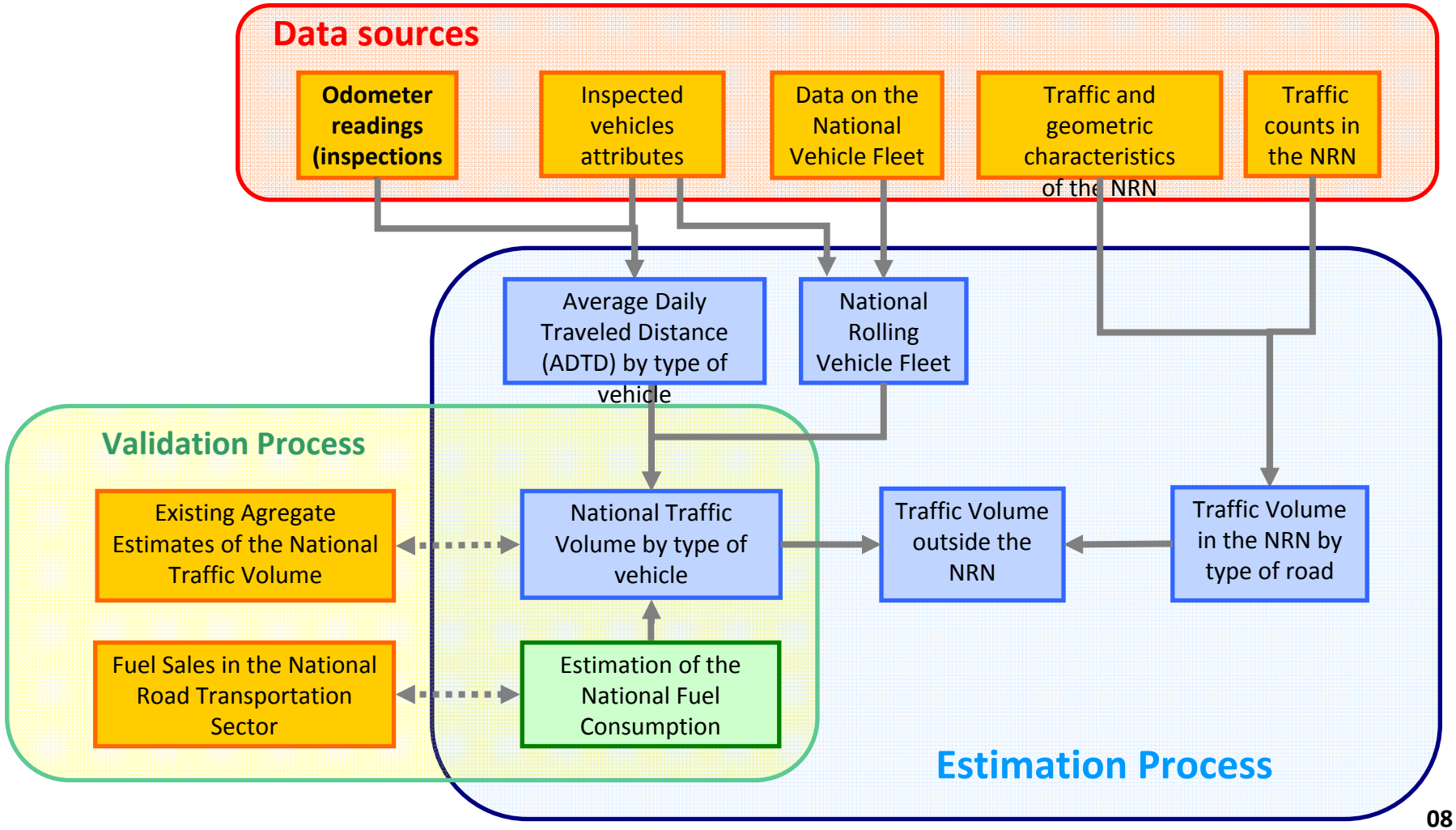
Drivers Information

Impossibility of using traffic counts from other roads

Anual Fuel Sales

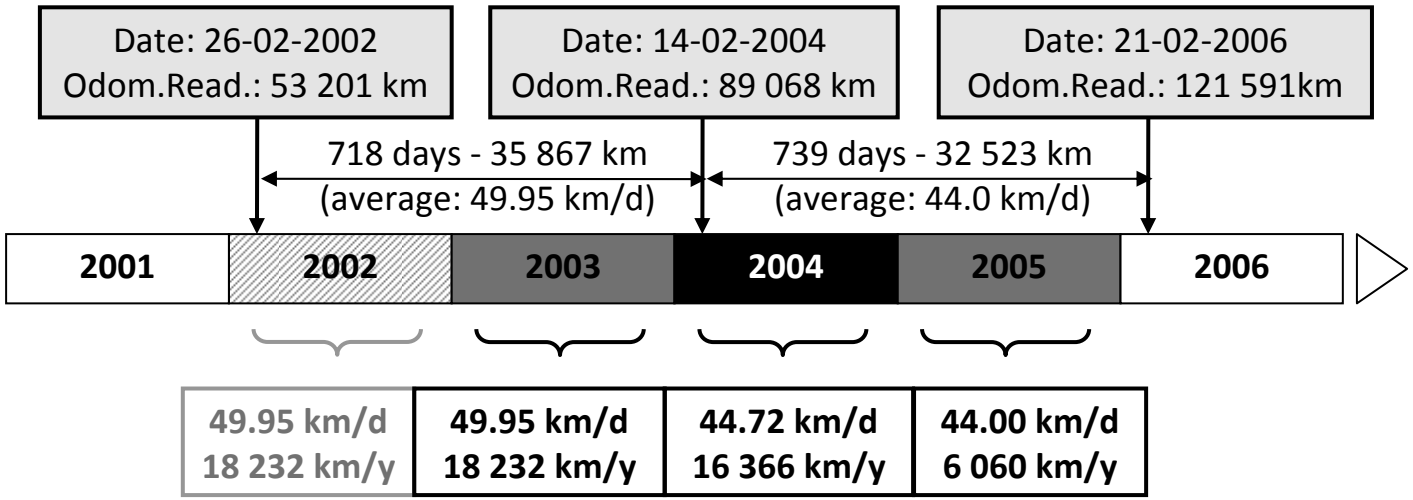
Vehicle fuel consumption

The proposed methodology



The proposed methodology

- Calculation of the Averafge Daily Traveled Distances (ADTD) for each inspected vehicle
- Error mitigation and outliers



Year with inspection and partially covered

Year fully covered but without inspection

Year with inspection and fully covered

Year not covered

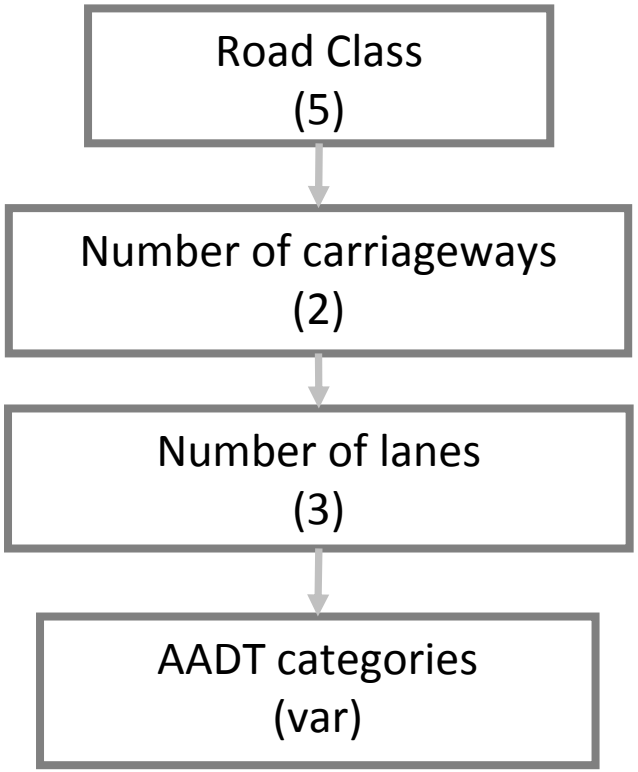
The proposed methodology

$$ADTD = e^{\beta_0} \times e^{\sum_i (\beta_i \times x_i)} \times e^{\varepsilon} = c_0 \times \prod_i (c_{ij}) \times c_\varepsilon$$

	2004			2005			2006		
	Factor	s	t	Factor	s	t	Factor	s	t
c_o (km/dia)	24.19	0.0007	4693.0	20.72	0.0009	3535.0	19.49	0.0010	2943.0
Fuel type									
Gasoline	*1.00*			*1.00*			*1.00*		
Diesel	1.46	0.0010	361.3	1.54	0.0013	326.9	1.61	0.0016	296.6
Weight									
1300 - 2999 kg	*1.00*			*1.00*			*1.00*		
3000 - 3500 kg	0.92	0.0016	-49.5	0.94	0.0020	-32.5	0.98	0.0024	-10.6
Engine (cm^3)									
< 1.4 l	*1.00*			*1.00*			*1.00*		
≥ 2.0 l	1.09	0.0014	63.9	0.90	0.0017	-59.8	0.83	0.0021	-89.2
Year									
1992 - 1996	*1.00*			*1.00*			*1.00*		
2001	1.43	0.0012	300.7	1.61	0.0015	320.6	1.52	0.0026	160.2
	N= 4 576 791			N = 4 379 275			N = 3 525 088		

The proposed methodology

- Estimation of the VKT by type of road in the NRN
- Based on the road characteristics database and a 2005 AADT
- Estimation of the share of each vehicle type in each road category using the data collect by traffic counts in the NRN



Results

(10^6 vkm)	2004	2005	2006
Heavy vehicles	7 691	6 772	6 319
Light Vehicles	80 120	79 920	81 700
TOTAL	89 390	86 690	86 440

Light vehicles - **91.4%** of the National VKM

Diesel vehicles - **99.8%** of the heavy VKM and **60.7%** of the light VKM

Increase of the diesel light vehicle share

60.7% in 2004 61.3% in 2005 64.8% in 2006

Light vehicles VKT

Age » **First year** - **9.11%** (5.4% of the national light vehicle fleet)

Heavy vehicles VKT

Gross weight » **40 tons** - **52.6%** (27.6% of the national heavy vehicle fleet)

Results

(10^6 vkm)	TOTAL	NRN	Other Roads
Heavy Vehicles	6 772	4 427	2 346
Light Vehicles	79 920	39 540	40 380
TOTAL	86 690	43 970	42 720

NRN represents **50.7%** of the national VKT *(2005)*

Heavy vehicles

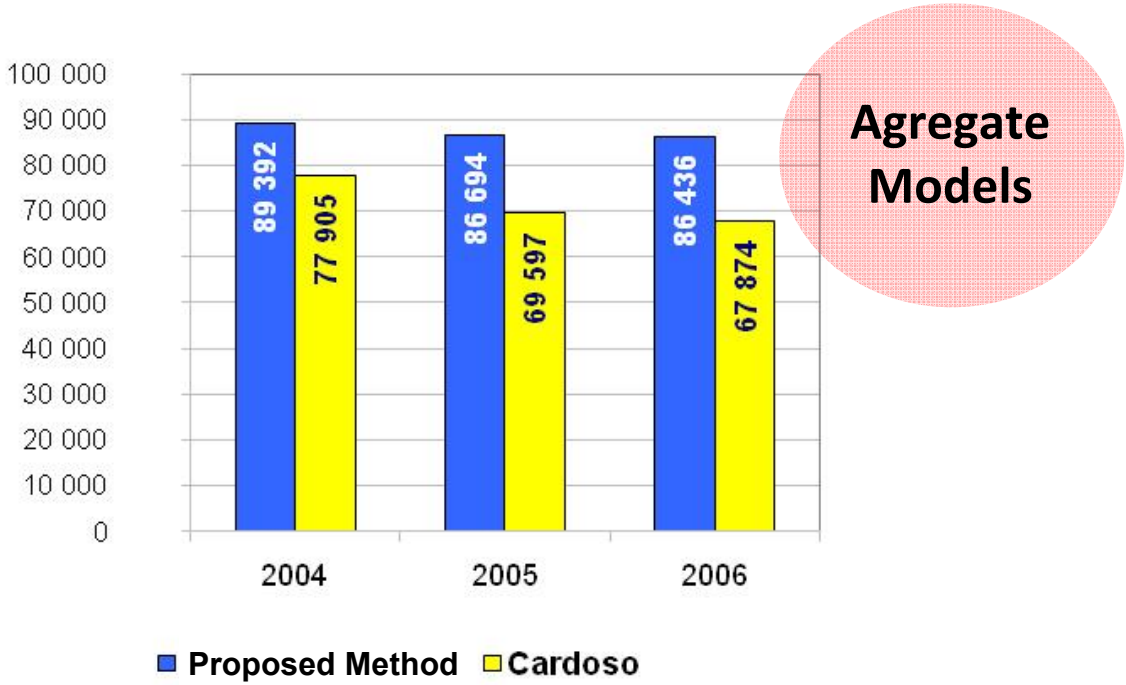
The majority of their distances are traveled in the NRN - **65.4%**

Light vehicles

Less than half of their distances are traveled in the NRN - **49.5%**

Motorways represent the main share of the NRN with **38.8%** of its traffic volume in 2005

Validation Process



Agregate Models

Copert

(ton) 2004	Sales	Estimated consumption	Difference (%)
Diesel	4 930 826	4 747 417	-3.7%
Gasoline	1 927 122	1 789 613	-7.1%
Gaz	20 134	17 961	-10.8%

Conclusions and further work

These results are the **first disaggregate VKT estimates** by type of road and vehicle for Portugal

However, next applications of the proposed methodology must be undertaken under a **systematic plan** for **flexible, comprehensive and reliable** estimates, with the following **improvements:**

- Estimation using data in the type of use of each vehicle
- Inclusion of traveled distances by vehicles that are not subjected to periodical inspections (namely motorcycles)
- Additional information on traveled distances of new vehicles
- Additional information on the national vehicles traffic volume abroad, and vice-versa

THANK YOU!