



# » Road Traffic Statistics –

## Odometer readings Methodology «

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 23-10-2020



### Summary



- European strategy for transport sector
- Periodic obligatory inspections in Portugal
- Portuguese stock of road vehicles
- Vehicles database
- Data processing
- Methodology used
- Main conclusions and results
- Further developments





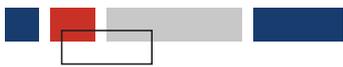
## European strategy for transport sector



**European Commission's White Paper on transport sector** – Main guidelines for European strategy for the transport sector;

- Focus on reducing the greenhouse effect gases emission by 60%
- Traffic efficiency and multimodal transport
- Ecologic urban and suburban transport
- Market competitiveness on long freight and passenger transport

One of the measures to achieve this vision is to reduce the number of fatalities in road accidents close to zero until 2050.



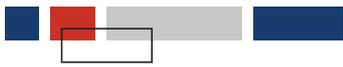
## European strategy for transport sector



**Roadworthiness Package** – European Commission 3 directive package aiming to toughening the periodic mandatory inspections (IPO) and widening its scope;

- Common standards for equipment, training of inspectors and assessment of deficiencies
- Electronic safety components subject to inspection
- Compulsory testing for heavy motorbikes
- Measures to combat vehicle mileage fraud

One of the measures to combat vehicle mileage fraud consists on collecting and centralize vehicle-km data from odometer readings.



# Periodic Inspections in Portugal



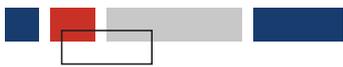
Type of vehicle	Periodic mandatory vehicle inspection (IPO)
Light passenger vehicles (M1)	Four years after first registration, then every two years until eight years, then annually
Light freight vehicles (N1)	Two years after the first registration, then annually
Heavy passenger vehicles (M2 or M3)	Annually until seven years since first registration, then every six months
Heavy freight vehicles (N2 or N3)	Annually
Special vehicles (ambulances and taxi)	Annually until eight years since first registration, then every six months
Road tractors (T5)	Four years after first registration and then every two years
Motorcycles and Mopeds (L3e to L7e)*	Four years after first registration, then every two years until eight years, then annually

\*Motorcycles and mopeds IPOs have not been approved from the government member responsible for the transport sector

Source: Portuguese Road Agency (IMT, I.P.)



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# Periodic Inspections in Portugal



There are four types of inspections:

- Periodic (mandatory);
- Extraordinary,
- For new licensed vehicles
- Facultative;

**How to calculate vehicle-km for so many different types of vehicles?**



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## Portuguese stock of road vehicles



Statistics Portugal receives information from IMT since 2011 in order to produce statistics on the national stock of vehicles;

Variables include licence plate, year of registration, type of vehicle, maximum laden weight and engine cylinder capacity;

Vehicles that reprovved over the last two periodical road inspections are excluded from the stock;



## Vehicles database

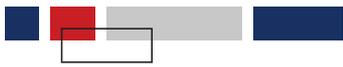


The database for the calculation of vehicles-km was a combination of the stock of vehicles database and the number of kilometres for each inspection;

The classification of European vehicles was included to the database;

The variables in the database are: licence plate, year of registration, european classification of vehicle, fuel type, engine capacity, laden weight, year and month of inspection and kilometres registered in inspection;





## Data processing



The first procedure was to eliminate the IPO's from the trailers and semi trailers. Every licence plate that was not in the format were eliminated;

An evolution on the readings across time detected some irregularities in the progression of the kilometres travelled by some vehicles. Mainly, two types of errors were detected:

- One-time error
- Break in series



## Data processing



For one time errors, the following formula was used:

$$X_{i,j} = X_{i-1,j} + \frac{m_{i,i-1,j}}{m_{i+1,i-1,j}} (X_{i+1,j} - X_{i-1,j})$$

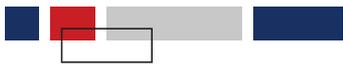
$X_{i,j}$ : Number of kilometres in inspection  $i$  of vehicle  $j$

$X_{i+1,j}$ : Number of kilometres in one inspection after inspection  $i$  of vehicle  $j$

$X_{i-1,j}$ : Number of kilometres in one inspection before inspection  $i$  of vehicle  $j$

$M_{i,i-1,j}$ : Number of months between inspection  $i$  and the inspection before  $i$  of vehicle  $j$

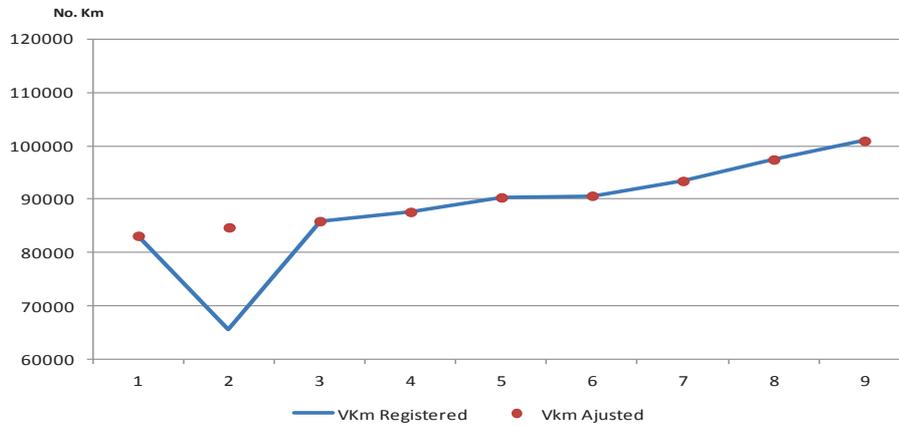
$M_{i+1,i-1,j}$ : Number of months between inspection after  $i$  and inspection before  $i$  of vehicle  $j$



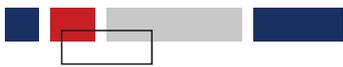
## Data processing



The adjusted kilometres were:



The values who represented a break in series were left unchanged.



## Methodology used



The vehicles-km for any given year is:

$$VKm_t = \sum_{i=1}^N (Km_{it} - Km_{i,t-1})$$

N: Number of vehicles in universe

$Km_{i,t}$ : Number of kilometres estimated for vehicle  $i$  in the end of the year  $t$

$Km_{i,t-1}$ : Number of kilometres estimated for vehicle  $i$  in the end of the year  $t-1$

**How to find Km in the end of the year?**



## Methodology used



For vehicles with two IPO's :

$$Km_{it} = I_{it} + m_{it} \cdot DMM_{i,0,1} \quad DMM_{i,0,1} = \frac{I_{it} - I_{i,t-1}}{d_{i,0,1}}$$

$Km_{it}$  : Number of kilometres registered for vehicle  $i$  in the year  $t$

$m_{it}$  : Number of months between the IPO of vehicle  $i$  in the year  $t$  and the end of that year

$DMM_i$  : Average monthly distance performed by vehicle  $i$  between the IPO in the year  $t$  and the IPO in the year  $t-1$

$I_{i,t-1}$  : Number of kilometres registered for vehicle  $i$  in the year  $t-1$

$d_{i,t-1}$  : Distance, in months, between the IPO in the year  $t$  and the IPO in the year  $t-1$



## Methodology used



For vehicles with one IPO:

$$Km_{it} = I_{it} + m_{it} \cdot DMM_{K,0,1} \quad DMM_{K,0,1} = \frac{\sum_{j=1}^K \frac{(I_{jt} - I_{j,t-1})}{d_{j,0,1}}}{K}$$

$I_{j,t}$  : Number of kilometres registered in IPO of vehicle  $j$  in the year  $t$  ( $j = 1, \dots, K$ )

$I_{j,t-1}$  : Number of kilometres registered in IPO of vehicle  $j$  in the year  $t-1$  ( $j = 1, \dots, K$ )

$D_{j,0,1}$  : Distance, in months, between the IPO in the year  $t$  and the IPO in the year  $t-1$  by vehicle  $j$

$K$  : Vehicles that did an IPO in the year  $t$  and  $t-1$  and which characteristics are similar to vehicle  $i$



## Methodology used



For vehicles with no IPO:

$$Km_{it} = m'_{it} \cdot DMM_{K,0,1} \quad DMM_{K,0,1} = \frac{\sum_{j=1}^K \frac{(I_{jt} - I_{j,t-1})}{d_{j,0,1}}}{K}$$

$m'_{it}$ : Number of months between the register of the vehicle  $i$  and the end of year  $t$

As currently information regarding the month of the first registration is not available, it is suggested that  $m'_{it} = 6, 18, 30$  or  $42$ , if the vehicle was registered in year  $t, t-1, t-2$  or  $t-3$ , respectively.



## Methodology used



Vehicles presumably out-of-service will be removed from the estimation for year  $t$  but not from the universe database;

The criterion for the definition of the group of  $K$  vehicles similar to vehicle  $i$  will be that of the European vehicle category classification;

For vehicles who performed more than one IPO in a given year, the IPO closest to the end of year  $t$  should be selected for the purposes of the previous calculations;

For registrations that take place within the same month, an average of the values for recording the IPO value will be calculated over that period.



## Main conclusions and results



Units: Millions of Vkm

Type of vehicle	2015	2016	2017	2018
M1: Passenger cars	55,996.77	56,236.62	55,663.23	67,520.62
M2: Mini buses	50.48	45.53	43.30	47.19
M3: Buses and coaches	660.37	641.28	684.43	748.81
N1: Goods vehicles up to 3.5t	17,927.66	17,851.65	17,589.21	20,587.33
N2: Goods vehicles between 3.5t and 12t	754.30	743.53	675.79	856.51
N3: Goods vehicles over 12t	4,712.07	4,876.01	5,230.03	5,993.91
<b>TOTAL</b>	<b>80,101.64</b>	<b>80,394.61</b>	<b>79,885.99</b>	<b>95,754.37</b>



## Main conclusions and results



- It is possible to calculate vehicle-km for any given period since 2015;
- The results must be reviewed periodically to incorporate new readings on the vehicles instead of estimates;
- The use of administrative data is crucial in the present and in the future of official statistics production process;





## Further developments



- Consolidation of this methodology with the Portuguese Road Agency;
- Publish the data in the Statistics Portugal Stats Lab;
- Calculate the vehicle-km for 2019;
- Produce, in the near future, statistical data on road traffic in annual basis;



## Bibliography



European Strategy for transports (White Paper):

[https://ec.europa.eu/transport/themes/strategies/2011\\_white\\_paper\\_en](https://ec.europa.eu/transport/themes/strategies/2011_white_paper_en)

Roadworthiness tests:

[https://ec.europa.eu/transport/road\\_safety/topics/vehicles/vehicle-inspection\\_en](https://ec.europa.eu/transport/road_safety/topics/vehicles/vehicle-inspection_en)

Portuguese stock of vehicles:

[https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine\\_indicadores&contecto=pi&indOcorrCod=0007244&selTab=tab0&xlang=en](https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_indicadores&contecto=pi&indOcorrCod=0007244&selTab=tab0&xlang=en)





**Thank you for your attention**

