

The main vectors influencing the levels of fuel consumption in a bus company. The driver, the vehicles and the lines

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Abstract

Nowadays, mobility is an essential part of an increasingly urbanized and complex world. Thus transportation, both of people and goods, occupies a central part in modern societies and has become more extensive and far-reaching than ever. Therefore it represents an important share, around 30%, in the consumption of fossil fuels, and road transportation is responsible for an expressive majority of that consumption.

Fuel consumption represents an important parcel of the total operating costs for urban bus operators. Thus in a context of raising fuel prices curbing fuel consumption is an important objective for bus operators. But in order to curb fuel consumption it is fundamental to know the main factors that contribute to it. The main objective of this paper is to build a model that explains fuel consumption in the Rodoviária de Lisboa bus network considering three main vectors the line characteristics, the driver behavior and characteristics and the vehicle characteristics. Rodoviária de Lisboa S.A. operates in the municipalities of Lisbon, Loures, Odivelas and Vila Franca de Xira, serving 400 000 inhabitants, and carrying 200 000 passengers per day.

To examine which factors have a higher influence on fuel consumption three models were developed for the referred main vectors.

The methodology adopted was stepwise multiple linear regression analysis and the dependent variable the logarithm of the fuel consumption. The data used in these models included the type of bus line, the topography characteristics of each line, the vehicle typology and several variables collected by the onboard information system Gisfrot which collects driving events and relates them with the driver, the vehicle and the line.

The data collected for the months of October and November of 2009 and March 2010 was used to calibrate the models which were later validated with data collected for the months of May and September of 2010.

All the 3 models presented good adjustment indicators, being the lowest R2 equal to 0,89.

The set of variables that proved to be more influent defining the fuel consumption were always those referring to the type of vehicle performing the services. Besides this, the commercial speed was also present in the three models, as one of the most influential variables in explaining fuel consumption (with a negative sign). Other important variables included in the models comprised the number of formative monitoring sessions with bus drivers (revealing a tendency to reduce consumption), the average age of the drivers (higher the driver age tends to mean higher consumption). Also some driving events were detected as prejudicial to fuel consumption, namely the high rotations and the abrupt braking. Lines with important grades tended to have higher consumption levels.

These results provide important policy results that could help guiding Rodoviária de Lisboa, to implement and justify the efficiency of measures aimed at reducing the consumption levels of their bus lines.

Keywords: consumption, bus, driver, route, energy efficiency, commercial speed, multiple linear regression.