1. Introduction

Driver behavior is intrinsically connected with vehicle performance, directly influencing its energy, environmental and safety outcomes. This is particularly relevant at urban level, due to health impacts associated to air quality, as well as driver and pedestrian safety. Also, influencing driver behavior constitutes a very difficult task, due to deeply rooted habits and perceptions associated to the activity of driving. However, emerging technologies can play an important role in this framework, by providing useful information regarding vehicle use that can be used to provide tailor-made feedback to the user, as well as by forcing or limiting driver behavior. Having this in mind, one alternative solution can include adjustable speed limits according to factors such as time of day, traffic, weather, among others, with consequent impacts in terms of road safety improvements. This research work focuses on exploring naturalistic driving data to evaluate the possibility of adjustable speed limits and assessing its impacts regarding energy, environmental and safety outcomes.

2. Methods and data

To accomplish the objectives of this work, firstly, a sample of 10 drivers was monitored for a period of one month in the Metropolitan Area of Lisbon using an on-board data logger, the i2D device. The i2d device acquires 1 Hz data on vehicle dynamics (speed, acceleration, etc.), engine data and also location information. This dataset was coupled with data regarding the road type (defined by hierarchical street levels, from level 1 – arterials – to level 4 – local streets).

Secondly, to assess the impacts of adjustable speed limits, a numerical tool to adjust real world drive cycles was developed. This tool was developed in Matlab® to modify the sample’s second-by-second vehicle power requirements and by imposing lower speed limits based on the hierarchical street levels the vehicle was circulating.
The outcomes in terms of total driving time (for the same distance), average speed (km/h), energy consumption (g/s and l/100km) and energy consumption reduction potential (%). Also, the possible safety gains of implementing such measure are also discussed.

3. Preliminary results and conclusions

The application of the developed numerical tool to the collected sample confirms the possibility of using adjustable speed limits to improve safety. Additionally, for the 120 km/h drive cycle limitation, results show potential average speed reductions of up to 8%, coupled with an energy consumption reduction potential that can reach 15%. Further scenarios will be explored and assessed in the full paper. Summing up, using naturalistic driving data brings new opportunities to characterize and to evaluate driving behavior, which can be easily translated in road safety improvement.