Could CAVs be future eco-driving agents to influence the environmental performance of road traffic?

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***Abstract*—Connected Autonomous vehicle (CAVs) could be an environmental boon or disaster, depending on public policy [1]. At operational level, CAV technologies are expected to improve fuel economy and reduce emissions per unit of distance thanks to more gradual acceleration and deceleration patterns [2] and fewer stop-and-go movements [3]. Under a likely transitional stage of co-existence of connected and automated vehicles (CAVs) and conventional vehicles (CVs), this study explores the potential effects of CAVs to reduce greenhouse gases (GHG) and pollutant emissions in different road types based on improved operational parameters. For that purpose, CAVs were assumed to behave as eco-driving agents to influence the environmental performance of overall traffic. A microscopic traffic and emission model platform was applied to simulate a European medium-sized city during the morning peak period. Three roadway sections, including motorway, rural and urban, were selected to evaluate in detail the impact of CAVs in different roads types and over multiple CAVs penetration rates (MPR) to address the following questions:**

1) **What is the potential reduction of carbon dioxide (CO_2) and nitrogen oxides (NO_X) emissions resulting from CAVs operating in different road typologies?**

2) **How can network-wide emissions and fuel consumption vary according to different MPR of CAVs?**

3) **May CAVs significantly influence the energetic and environmental performance of CVs on different road types?**

Results allow assessing the main research questions defined, concretely:

1) CAVs impacts were particularly beneficial for the environment in the road segment "national road", with emission reductions up to 12%. In the urban corridor, the impacts were shown to be detrimental due to an inefficient configuration of the car following adjustment parameters (CFAP) in the local context and a slight increase in the capacity of the upstream intersections. At the motorway level operating at low volume-to-capacity (V/C) ratio, impacts are negligible. Nevertheless, an optimization of the speed to 90 km/h allows reductions up to 18% of CO2 and 32% of NOx.

2) In sections outside the urban context, the environmental impacts resulting from the presence of CAVs are positive, following a strong linear relationship and in line with higher MPR.

3) CAVs showed to significantly influence the energetic and environmental performance of CVs ranging from 3 to 13%. These results suggest that even CAVs will be predominantly fully electric in the near future, the impact on network-wide emissions should be taken into account and adjusted to different driving scenarios.

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TOPIC

2) b.: Technologies for the Wellbeing – Innovative technologies for Smart Cities.

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