1. INTRODUCTION & OBJECTIVES

The purpose of this work is to develop tools and methodologies to implement smart and dynamic pricing to perform traffic assignment and mitigate negative externalities associated with intercity corridors. Central research questions:

- Evaluate how an optimal traffic distribution in intercity corridors may contribute for the reduction of transport-related externalities.
- Estimate the impact of new smart and dynamic tolls and fares may contribute to optimal traffic solutions.

The following topics will be addressed:

- Optimal traffic distribution for the reduction of externalities;
- Estimation of key variables (emissions, noise, accidents) and their external costs;
- Achieving optimal traffic solutions using new smart and dynamic tolls and public transport fares.

2. METHODOLOGY

2.1. Estimation of emissions

The CO2 and NOx emissions factors (g/km) are given for a typical Portuguese diesel and petrol passenger car. For a petrol vehicle, they can be found in the following expressions (Macedo et al., 2020):

\[ CO_2 = \frac{0.193 f - 0.0072 \times 0.753 f + 1.0424}{0.0018 + 0.238 f + 2.325f + 3.52f - 0.145f + 0.362 \times f + 1.160 f} \]

\[ NO_x = \frac{0.104 f}{0.0018 + 0.238 f + 2.325 f + 3.52 f - 0.145 f + 0.362 \times f + 1.160 f} \]

where \( f \) is the average speed (kph) of the road segment.

2.2. External and Internal costs

\[ EC = GP \cdot EC + \sum L_P & \cdot EC + \sum L_C & \cdot NC + SC \]

- GP is the Global Pollutant;
- LP are the Local Pollutants;
- EC is the economic factor for Portugal;
- f is the adjustment factor related to population density.
- NC the noise related costs;
- SC the crashes related costs.

\[ UC = UC + \sum L_P \cdot EC \]

The highway (between 160 and 240 gCO2/veh.km) has higher specific CO2 emissions than the national road (between 80 and 160 gCO2/veh.km).

The overall estimated CO2 emissions are 23 ton.

2.3. Precision and Validation

The accuracy of the models have been validated with real data gathered from Portable Emissions Monitoring Systems (PEMS), sound level meters and air quality stations. The models will be used in the future work.

3. PRELIMINARY RESULTS

3.1. Calibration and Validation

- General socioeconomic data used to calibrate the model.
- GIS maps information used to calibrate the travel time between zones.
- The OD (Origin-Destination) number of movements from municipality reports used to calibrate the OD matrices. The following production/attraction function was used:

\[ c' = (POP \cdot Gravy) \cdot x \cdot b \]

where, \( a \) is the average number of trips per inhabitant; \( b \) is the percentage of individual transportation; and \( c' \) is an adjustment factor.

3.2. Baseline scenario

- The highway (between 1 and 2 gNOx/veh.km) has higher specific NOx emissions than the national road (less than 1 gNOx/veh.km).
- The overall estimated NOx emissions are 0.07 ton.

4. FUTURE WORK

- Continue to model traffic-related impacts, such as noise and accidents.
- Characterization of the population exposure to pollutants and monetization of the traffic related impacts.
- Optimal flow distributions and optimal pricing strategies.

5. REFERENCES