Integrating road traffic externalities through a sustainability indicator

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Road traffic poses negative externalities on society and represents a key challenge in sustainable transportation. However, the existing literature about the assessment of traffic externalities drawn on a common measure is scarce.

This paper develops a sustainability indicator that integrates traffic-related externalities as means of traffic congestion, noise, greenhouse gases (GHG) and nitrogen oxides (NOx) emissions, health impacts and road crash related costs, and adjusted to local contexts of vulnerability. Traffic, road crashes, acoustic and vehicle dynamic data were collected from one real-world intercity corridor pair comprising three alternative routes: i) partly rural/urban; ii) low-traffic-volume highway with electronic pay tolls; iii) high-traffic-volume highway with both conventional and electronic pay tolls. The site-specific operations were characterized using a modeling platform of traffic, emissions, noise and air quality. A specific methodology is applied for each road traffic externality and translated in a single factor – external cost.

Low-traffic-volume highway yielded lower external costs than other routes. Road crash costs presented the largest share along the partly rural/urban route while GHG costs were relevant in routes with highway trip sections. For the road-level analysis, some differences in the distribution of external costs can be stressed. The share of noise and NOx in external costs were only significant in urban roads, mostly due to higher potentially exposed population in those areas.
This paper offers a line of research that produced a method for decision-makers with a reliable and flexible cost analysis aimed at reducing the negative impacts of road traffic. It also encourages the design of eco-traffic management policies considering the perspective of drivers, commuters and population, and the support of future road pricing schemes that include a given cost value related to road traffic externalities.

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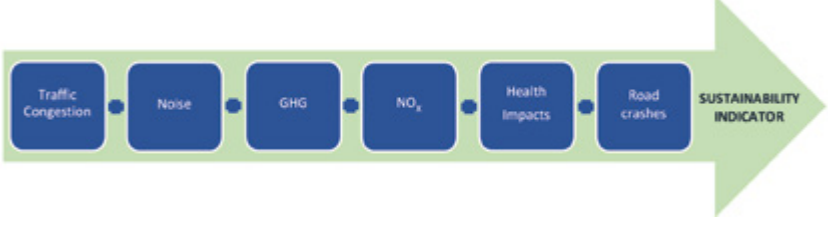

FIGURE 1
(upper) Sustainability Indicator (congestion, noise, GHG, NOX, health impacts and road crash) in €/veh

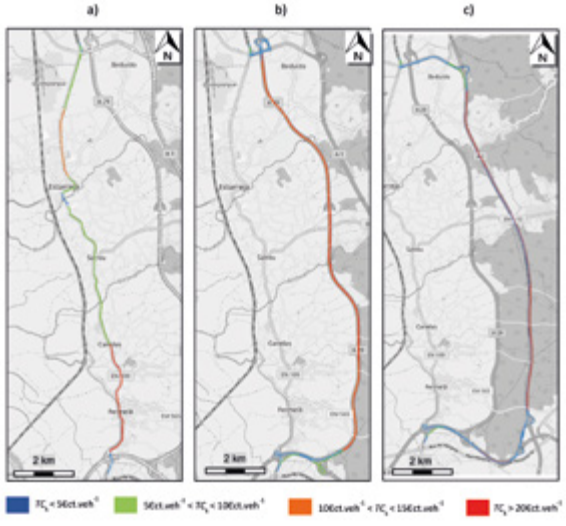

FIGURE 2
(bottom) Distribution of external costs by route: a) R1; b) R2; and c) R3.