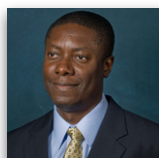


Editorial: techniques for addressing sustainability of the transportation system

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From rising global temperatures and increasing precipitation to increasing wind speeds, the transport infrastructure is vulnerable to adverse climatic impacts. A recent study published in the journal *Nature Climate Change*, for example, found that winds across much of North America, Europe and Asia have been growing faster since about 2010 (Zeng *et al.*, 2019). At the same time, human activities have caused explosive increases in emissions, safety and pollution in our towns and cities. The solution to these issues can be considered as a holy grail of the global sustainability agenda. The papers in the current issue of *Transport* address these topical issues focusing on various aspects of congestion, air and noise pollution and road safety (Car) impacting the sustainability of all the key modes of transportation in the UK and around the world. That the Car (pun intended) is the problem is something all societies can relate to, as a consequence of our way of life. Maintaining our current way of life in a changing climate is another problem that is the very essence of transportation engineering today. Here, the authors address these issues using a combination of advanced experimental and computational models.

As indicated above, the great increase in automobile ownership is a major cause of the endemic traffic congestion seen on many road networks. Thus, traffic mobility, safety and emission concerns have become one of the most serious challenges for transportation researchers. One of the most efficient traffic control methods for dynamically enhancing freeway capacities is by regulating the inflow from on-ramps to the freeway main-stream through the implementation of ramp metering (RM). The first paper, by Xie *et al.* (2022), proposes a novel RM control approach with potential to simultaneously reduce the major Car problems. Unlike most existing RM approaches, the technique proposed by Xie and co-workers uses a multi-objective optimisation algorithm that addresses mobility, safety and emission performances, simultaneously. For the 11 km length of a Canadian freeway section simulated, the authors showed their approach leads to about 59% improvement in mobility, about 82% improvement in safety and about 14% reduction in emissions.

In the second paper, Lv *et al.* (2022) discuss carbon dioxide (CO₂) emissions resulting from rail transport of coal across China over the 14-year period from 2000 to 2014 using spatio-temporal analytical techniques. Even though the authors found carbon dioxide emissions to have declined along certain railway corridors, a 10-fold increase in emissions was found in a few others. The spatio-temporal nature of the results was illustrated by the fact that emissions from two Inner Mongolian provinces were contributing to about 80% of all emissions in the country in 2014, compared with only 21% in 2000. The authors proposed various recommendations that their government could take in order to reduce emissions, including updating railway locomotives to reduce their energy consumption, to reduce coal consumption as a percentage of total energy and the introduction of ultra-high-voltage trans-regional electric power transmission.

In the third paper, Taylor (2022) uses the so-called 'Northern Powerhouse' region of northern England in the UK as a backdrop to demonstrate the limitations of personal road vehicles and public rails in achieving sufficient connectivity in a city-region. The author posits that limits to mobility are imposed by geography and the speed, access, energy and ergonomic constraints of travel modes, and therefore conventional 'predict and provide' design philosophy cannot be used to address the Car problems in megacities and urban sprawl. To address sustainability questions such as what is sufficient and what is the most efficient mode of transport, Taylor provides a comparative review of the performance of various of transport modes including road vehicles (manual and autonomous) and railways (conventional and magnetic levitation), but not aviation. The paper concludes that integrated public transport centred on advanced technology such as magnetic levitation when combined with corridor-based intensification could enable totally improved and sustainable mobility.

Excessive wind gusts pose dangers to certain road vehicles, especially high-sided lightly loaded ones. The fourth paper, by Baker and Soper (2022), describes a new method for

developing site-specific vehicle restriction strategies for use in locations where high-sided vehicles could be subjected to high-cross-winds conditions. Unlike existing methods, which could be very difficult and time-consuming to use, the new risk-based approach appears simple in terms of its ease of use. The authors note, however, that the simplified method proposed cannot entirely replace all complicated models, especially when dealing with wind-sensitive sites or for complex geometries.

Traffic-generated noise can negatively affect the health and well-being of people exposed to it. The fifth paper, by Wang *et al.* (2022), focuses on the development of a road shoulder's equivalent sound source traffic noise prediction model as a means for improving the accuracy of traffic noise prediction. According to the authors, key attributes of the proposed methodology include better prediction accuracy, ease of use and adaptability to different environments.

A durable age- and moisture-resistant asphalt mixture will not only result in less maintenance (low emission and less congestion) but also improved safety (fewer potholes, lower exposure to live traffic by construction workers) and less emissions. Thus, although not readily apparent to the casual observer, understanding the effects of ageing and moisture in asphalt mixtures can be considered one of the most vexing problems in the road transport sector. In the final paper, Xu *et al.* (2022) describe how the addition of certain anti-ageing agents affects the cohesive and adhesive properties of polymer-modified asphalt mixtures based on surface energy measurements. Using a combination of asphalt mixtures modified with styrene-butadiene-styrene and their anti-ageing additives, the authors conclude that their anti-ageing agent could significantly

improve the high-temperature stability and water stability of a modified asphalt mixture with only a small decrease in the low-temperature crack resistance.

Readers interested in techniques for addressing sustainable mobility, traffic congestion and emissions should find the six papers featured in this issue of *Transport* very timely.

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