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Editorial: Sustainable road infrastructure: technologies and assessments

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Editorial on the Research Topic
Sustainable road infrastructure: technologies and assessments

1 Introduction

The construction of sustainable road infrastructures has become an issue of concern to the international community. This Research Topic on "*Sustainable Road Infrastructure: Technologies and Assessments*" mainly focuses on upgrading the construction and maintenance levels of road infrastructure, improving the recycling level of infrastructure materials, and efficiently harvesting and utilizing clean energy from sustainable road infrastructures. Moreover, the sustainable transportation systems like transportation tools, transportation planning and organization are also included in the Research Topic. There are 69 authors and 13 papers that are contributed to this Research Topic. These papers are classified according to the following sections

1.1 Technologies for sustainable road infrastructures

Tu et al. replaced a limestone filler with a Prestressed High-Strength Concrete Pile Waste Concrete (PPWC) to prepare asphalt concrete. The results indicated that the PPWC filler effectively improved the mechanical properties, high-temperature rutting resistance and low-temperature crack resistance, but reduced the low-temperature fatigue resistance of asphalt concrete. Overall, the use of PPWC as a filler in asphalt mixtures provides a reliable solution for the sustainable development of road.

Chang et al. studied the effects of a warm mix agent (Evotherm M1) on asphalt binders from different oil sources. The results revealed that the addition of warm mix agent could slow down the decrease of asphalt viscosity during the aging process and the aging of asphalt. The warm mixing agents could also make the chemical components in asphalt relatively stable and less prone to further pyrolysis or cracking reactions.

Li et al. aimed to improve the performance of thin overlayers in pavement surface by adding a basalt fiber to two types of thin overlayer asphalt mixtures. The results indicated that adding basalt fiber could enhance the high temperature deformation resistance, low temperature cracking resistance, intermediate temperature cracking resistance and stripping resistance of the thin overlayer, but had no significant impact on skid resistance.

Chu et al. prepared a solid waste–based cementitious material (SWCM) using slag, fly ash, desulfurization gypsum, and gangue, to improve the high-value utilization of industrial solid waste materials. The mechanical strength and hydration process of the SWCM and an ordinary Portland cement (OPC) were studied. The results showed that the induction period of the SWCM was five times that of OPC, and the total 4 days exothermic amount of OPC was 1.7 times that of the SWCM. The unconfined compressive strength of the SWCM-stabilized macadam was comparable to that of the OPC-stabilized macadam.

Wang et al. explored the utilization of natural resources (i.e., solar energy and wind energy) along desert highways in northern Xinjiang, China, to establish hybrid energy generation systems for service areas. The application of these hybrid energy generation systems across the three service areas could provide 3,349,557 kWh of electrical energy annually for the desert highway. The Net Present Cost (NPC) and Cost of Energy (COE) values decreased with increasing radiation levels, while NPC showed an increasing trend with a growing load demand, and COE exhibited a decreasing trend.

Liao et al. constructed a renewable hybrid energy system for the highway tunnel with using a highway in southern China as an example. The research results indicated the feasibility of constructing a highway tunnel renewable hybrid energy system by utilizing natural resources (i.e., solar energy and wind energy) within the road area. The hybrid energy system could reduce greenhouse gas emissions, contributing to the sustainable development of the project.

1.2 Assessment methods for sustainable road infrastructures

Zhang et al. developed a rapid evaluation method of stacking peak ratio(SPR) for assessing the interlayer condition of asphalt pavements. The results indicated that the SPR method could be compatible with various bonding materials and pollution layers, and could identify insufficient layer bonding and predict potential flaws in advance. This method provides theoretical support for promptly evaluating the bonding status, which is also of great significance for improving the durability of asphalt pavements.

Ding et al. explored the correlations between pavement structure combinations and pavement performances to promoting the longevity development of asphalt pavements. The results showed that the seasonal factors significantly affected the deflection values of pavement structures, and that increasing the thickness of the asphalt surface was beneficial for reducing the area of defects, while laying the semi-rigid base layer was beneficial for maintaining the deflection value and rut depth at a lower level.

Ma et al. improved the assessment accuracy of pavement assets by introducing the replacement cost and condition-based valuation methods. The results demonstrated that the condition-based pavement asset valuation method comprehensively considered each stage of pavement operation and could serve as an effective tool for evaluating pavement asset depreciation. This research finding can promote the sustainable development of road infrastructure.

Bi et al. developed an advanced data processing and mathematical model to compare the comprehensive performance of asphalt concretes with replacing different amounts of mineral powder by an activated carbon powder (ACP). The results indicated that the larger the replacement amount of ACP, the better was the comprehensive performance of asphalt concrete, which could improve the microwave heating efficiency of asphalt concrete.

1.3 Sustainable transportation systems

Yang et al. investigated the traffic applicability of five expressway entrance forms: conventional interchange entrance ramp (CI), passenger vehicles and trucks separation (PVTS), lanes separation around interchange (LSI), both left-side and right-side entrance ramp (LRER) and the stacked composite cross-section expressway (CCE). It was demonstrated that the strengths and applicability of PVTS, LSI, and CCE could guide the choice of entrance forms for ten-lane expressways.

Zhang et al. conducted research on the traffic safety of new energy vehicles by using three sampling methods. Studies have found that people using less protective means of transportation (bicycles, motorcycles) and vulnerable groups such as pedestrians were susceptible to serious injury and death.

Dong et al. constructed a carbon emission prediction model applicable to road sections with different planar geometries, which could realize the carbon emission quantification of vehicles on the road sections. The model revealed that the geometric parameters of horizontal curves that affect carbon emissions were the radius of the circular curve, the superelevation, and the length of the gentle curve. The root causes of high carbon emissions on horizontal curve road sections were curve driving resistance and speed fluctuations.

Author contributions

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Conflict of interest

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