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Systematic Review

Autonomous Vehicles in the Traffic Ecosystem: A Comprehensive Review of Integration, Impacts, and Policy Implications

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Abstract

Autonomous vehicles (AVs) are expected to significantly influence road safety, traffic efficiency, and urban mobility. However, their real-world impacts depend not only on vehicle-level automation but also on interactions within the broader traffic ecosystem, including human-driven vehicles, vulnerable road users, infrastructure, and governance frameworks. This review provides a system-level synthesis of recent research on the integration of autonomous and connected autonomous vehicles in mixed traffic environments. Following PRISMA 2020 guidelines, 51 peer-reviewed studies published between 2016 and 2025 were systematically reviewed and thematically analyzed. The review addresses technological foundations, safety impacts, traffic flow and network performance, mixed traffic dynamics, infrastructure and urban systems, and policy and governance challenges. The findings indicate that AV impacts are highly non-linear and sensitive to market penetration rates, control strategies, and human behavioral adaptation. While high levels of automation and connectivity can improve safety, capacity, and traffic stability, early-stage deployment may temporarily increase delays and traffic conflicts. Policy measures—such as pricing, shared mobility integration, and regulatory oversight—are therefore critical to ensuring that AV deployment delivers sustainable and equitable mobility outcomes.

Keywords: connected autonomous vehicles; mixed traffic; urban mobility; intelligent transportation systems; transportation policy

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