

Editorial: Infrastructure planning to accommodate autonomous mobility systems

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Autonomous vehicle (AV) technologies are expected to reshape the future of mobility, but their successful deployment will require more than advances in vehicles themselves. As automation becomes increasingly embedded in urban transport systems, the built environment must also evolve to accommodate new operational, spatial, and societal requirements. For civil and municipal engineers, this means reconsidering how roads, intersections, public transport systems, pedestrian spaces, and digital infrastructure are planned, designed, and managed.

This motivated the themed issue Infrastructure Planning to Accommodate Autonomous Mobility Systems. The issue was conceived around the premise that the transition towards autonomous mobility requires both technological innovation and a parallel transformation of infrastructure. Safer, more efficient transport networks must be developed alongside systems that minimise environmental impacts, remain adaptable to changing levels of automation, and respond to societal needs.

These questions are not entirely new to Municipal Engineer. Sousa *et al.* (2018) examined the opportunities and challenges associated with AVs and their implications for urban infrastructure, while Parkin *et al.* (2018) highlighted interactions between AVs, pedestrians, cyclists, and other users of urban streets. More recently, the journal has reflected a broader shift towards data-driven and adaptive infrastructure planning. Kwak *et al.* (2024) linked transport planning with climate-change mitigation, and Yeon *et al.* (2025) demonstrated how reinforcement learning can support dynamic mobility operations. Collectively, these studies show that infrastructure is becoming increasingly digital, responsive, and interconnected. The four contributions to this themed issue extend this discussion across different scales of autonomous mobility. They move from road-space allocation, through the experience of autonomous transport users and the expansion of automation into pedestrian environments, to a real-world living laboratory for intelligent and cooperative infrastructure.

Lee *et al.* (2026) formulate dedicated AV lane (DAVL) allocation as a reinforcement-learning problem and evaluate traffic, energy, and environmental outcomes under different AV market penetration rates. Their findings show that dedicated infrastructure is not

universally beneficial. At low penetration, premature DAVL allocation can reduce capacity for human-driven vehicles and worsen congestion and emissions, whereas more consistent benefits emerge as AV penetration increases, with a structural transition between approximately 30% and 50%. This suggests that autonomous mobility should not be planned around a single assumed future state. The transition will be gradual and characterised by prolonged coexistence between automated and conventional vehicles. Phased, reversible, and dynamically managed infrastructure may therefore be preferable to rigid permanent allocation. Similar concerns about the flexible use of constrained road space appear in Lee *et al.* (2025), who examined the design of pick-up locations in congested urban road sections.

Operational efficiency, however, is only one dimension of readiness. Yang *et al.* (2026) shift attention from infrastructure performance to the people who actually use autonomous mobility services. Analysing large-scale user reviews of autonomous public transport in Korea, they conceptualise acceptance as a situated judgement shaped by functional, technological, and emotional factors, as well as spatial and temporal context. Tourism-oriented services are associated more strongly with novelty and enjoyment, whereas services operating in dense late-night urban environments raise greater safety concerns while also being valued for filling gaps in existing mobility provision. This implies that municipal engineers cannot assess infrastructure readiness solely through technological capability or traffic performance. Infrastructure and service planning must therefore consider when, where, and for whom autonomous mobility creates meaningful value.

Park *et al.* (2026) broaden the discussion further by moving beyond road vehicles to autonomous mobile robots (AMRs) operating in pedestrian environments. Their study develops a robot-specific network incorporating sidewalk width, obstacles, and pedestrian activity and validates the framework through real-world AMR experiments. The results show a clear relationship between pedestrian density and robot delay and demonstrate that routes with fewer pedestrian conflicts generally provide more reliable operating conditions. Autonomous mobility is no longer confined to vehicles travelling on carriageways. As robotic systems increasingly enter sidewalks and shared public spaces,

infrastructure traditionally designed for human movement must accommodate new interactions. Building on wider research into pedestrian-network resilience and data-driven infrastructure assessment (Ku *et al.*, 2022), Park *et al.* (2026) suggest that familiar planning concepts such as accessibility and walkability may increasingly need to be complemented by the emerging notion of robotability.

These increasingly diverse requirements raise a further question: how can adaptive road management, connected vehicles, human needs, and emerging autonomous systems be coordinated and tested within an integrated urban infrastructure environment? Weidl and Talluri (2026) address this system-level challenge through the Aschaffenburg City Mobility Living Lab. Their framework combines LiDAR and environmental sensing, Bayesian probabilistic modelling, reinforcement learning, vehicle-to-everything communication, and digital twins across 12 urban intersections. The Living Lab demonstrates how infrastructure can become an active participant in mobility management by perceiving conditions, anticipating disturbances, exchanging information, and supporting adaptive decisions. Its real-world testbed approach also bridges modelling and implementation, allowing cooperative and resilient mobility concepts to be evaluated under actual urban conditions.

Taken together, the four papers show a progression from adapting physical road space, to understanding users, extending autonomous mobility into pedestrian environments, and finally integrating these emerging requirements within intelligent infrastructure systems. They also reinforce a broader reality: cities are unlikely to move directly from conventional transport to full autonomy. Instead, they will experience a prolonged period of mixed mobility involving human-driven and AVs, conventional and autonomous public transport, pedestrians, and increasingly robotic systems.

For civil and municipal engineers, this transition calls for a broader and more flexible conception of infrastructure, in which physical design is increasingly integrated with sensing, communication, artificial intelligence, digital representations, and adaptive control. Autonomous mobility therefore represents more than a new generation of vehicles. It requires a parallel transformation of

the infrastructure and built environment within which those technologies operate. The task is not simply to prepare cities for AVs, but to shape infrastructure systems that enable autonomous mobility to contribute to safer, more efficient, resilient, and sustainable urban environments.

REFERENCES

- Ku D, Choi M, Oh H, Shin S and Lee S (2022) Assessment of the resilience of pedestrian roads based on image deep learning models. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **175**(3): 135–147, [10.1680/jmuen.21.00037](https://doi.org/10.1680/jmuen.21.00037).
- Kwak J, Ku D, Jo J *et al.* (2024) Travel demand management strategies to mitigate climate change. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **177**(2): 64–75, [10.1680/jmuen.23.00026](https://doi.org/10.1680/jmuen.23.00026).
- Lee R, Lee J, Kwak J and Lee S (2025) Design of pick-up locations in the crowded road sections. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **178**(1): 18–31, [10.1680/jmuen.24.00051](https://doi.org/10.1680/jmuen.24.00051).
- Lee Y, Lee S, Jeong I *et al.* (2026) Reinforcement learning-based adaptive dedicated lane planning for autonomous vehicles. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **179**(3): 167–182, [10.1680/jmuen.25.00117](https://doi.org/10.1680/jmuen.25.00117).
- Park S, Min S, Choi M, Kim S and Lee S (2026) Network construction strategies for the activation of autonomous mobile robots. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **179**(3): 196–206, [10.1680/jmuen.25.00118](https://doi.org/10.1680/jmuen.25.00118).
- Parkin J, Clark B, Clayton W, Ricci M and Parkhurst G (2018) Autonomous vehicle interactions in the urban street environment: a research agenda. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **171**(1): 15–25, [10.1680/jmuen.16.00062](https://doi.org/10.1680/jmuen.16.00062).
- Sousa N, Almeida A, Coutinho-Rodrigues J and Natividade-Jesus E (2018) Dawn of autonomous vehicles: review and challenges ahead. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **171**(1): 3–14, [10.1680/jmuen.16.00063](https://doi.org/10.1680/jmuen.16.00063).
- Weidl G and Talluri KK (2026) Living Lab: cooperative, predictive and resilient AI-driven infrastructure. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **179**(3): 207–224, [10.1680/jmuen.25.00109](https://doi.org/10.1680/jmuen.25.00109).
- Yang Y, Song J, Kim S and Lee J (2026) Acceptance as situated judgement: text mining user reviews of autonomous public transport. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **179**(3): 183–195, [10.1680/jmuen.25.00116](https://doi.org/10.1680/jmuen.25.00116).
- Yeon C, Cho A, Kim S, Lee Y and Lee S (2025) Real-time dynamic route generation algorithm of DRT with deep Q-learning. *Proceedings of the Institution of Civil Engineers – Municipal Engineer* **178**(2): 116–129, [10.1680/jmuen.24.00082](https://doi.org/10.1680/jmuen.24.00082).