Chapter 3
Advances in AI-Based Mobility Modelling: Toward Intelligent Transport Infrastructure in Smart Cities

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ABSTRACT

To build smart cities, we need to completely change how we design, run, and manage transportation systems in cities. Artificial Intelligence (AI) is a game-changing tool that enables us to model human movement, enhance transportation networks, and predict travel patterns with unprecedented accuracy. This chapter gives a thorough overview of the most recent developments in AI-based mobility modeling, with a focus on how transportation has changed from traditional methods to smart, dynamic, and data-driven infrastructures. It examines how AI methods, such as machine learning, deep learning, and reinforcement learning, are applied in transportation systems to enhance real-time decision-making, traffic forecasting, demand-responsive services, and autonomous driving. The chapter also discusses the most pressing problems, moral issues, and future directions for integrating AI into urban transportation systems to create smart, sustainable, inclusive, and resilient cities.

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1. INTRODUCTION

In modern cities, urban mobility is the most important thing for economic growth, social inclusion, and environmental sustainability (Sharma & Dehalwar, 2025). The idea of smart cities has come up as a way to change how cities grow in the future as cities around the world deal with rapid urbanization, traffic jams, environmental issues, and changing needs for transportation (Lewis, 2015). The main idea behind this vision is to rethink how we move around, making systems smarter, more efficient, more responsive, and more environmentally friendly. Smart cities combine human, collective, and artificial intelligence to improve people's lives (Herath & Mittal, 2022). Smart mobility is one of the six most essential parts of this. So, mobility is not only a necessary part of smart urban living, but it is also a strategic tool.

Traditional transportation systems, which rely heavily on static modeling and infrastructure-centric approaches, are becoming less and less able to meet the complex and changing needs of modern urban mobility. Adaptive, predictive, and scalable solutions are necessary to address challenges such as unpredictable traffic, fluctuating travel demand, inefficient public transportation, and the introduction of new modes of transportation like ride-sharing and autonomous vehicles. In this situation, intelligent transport infrastructure, which includes real-time data collection, dynamic modeling, predictive analytics, and automated decision-making, becomes very important (Sumalee & Ho, 2018). Neirotti et al. (2014) say that urban smartness projects will only be successful if they can use data-driven insights and add intelligence to transportation systems (Neirotti et al., 2014).

Recent progress in Artificial Intelligence (AI) has opened up new ways to deal with these problems (Bahamazava, 2025). AI techniques like Machine Learning (ML) (Chen & Zhang, 2024), Deep Learning (DL) (Li et al., 2021), Reinforcement Learning (RL) (Savithramma et al., 2023), and Natural Language Processing (NLP) are changing the way people move around by making it possible to predict traffic in real time (Nayak & Pandit, 2025), change routes on the fly, and make public transportation respond to demand (Vansteenwegen et al., 2022). With the help of AI, transportation systems are changing from passive physical networks to smart ecosystems that can sense, analyze, learn, and adapt to changes in cities.

The change from traditional to AI-based mobility modeling is part of a bigger shift in how transportation planning is done. The four-step model (trip generation, trip distribution, mode choice, and route assignment is an example of a traditional transport model that is static and doesn't always show how unpredictable urban travel behaviors can be (Ihrig et al., 2024). These models utilise historical data and assume that conditions remain stable, which is not often the case in real life. AI-driven models, on the other hand, are rich in data, take context into account, and are continually evolving. They can update predictions based on real-time information