Chapter 10
Strategic Integration of WASPAS Method for Effective Traffic Management and Congestion Control

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ABSTRACT

Effective traffic management and congestion control are pivotal for sustainable urban development. This study proposes a Multi-Criteria Decision-Making (MCDM) approach, employing the Weighted Aggregated Sum Product Assessment (WASPAS) method, to address these obstacles. Integrating 30 diverse sub-criteria, including infrastructure capacity, environmental impact, and socio-economic elements, the model offers a comprehensive framework for decision-makers. By categorizing

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criteria through WASPAS, informed decisions can be made to optimize traffic flow and mitigate congestion. Here we highlight the innovative application of MCDM in transportation planning, emphasizing its potential to enhance urban mobility and promote sustainable development in increasingly congested urban environments.

1. INTRODUCTION

Traffic management and congestion control are critical aspects of urbanization and transportation engineering, aimed at ensuring the seamless flow of vehicles and minimizing delays on road highway systems. With the rapid increase in urban sprawl and vehicle ownership, cities worldwide face notable challenges in managing traffic congestion. Effective traffic management involves an inclusive approach that considers multiple factors contributing to congestion, including high vehicle density, inadequate public transportation systems, and behavioural factors of drivers. Fuzzy logic is increasingly being used in traffic management and congestion control to handle the uncertainty and fluctuation of traffic conditions. It helps in dynamically adjusting traffic signals based on real-time data, improving flow efficiency. For instance, fuzzy logic controllers can evaluate traffic density at intersections and adjust signal timings to optimize traffic flow, reducing wait times and improving overall efficiency. This method of using fuzzy logic for traffic control has been successfully implemented in various cities, demonstrating significant reductions in congestion and improvements in traffic flow. One of the primary advantages of using fuzzy logic in traffic management is its ability to handle imprecise and changing data, which is a common characteristic of real-world traffic scenarios. Traditional traffic control systems often rely on fixed signal timings and established guidelines, which may not be effective in dealing with fluctuating traffic volumes and unpredictable conditions. In contrast, fuzzy logic systems can continuously adapt to fluctuating circumstances, providing a more responsive and efficient solution to traffic management. To effectively address the elements of traffic congestion, multi-criteria decision-making (MCDM) techniques are applied to analyse and prioritize the various elements that impact traffic management. MCDM methods are used to make well-informed and organized resolutions when multiple conflicting alternatives are involved. This multi-criterion decision-making approach helps traffic planners recognize the most impactful factors and implement targeted interventions to enhance traffic flow and reduce congestion. They help to analyse and prioritize criteria by methodically considering various factors, enhancing transparency and objectivity. MCDM approach facilitates stakeholder involvement, resolves conflicts, and assists a strategic approach across diverse fields like project management, environmental management, and healthcare. By incorporating both quantitative and qualitative data,

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