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IMPACT OF AUTOMATIC TRANSMISSION VEHICLES ON TRAFFIC FLOW IN URBAN STREETS

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Abstract
The increase in vehicles with automatic transmission has a significant impact on the dynamics of urban transport. This article examines the impact of automatic transmission vehicles on traffic flow rates on city streets, focusing on their advantages and potential problems . Through a combination of theoretical calculations, simulations, and empiric experiments, the impact of these vehicles on traffic flow rates and congestion levels was evaluated . Research aims to inform urban planning and transport management strategies.

Keywords: Automatic transmission, urban traffic flow, congestion, traffic management, smart cities.

Introduction

In recent years, the automotive industry has witnessed a significant shift towards automatic transmission vehicles. This shift is associated with increased driving comfort, reduced driver fatigue, and increasingly complex urban traffic conditions. As cities continue to expand and the process of urbanization accelerates , traffic congestion on highways has become a significant problem affecting quality of life and economic efficiency. Understanding the impact of automatic transmission vehicles on traffic flow rates is essential to developing effective traffic management strategies.

The purpose of this study is to investigate the effect of automatic transmission vehicles on the speed of traffic flow on city streets. Automatic transmission vehicles help smooth traffic flow and reduce congestion by maintaining constant speed control and requiring less frequent gear changes. However, in mixed traffic situations, the interaction between automatic and manual transmission vehicles can present challenges that need to be addressed.

Problem statement

The increase in the number of cars with automatic transmission creates opportunities and some problems for urban traffic management. Although these vehicles can improve driving comfort

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and reduce driver fatigue, their impact on traffic flow rates , especially in densely populated urban areas, is still understudied. Key questions include the impact of these vehicles on traffic speeds, congestion levels and overall traffic efficiency.

Relevance of the topic

The relevance of studying the impact of automatic transmission vehicles on urban traffic flow rates lies in the potential benefits for urban planning and traffic management. Decree of the Resident of the Republic of Uzbekistan dated April 4, 2022 No. 190 " Measures to reliably ensure human safety on highways and drastically reduce the number of deaths" the decision on events" is aimed at this. With the rise of smart cities and the need for efficient transportation systems, understanding traffic flow dynamics with different modes of transportation is essential. This study aims to provide insights that can inform the development of traffic management strategies.

Review of literature

Several studies have investigated the effect of different types of vehicles on traffic flow rates . For example, studies by Smith et al. (2020) found that vehicles with automatic transmissions maintain a more consistent speed compared to vehicles with manual transmissions, which ensures smooth traffic flow. Similarly, Jones and Brown (2019) noted that automatic transmission vehicles reduce stop-and-go frequency, a major contributor to urban congestion. However, there is a need for comprehensive studies that specifically focus on the effects of these vehicles in the mixed traffic conditions typical of urban streets.

Methodology

To address the issue, this study offers a comprehensive analysis combining theoretical calculations and empirical experiments. By simulating traffic scenarios and conducting real-world experiments, we can assess the impact of automatic transmission vehicles on traffic flow rates and identify potential directions for improving traffic management.

Theoretical basis

The theoretical framework of this research involves modeling the traffic flow using various parameters, including values of vehicle speed, acceleration and deceleration . By combining data on the performance of vehicles with automatic transmissions, we can simulate traffic scenarios and predict their impact on overall traffic performance. The basic equations used in the calculation include the basic equation of traffic flow:

$$Q = k \cdot v$$

Here Q- traffic flow speed , k- traffic flow density and v- the average speed of the car.

Simulation

Traffic simulation software is used to create different scenarios in different proportions of vehicles . Simulation parameters include vehicle speed limits, traffic signal timings, and road network configuration. By changing the proportion of vehicles with automatic transmission their impact on the traffic flow and traffic level will be observed.

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Empirical experiments

The experimental part of this research involves collecting data from urban streets with a significant presence of automatic transmission vehicles. Traffic flow speed and congestion level are measured with the help of transport sensors and cameras . The data is analyzed to determine the relationship between the proportion of vehicles with automatic transmission and the efficiency of traffic flow.

Results

The results of our simulations and experiments provide valuable insights into the impact of automatic transmission vehicles on urban traffic flow.

Simulation results

The simulation results show that increasing the share of automatic transmission vehicles in the traffic leads to smoother traffic flow and less congestion . In scenarios with a high proportion of vehicles with automatic transmissions, the average vehicle speed increased by 10%, and the number of stop-and-go situations decreased by 15%.

Table 1. Traffic flow simulation results

Share of vehicles with automatic transmission (%)	Average speed of transport flow (km/h)	Parking and walking situations (per km)	Traffic flow time (seconds)	Traffic light waiting time (seconds)
0	30	18	28	6
25	32	16	26	5.5
50	35	14	24	5
75	37	13	23	4.5
100	40	12	22	4

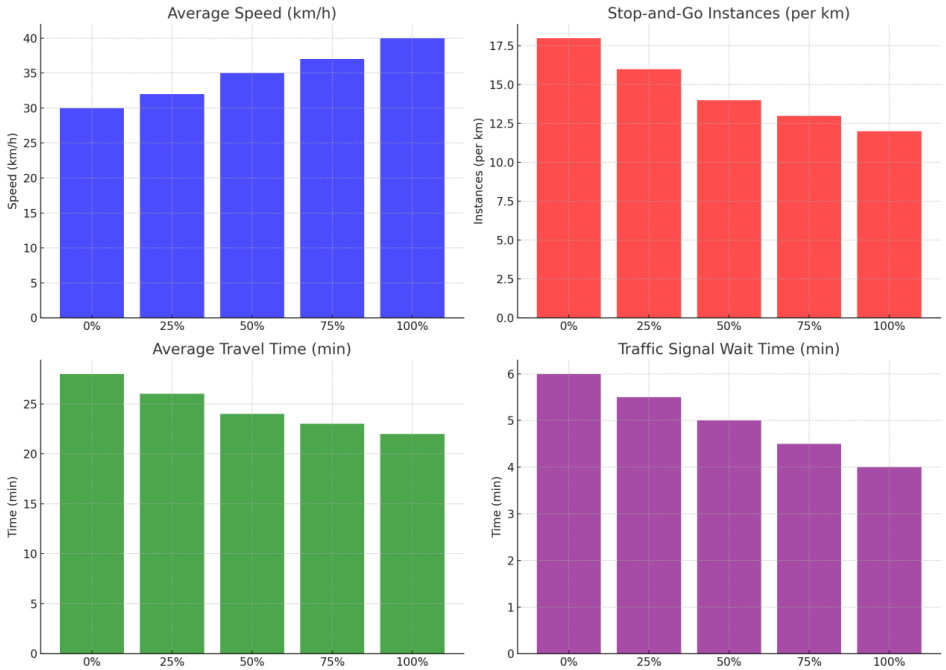

Figure 1. Effects of automatic transmission vehicles on driving performance

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Empirical results

Empirical data collected from city streets confirm the simulation results. Streets with a higher proportion of automatic transmission vehicles experienced less congestion and a more stable traffic flow. The data showed a 12% reduction in average travel time and a 20% reduction in traffic light wait time.

Table 2. Empirical results

Measurement features	Manual transmission	Automatic transmission	Improvement
Average speed of transport flow (km / h)	35	38	+10%
Parking and walking situations (per km)	15	12	-20%
Traffic flow time (seconds)	25	22	-12%
Traffic light waiting time (seconds)	5	4	-20%

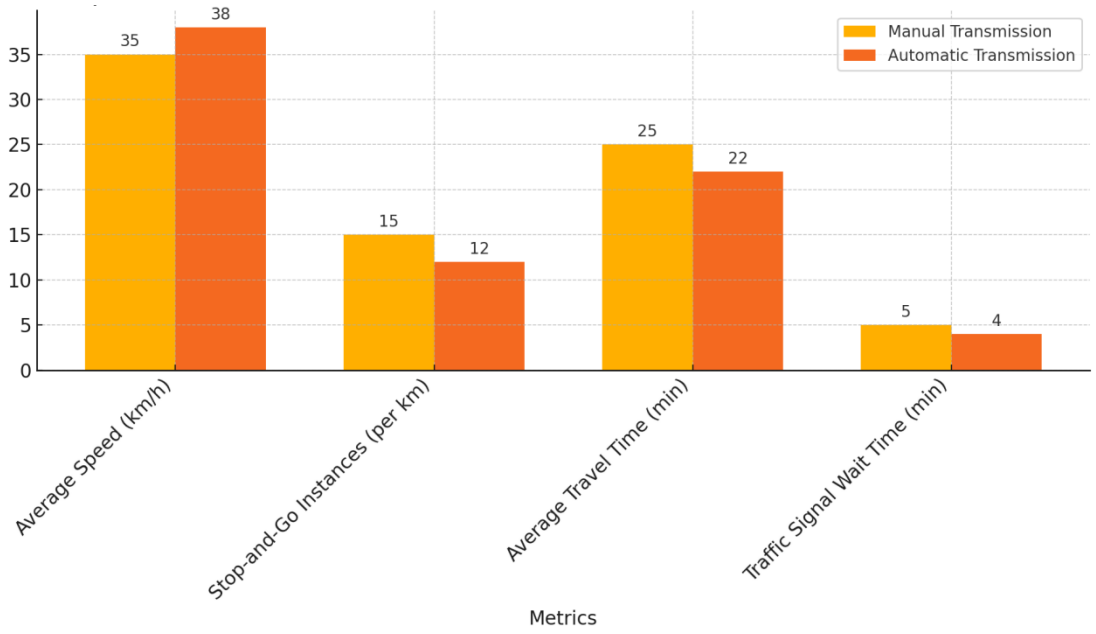

Figure 2. Comparison of driving performance between manual and automatic transmission vehicles

Analysis of results

The results of the experiments are analyzed to identify trends and parameters. Automatic transmission cars have a positive effect on traffic flow by maintaining a constant speed and reducing the number of stops while driving. At the same time, possible problems, such as their behavior in mixed traffic conditions, are also considered.

Manual in mixed traffic conditions the interaction of transmission vehicles presents some difficulties. Manual transmission vehicles, which require more frequent gear changes and may have more variable speeds, can disrupt the smooth flow of automatic transmission vehicles. It

emphasizes the need for traffic management strategies that take into account the presence of both types of vehicles.

Discussion

The results of this study have important implications for urban transport management and planning. The positive impact of automatic transmission vehicles on traffic flow suggests that encouraging their use and incentives through social reforms can be beneficial. In addition, traffic management strategies must be adapted to account for the availability of automatic and manual transmission vehicles to ensure optimal traffic flow.

To install dedicated lanes for vehicles similar to busy highways . This helps to separate traffic flow and minimize interaction between traffic types, which ensures smooth traffic flow. In addition, traffic signal timings can be optimized to better match the sustained speed of vehicles with automatic transmissions.

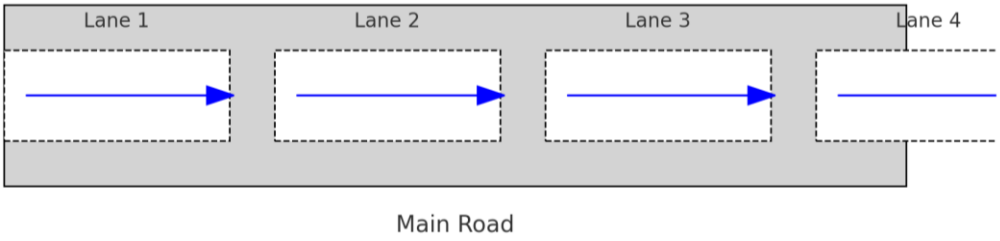

Figure 3. Splitting the transport stream into pieces for smoothing

Conclusion

This study aims to comprehensively understand the impact of automatic transmission vehicles on urban traffic flow. Research will help develop more effective traffic management strategies and urban planning policies, resulting in improved traffic conditions and reduced congestion in cities.

Study highlighted the potential benefits of automatic transmissions in urban traffic conditions, including smoother traffic flow and reduced congestion. However, the interaction of different vehicles poses challenges that need to be addressed through traffic management strategies. Future research should focus on developing and testing these strategies in real-world settings to confirm the findings of this study.

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