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UNLOCKING EFFICIENCY: A COMPARATIVE ANALYSIS OF ROAD TOLL SYSTEMS BASED ON VEHICLE IDLING TIME AND CO2 EMISSION - A CASE STUDY

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Abstract: This study presents a comparative analysis of road toll systems by assessing their efficiency based on vehicle idling time and CO2 emissions. Road tolls are a crucial mechanism for managing traffic congestion and reducing environmental impact. Through a detailed case study, this research investigates the impact of road toll systems on two key factors: vehicle idling time and CO2 emissions. By comparing different tolling approaches, the study aims to unlock insights into their effectiveness in mitigating congestion and promoting environmental sustainability. The findings provide valuable guidance for policymakers, urban planners, and transportation authority's seeking to optimize road toll systems for enhanced efficiency and reduced environmental footprint.

Keywords: Road toll systems, comparative analysis, efficiency, vehicle idling time, CO2 emissions, congestion management, environmental sustainability, case study.

INTRODUCTION

As urbanization accelerates and traffic congestion worsens, effective transportation management strategies become essential. Road toll systems have emerged as powerful tools to mitigate congestion and reduce environmental impact. However, the efficiency of various road tolling approaches in terms of both vehicular idling time and CO2 emissions reduction remains a topic of significant interest. This study aims to address this gap by conducting a comparative analysis of different road toll systems, focusing on their impact on vehicle idling time and CO2 emissions. Through a comprehensive case study, this research delves into the effectiveness of these tolling systems in optimizing traffic flow and promoting environmental sustainability.

The importance of this research lies in its potential to offer insights into designing road toll systems that not only alleviate congestion but also contribute to a greener urban environment. By analyzing real-world data and conducting a comparative assessment, this study seeks to provide actionable recommendations for transportation policymakers and authorities striving to unlock efficiency in road tolling systems.

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METHOD

Case Selection:

The research selects a diverse set of cities with varying road toll systems in place. These cities are chosen to represent different tolling methods, such as distance-based tolling, congestion pricing, and time-based tolling.

Data Collection:

Quantitative data on vehicle idling time and CO2 emissions is collected through GPS tracking devices installed in a sample of vehicles. Traffic data is sourced from relevant urban transportation authorities, and emission factors are obtained from reputable environmental agencies.

Comparative Analysis:

The collected data is analyzed to assess the impact of different road toll systems on vehicle idling time and CO2 emissions. The analysis involves comparing the performance of each tolling system against a baseline scenario without tolls.

Statistical Techniques:

Statistical techniques such as regression analysis may be employed to identify correlations between road toll systems and the reduction in idling time and CO2 emissions.

Ethical Considerations:

Ethical approval is sought if human subjects are involved in data collection. Additionally, data privacy and confidentiality are maintained throughout the research.

Limitations:

Limitations include the availability and accuracy of data, as well as potential confounding factors that could influence the results.

Through this comprehensive methodology, the study aims to provide a nuanced understanding of the impact of road toll systems on vehicle idling time and CO2 emissions. The comparative analysis will shed light on the strengths and limitations of different tolling approaches and contribute to unlocking greater efficiency in managing traffic congestion and reducing environmental footprint.

RESULTS

The comparative analysis of road toll systems based on vehicle idling time and CO2 emissions revealed valuable insights into their efficiency and environmental impact.

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Quantitative analysis of the data collected from various cities with different road tolling systems indicated notable reductions in both vehicle idling time and CO2 emissions in areas with tolls compared to baseline scenarios. Distance-based tolling systems demonstrated a significant reduction in vehicle idling time, particularly during peak hours. Congestion pricing models effectively decreased traffic congestion and subsequently led to lower CO2 emissions, aligning with the objectives of promoting environmental sustainability.

DISCUSSION

The results of the study emphasize the potential of road tolling systems to unlock efficiency in urban transportation management. Reductions in vehicle idling time not only alleviate traffic congestion but also contribute to lower fuel consumption and reduced air pollutants. The correlation between congestion pricing and decreased CO2 emissions underscores the role of financial incentives in encouraging shifts towards greener transportation choices.

The comparative analysis sheds light on the diverse impacts of different tolling systems. While distance-based tolling addresses idling time, congestion pricing directly targets environmental concerns. This suggests that tailoring tolling strategies to specific urban contexts and objectives is crucial for maximizing their effectiveness.

CONCLUSION

The research on the comparative analysis of road toll systems presents compelling evidence of their potential to unlock efficiency in urban transportation. The reductions in vehicle idling time and CO2 emissions underscore the multifaceted benefits of road tolling systems beyond congestion management.

The findings hold significance for policymakers, urban planners, and transportation authorities. The study provides actionable insights into designing road tolling systems that align with local objectives while contributing to broader environmental sustainability goals. Implementing context-specific tolling strategies can pave the way for more efficient and eco-friendly urban transportation networks.

In conclusion, this research contributes to the advancement of transportation management strategies by demonstrating the effectiveness of road toll systems in reducing vehicle idling time and CO2 emissions. The study highlights the significance of tailoring tolling approaches to specific urban contexts and underscores their potential to unlock efficiency and promote greener urban mobility.

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