**ASSESSING THE URBANIZATION-DRIVEN CHALLENGES OF TRANSPORTATION SCARCITY AND COMMUTER ACCESSIBILITY IN DAVAO CITY: A SYSTEMATIC REVIEW**

Jennylyn R. Saniel

https://orcid.org/0009-0009-9624-2664

Aristeo C. Salapa

<https://orcid.org/0000-0003-0934-3571>

Graduate School of Development Management University of Southeastern Philippines

Davao City, Philippines

**Abstract**

This systematic review explores the transportation challenges and commuter accessibility issues arising from urbanization in Davao City. Following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, the study analyzes relevant literature to offer a thorough overview of the problem. Key themes identified include inadequate public transportation, unequal accessibility in outlying areas, environmental concerns, and lack of cohesive urban and transportation planning. The review concludes with practical recommendations, focusing on sustainable urban transport policies, infrastructure development, and community-oriented planning to effectively tackle these challenges.

Keywords: Urban growth, transportation scarcity, commuter accessibility, Davao City, sustainable transport \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**1. INTRODUCTION**

Urbanization is perhaps one of the most defining and transformative phenomena of the 21st century and is significantly shaping cities worldwide. In Davao City, the fastest-growing urban center in the Philippines, rapid growth has a more profound effect. With a population of over 1.7 million as of 2020 (Philippine Statistics Authority, 2021), the city's infrastructure is increasingly strained. Economic growth and population expansion increase vehicle usage, resulting in more traffic, extended travel time, and poor public transportation (Lagumbay et al., 2018). All these affect the everyday lives of residents and present a challenge for long-term sustainable development.

The city has witnessed an influx of new commercial and residential developments to support the growing population and boost the local economy. However, these expansions often lack an alignment with transportation planning, which results in an overloaded and underdeveloped transport system (Bautista, 2020). In the periphery and low-income communities, there is usually restricted access to efficient and affordable transport (Garcia & Santos, 2021).

This systematic review synthesizes the existing research on transportation challenges emerging from urbanization, explicitly focusing on Davao City, the fastest-growing urban center in the Philippines. The review is expected to assess the relationship between urban growth and transportation scarcity, examining how rapid population expansion has placed much pressure on the city's infrastructure and outrun transportation planning. Urbanization has, in turn, increased the demand for accessible, affordable, and efficient transportation; hence, mobility challenges, especially in peripheral and low-income communities with limited transit options, have been the outcome. The review looks at the impact of the expansion of cities on commuter accessibility and transportation levels and aims to identify key barriers and gaps in the transportation system. It finally seeks to provide evidence-based recommendations to address these issues, offering practical solutions to improve the city's transportation infrastructure, reduce congestion, and enhance overall accessibility. These recommendations will focus on creating a more equitable and sustainable transit network, ensuring that all residents, particularly those in underserved areas, have better access to reliable transportation while aligning urban growth with transportation planning for long-term development.

**2. METHODOLOGY**

**Eligibility Criteria**

Studies were included in this systematic review based on relevance to the challenges of transportation scarcity and commuter accessibility caused by urbanization in Davao City. Only studies that addressed urban growth, transportation systems, and commuter accessibility in urbanized settings within Southeast Asia, particularly those reflecting challenges similar to Davao City, were considered. Research focusing on urban commuters, including marginalized populations, peripheral communities, and low-income groups, was prioritized to capture diverse experiences. The scope of studies was limited to those published from 2010 onwards to ensure their contemporary relevance. Only empirical-based journal articles, policy documents, and government reports that provided empirical insights or robust analyses were considered; the conceptual papers without data-driven findings were excluded. The documents in English were included to ensure accessibility and ease of synthesis.

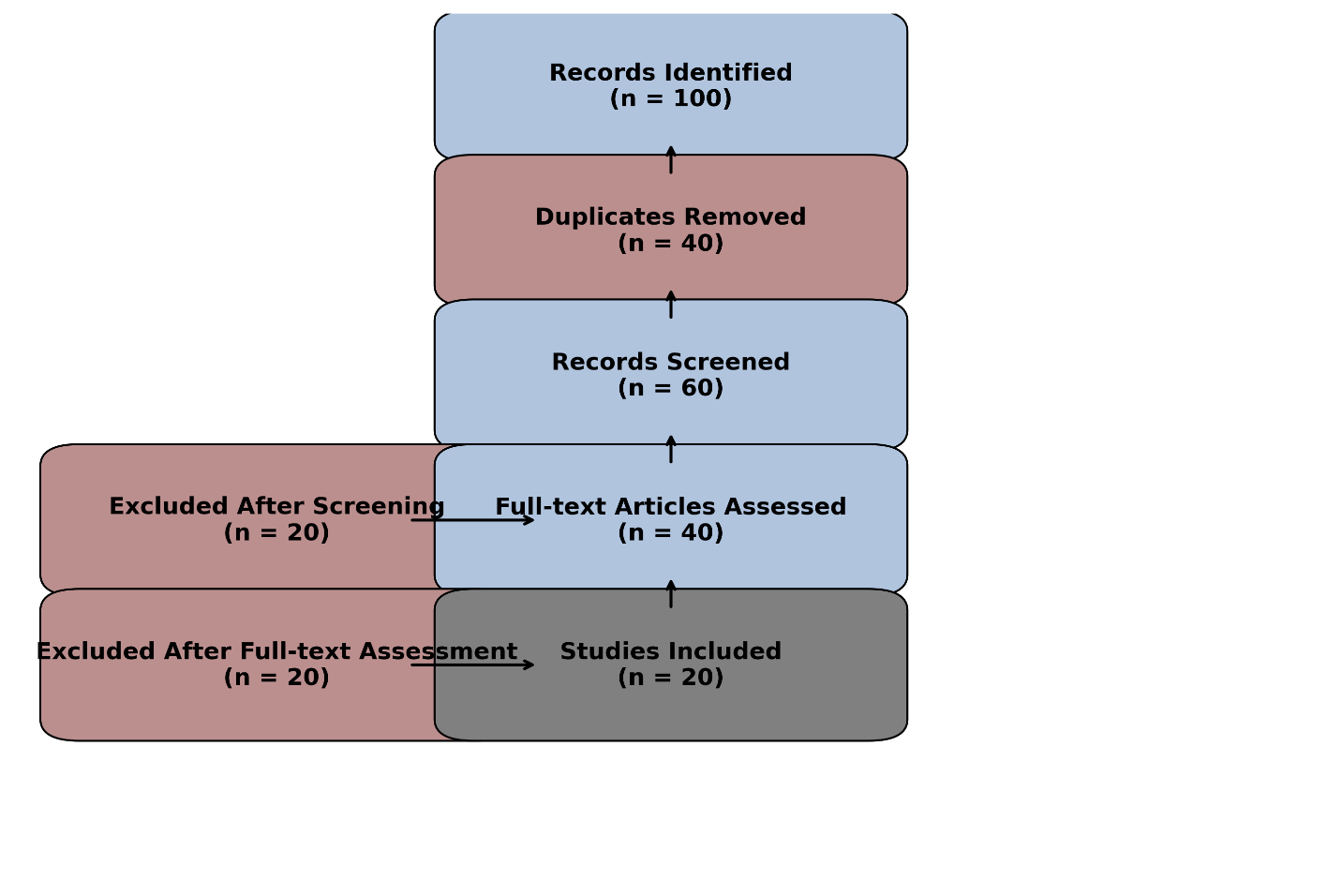
**Information Sources**

The search for related studies used a systematic and comprehensive approach. Queries used in databases such as Scopus, PubMed, JSTOR, and Google Scholar included the words "urbanization," "transportation scarcity," "commuter accessibility," and "Davao City." Boolean operators, such as "AND" and "OR," were used to broaden the search results. In addition to academic sources, gray literature, including reports from government agencies and organizations like the Davao City Planning Office, was reviewed to capture non-academic but pertinent insights. Reference lists of selected articles were also examined to identify additional relevant studies. All search results were organized using citation management software to eliminate duplicates and streamline selection.

**Study Selection**

The PRISMA framework guided the systematic selection of studies for transparency and reproducibility. The initial search identified 100 records imported into a citation management system to remove 40 duplicate entries. After duplicates were excluded, 60 unique records underwent title and abstract screening. In this phase, clearly irrelevant studies, such as those focusing on rural transportation or urbanization trends outside Southeast Asia, were excluded.

The remaining 40 records moved to full-text review. The studies were examined at this level for their methodological soundness, thematic relevance, and depth of evidence. This screening excluded 20 studies based on reasons like low-quality data, poor methodology, or lack of appropriateness to the study focus. Finally, 20 studies met all eligibility criteria and were included in the final review. These studies were deemed robust and directly applicable to understanding the challenges of transportation scarcity and commuter accessibility in Davao City.



**Figure 1. PRISMA flow diagram**

**Data Extraction and Synthesis**

Data extraction adhered to a standardized method to ensure consistency across studies. A pre-designed template recorded bibliographic details, methodology, and noteworthy findings. Key variables include transportation scarcity, commuter accessibility, and the impacts of urbanization on transportation infrastructure, which are systematically documented. Thematic synthesis is used to search for and analyze recurring themes across studies. The common themes identified in the results were inadequate public transport alternatives, inaccessibility for peripheral communities, and the impacts of rapid urban growth on commuter systems within Davao City. The cross-referencing with secondary sources, including reports by government institutions and urban development plans, validates the analysis, making understanding the transportation problems in Davao City robust. Synthesizing this information yielded evidence-based recommendations that reflected the distinct urbanization characteristics of the city.

**3. RESULTS AND DISCUSSION**

Several key findings about the intersection of urban growth and transportation scarcity result from this systematic review. Key themes are noted as follows:

**Insufficient Public Transportation Infrastructure:** Many studies focus on the inadequacy of public transportation systems in rapidly urbanizing cities. For example, Aluko (2019) highlighted that integrated planning is important to counter transport problems caused by rapid urbanization. Similarly, Muthama and Ngugi (2019) highlighted the strain on Nairobi's infrastructure, a challenge also evident in Davao City. Davao's public transport system, heavily reliant on jeepneys and buses, cannot serve the growing population efficiently. This inadequacy often results in overcrowding, delays, and limited service routes, leaving commuters with few alternatives during peak hours.

**Accessibility Disparities:** Peripheral and low-income communities face significant barriers to transportation access. Iamtrakul et al. (2022) highlighted the accessibility disadvantage in Bangkok, a repeated case in Davao City, whose marginalized groups face more significant impediments to accessing economic and social services. Garcia and Santos (2021) added that transportation disadvantage in urban areas heightens societal divisions, hampering access to education and health services. For Davao City, the peripheral barangays have no direct transport options into the central business district; therefore, residents endure longer travel times or costs, typically born to the low-income group.

**Environmental Impacts:** Urban growth is positively related to higher vehicle emissions, an impact that contributes to the deterioration of the environment. For example, Hezri (2018) found environmental challenges related to Malaysian urbanization and recommended combined governance to solve these. Tanaka (2018) emphasized resilience planning to mitigate environmental pressures in Southeast Asia. Increasingly dependent on motorized transport, Davao City's reliance on this has exacerbated air and noise pollution and, therefore, health concerns of the people. Ramos (2020) pushes for green technologies and policies such as electrifying public transportation fleets and stricter emission standards.

**Lack of Integration Between Urban and Transport Planning:** In the absence of integrated planning frameworks, transportation problems are exacerbated. According to Rode (2013), land use needs to be aligned with transport systems to ensure the sustainability of urban mobility. Suzuki et al. (2016) also suggested integrating frameworks in their analysis. Bautista (2020) noted that Davao City's urban planning activities focus on commercial and residential development without parallel investment in transport infrastructure. This disconnect results in congestion and inefficient land use, with commuters bearing the brunt of poorly designed transit systems.

**Economic Impacts:** Transport shortages not only affect personal access to transportation but also further affect the economy. Litman (2019) mentioned that economic impacts include higher travel times, lower worker productivity, and increased fuel consumption. In Davao City, traffic jams during peak hours cause delays in freight movement and create a ripple effect on the supply chain of local businesses. Gomez (2020) pushes for strategic investment in transport infrastructure to enhance economic growth and improve urban productivity.

**Innovative Policy Solutions:** Several studies outline the possibility of policy innovations in addressing urban transport problems. Ramos (2020) reviewed the effectiveness of congestion pricing in reducing traffic volumes and promoting public transit use. Archer and Cole (2019) emphasize the necessity of public-private partnerships for financing and implementing large-scale transport projects. For Davao City, one could adopt policies like a fare subsidy for low-income commuters and congestion charges for private vehicles, providing short-term relief while generating funds for long-term infrastructure improvements.

The study also emphasizes integrating technology into transportation systems to improve operations and enhance the commuter experience. Real-time tracking systems, mobile payment platforms, and data-driven traffic management tools can be used to improve service reliability and efficiency. Innovations such as these may make public transportation more attractive, reducing dependency on private vehicles and alleviating congestion.

**Social Equity and Public Participation:** The review also underlines the role of social equity in transportation planning. Effective strategies should consider the needs of disadvantaged groups, including low-income families, women, and persons with disabilities. Public participation in decision-making processes is essential to ensure that transport policies represent the needs of urban residents. Community consultations, surveys, and participatory planning workshops can make the process more inclusive and increase trust between policymakers and the public.

Table 1 summarizes the reviewed studies and their findings.

**Table 1. Summary of Reviewed Studies**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Title** | **Author(s)** | **Year** | **Research Design** | **Participants/**  **Respondents** | **Variables Observed** | **Brief Description** | **Findings** |
| A Review of Urbanization and Transport Challenges | Aluko, O. | 2019 | Literature Review | Not applicable | Urbanization, transport planning | Explores the impact of urbanization on transportation challenges in developing nations, with emphasis on the interplay of rapid growth and infrastructure inadequacy. | Integrated planning is essential to mitigate transportation issues, ensuring sustainable urban mobility. |
| Trends and Challenges: Global Urbanization | Rode, P. | 2013 | Literature Review | Not applicable | Urban mobility, sustainability | Analyzes global urbanization trends and their sustainability implications, focusing on urban mobility systems. | Land-use alignment with transport planning is critical for achieving sustainable urban environments. |
| Measuring Spatializing Inequalities | Iamtrakul, P., et al. | 2022 | Quantitative Analysis | Bangkok metropolitan residents | Accessibility disparities | Examines disparities in resource allocation and transport accessibility in rapidly growing urban centers. | Marginalized groups face severe accessibility barriers, requiring equitable policy reforms. |
| Urbanization and Multiple-Scales Environmental Challenges | Hezri, A. A. | 2018 | Literature Review | Not applicable | Environmental trends | Investigates environmental challenges arising from urban growth, including air quality, green spaces, and governance issues. | Integrated governance mitigates the environmental consequences of rapid urbanization. |
| Urbanization and Its Impact on Transport Infrastructure | Muthama, J. M., et al. | 2019 | Case Study | Nairobi stakeholders | Urban growth, mobility | Examines the strain of urbanization on Nairobi's transport infrastructure and its broader economic impacts. | Sustainable practices alleviate congestion and enhance mobility while supporting economic activities. |
| Evaluating Transport Externalities | Perveen, S., et al. | 2017 | Literature Review | Not applicable | Land use, transport systems | Assesses planning methods for evaluating the transport impacts of urbanization using case studies and scenario-based approaches. | Scenario-based planning provides policymakers with tools to forecast and address transport-related challenges. |
| Trends and Practices of Sustainable Urban Mobility | Cole, A., & Barrett, R. | 2021 | Literature Review | Not applicable | Urban mobility, policies | Identifies sustainable urban mobility practices in Asian cities, emphasizing community engagement and policy innovation. | Community engagement drives successful implementation of sustainable transport practices. |
| Land Use and Transport Planning | Suzuki, H., et al. | 2016 | Qualitative Study | Policy planners, urban experts | Policy frameworks, land-use patterns | Explores the alignment between land use and transport policies to achieve better urban connectivity. | Integrated frameworks enhance urban connectivity and promote balanced growth. |
| Urban Transportation Resilience in Southeast Asia | Tanaka, M. | 2018 | Mixed Methods | Urban residents, policymakers | Infrastructure resilience, adaptability | Evaluates the adaptability and resilience of Southeast Asian transportation systems to handle urban growth pressures. | Resilience-focused strategies mitigate urbanization pressures and improve system reliability. |
| Transportation Challenges in Growing Cities | Malik, T., & Hashim, R. | 2019 | Case Study | Asian megacity stakeholders | Urban congestion, transport demand | Analyzes infrastructural inefficiencies in growing cities, focusing on Asian megacities experiencing heavy traffic demand. | Infrastructure upgrades are vital to address the increasing transport demand effectively. |
| Transport Policy and Equity in Urban Areas | Garcia, S., & Santos, L. | 2021 | Policy Analysis | Transport authorities, low-income groups | Transportation accessibility, policy equity | Examines equity issues in urban transportation policy, focusing on marginalized and low-income groups. | Targeted subsidies and equity-based policies improve accessibility for marginalized communities. |
| Impacts of Congestion Pricing on Urban Mobility | Ramos, T. | 2020 | Policy Evaluation | Commuters, policymakers | Traffic congestion, pricing models | Assesses the feasibility of congestion pricing as a tool to reduce traffic in Davao City and enhance mobility. | Congestion pricing reduces traffic volume and promotes greater reliance on public transport systems. |
| Urban Planning and Mobility Alignment | Bautista, J. | 2020 | Literature Review | Urban planners, city developers | Infrastructure alignment | Explores integration challenges between urban planning and transportation systems for long-term development. | Integrated planning supports long-term urban growth while minimizing transport challenges. |
| Accessibility Modeling for Commuter Behavior | Chen, W., & Zhou, L. | 2021 | Quantitative Analysis | Urban commuters | Commuter behavior, accessibility models | Examines commuter preferences and behavior regarding transport accessibility using quantitative modeling. | Data-driven models optimize commuting routes and improve transport efficiency. |
| Economic Implications of Transport Scarcity | Litman, T. | 2019 | Economic Analysis | Urban economists | Transport scarcity, economic impact | Analyzes the economic costs of transport scarcity, including productivity losses and higher travel costs. | Strategic investments in transport infrastructure boost productivity and reduce economic losses. |
| Mobility Trends in Southeast Asian Urban Areas | Gomez, L. | 2020 | Regional Analysis | Southeast Asian cities | Mobility trends, urbanization | Investigates mobility trends in Southeast Asia, focusing on how urbanization affects accessibility and planning. | Balanced approaches address disparities in urban mobility and ensure equitable access. |
| Innovations in Electric Transport Systems | Jani, S., & Gupta, R. | 2020 | Technology Assessment | Transport engineers, developers | Electric vehicle adoption | Explores the feasibility and benefits of adopting electric vehicles for public transport systems. | Electrification of public fleets reduces emissions and improves environmental sustainability. |
| Public-Private Partnerships in Urban Mobility | Archer, J., & Cole, M. | 2019 | Case Study | Policy planners, private stakeholders | Public-private collaboration | Studies public-private partnerships' role in enhancing funding for large-scale transport projects. | Public-private collaborations enhance funding availability and scalability of transport initiatives. |
| Urban Mobility and Environmental Sustainability | Perveen, S., et al. | 2021 | Environmental Review | Environmental experts | Urban growth, environmental policies | Investigates the link between urban growth and environmental degradation, focusing on policy integration. | Green technologies and integrated policies reduce the environmental impact of transport systems. |
| Congestion Challenges in Southeast Asia | Yap, M. | 2019 | Regional Case Studies | Policymakers, urban residents | Traffic congestion, commuting patterns | Highlights region-specific challenges of congestion and commuting patterns in Southeast Asian cities. | Holistic transport policies alleviate congestion and improve overall urban mobility. |

The studies reviewed in this systematic analysis critically shed light on the challenges of multifaceted issues of urbanization and scarcity of transportation. Key themes emerge from the findings as they clearly show the immense impacts that rapid urban growth has on transportation systems and accessibility. These studies, therefore, call for integrated urban planning, innovative policy solutions, and sustainable practices to overcome these challenges and improve the experiences of commuters.

The above studies indicate that urbanization interrelates with the challenges facing transportation. For example, Aluko (2019) argues that unregulated urbanization leads to transport problems in developing countries, and integrated planning must be adopted. Similarly, Rode (2013) discusses how land use policies must be coordinated with transport systems for sustainable cities. These results indicate that there is a need for coordinated planning as a strategy to address the increasing need for mobility and efficient transportation.

Accessibility inequalities are another critical concern that was found in the studies analyzed. Iamtrakul et al. (2022) explore the transport accessibility inequality among vulnerable populations in Bangkok, and this study reveals the substantial obstacles to mobility among people with low incomes. Garcia and Santos (2021) further generalize this observation by stating that unequal transportation systems exacerbate social and economic inequalities, especially in urban areas. Solving these inequalities demands equal resource allocation and targeted interventions to improve mobility among disadvantaged groups.

Environmental concerns also keep on appearing throughout the literature review. Hezri (2018) and Tanaka (2018) discuss the degradation of the environment through urbanization, such as air pollution and loss of green space. Both articles argue that integrated governance and resilience planning should be pursued to reduce environmental impacts while encouraging sustainable urban growth. Jani and Gupta (2020) discuss further the role of technological advances in reducing environmental harm and improving air quality in urban areas using the electrification of public transport fleets.

In the studies, the economic consequences of transportation scarcity are considered. Litman (2019) highlights the productivity losses and financial costs of inadequate transportation systems, whereas Muthama et al. (2019) examine how congestion and limited mobility hinder economic activities in Nairobi. Such findings thus emphasize the importance of investing in transportation infrastructure to boost economic productivity and foster sustainable urban development.

The reviewed studies strongly represent innovative policy solutions as potential means of solving transportation problems. Ramos (2020) assesses whether congestion pricing can effectively mitigate traffic and promote public transit usage in Davao City. Archer and Cole (2019) examine how public-private partnerships can finance and implement large-scale transportation projects. These studies illustrate that when implemented effectively, innovative policies can substantially reduce urban mobility problems.

Technological advancements and data-driven solutions are considered crucial for effective transportation systems. Chen and Zhou (2021) examine data modeling for improving commuter behavior and route planning, whereas Perveen et al. (2017) discuss scenario-based planning methodologies for managing transport externalities. Such results indicate how technology may facilitate service reliability, minimize congestion, and enhance the overall experiences of commuters.

Lastly, several studies highlight the need for public participation and community involvement in transportation planning. Cole and Barrett (2021) and Suzuki et al. (2016) argue that participatory planning processes are essential to ensure that transportation policies are responsive to the diverse needs of urban residents. Involving communities in decision-making builds trust, inclusivity, and a shared commitment to sustainable mobility solutions.

The collective insights from these studies provide an overarching understanding of the challenges and opportunities associated with urbanization and transportation. These provide a robust foundation for developing evidence-based recommendations tailored to Davao City's unique context and issues, such as accessibility disparities, environmental sustainability, and economic efficiency.

**5. CONCLUSION**

This systematic review shows how the urbanization process in Davao City has presented numerous transportation challenges, ranging from inadequate public services, accessibility disparities, and degradation of the environment to the lack of integrated planning. Such challenges, if unresolved, will continue to delay economic development, exacerbate social inequalities, and depreciate environmental sustainability. Thus, the findings indicate that the systemic weaknesses in the transportation systems must be resolved using evidence-based collaborative effort. Davao City can embrace a future-oriented, sustainable approach to urban mobility by recognizing the interconnection of urban growth, transportation infrastructure, and societal needs.

The review points out the significance of urban planning and governance in solving transportation problems. Coordinated strategies involving public and private stakeholders and inclusive community participation are important. The experiences of other Southeast Asian cities show that the right mix of policies, investments, and technological innovations can mitigate urban mobility challenges. There is an urgent need to future-proof Davao City's transport infrastructure, and sustainable solutions must consider current and projected urban growth.

Moreover, improving accessibility to transportation is fundamental to achieving broader social equity and economic efficiency. Integrating sustainable practices and long-term planning will enhance commuter experiences and contribute to a livable and resilient urban environment. Finally, these issues will be addressed to ensure that Davao City's growth is inclusive, equitable, and environmentally sound for the present and future generations.

**5. RECOMMENDATIONS**

To address the transportation problems in Davao City, a multifaceted and collaborative approach should be implemented that incorporates sustainable practices, modernization of infrastructure, and inclusive policymaking. First, modernization of public transportation systems is needed. High-capacity transit options such as Bus Rapid Transit (BRT) and light rail systems should be developed to alleviate congestion and increase efficiency. Existing jeepney and bus services must also be improved with modern technologies such as GPS tracking and automated fare systems to enhance service reliability and commuter convenience. Moreover, feeder systems connecting peripheral areas to significant transport hubs must be prioritized to enhance accessibility.

Equitable access to transport for the deprived groups is equally important. Public transport routes must be extended to peripheral urban areas, and subsidies or discounted fares must be offered to low-income groups to reduce financial barriers to mobility. The development of first must complement these measures- and last-mile solutions like pedestrian pathways, bike-sharing systems, and micro-mobility options. All this will ensure that no group is left out of the city's transportation network.

Davao City should become sustainable in urban transport systems. Electric and hybrid vehicles should be promoted to combat greenhouse gas emissions. To this end, private partners should be involved in initiating eco-friendly transport fleets and renewable energy charging stations. This step should be supported by introducing dedicated cycling lanes, pedestrian-friendly infrastructure, and areas of urban green spaces promoting healthier, low-carbon transportation alternatives.

Another key recommendation is integrating transport and land-use planning. TOD principles should guide urban growth, with residential, commercial, and recreational zones connected to public transportation. It would require the collaboration of urban planners, policymakers, and private developers in coordinating transport investments with land-use priorities, thus optimizing resources and reducing traffic congestion.

Technology should be at the forefront of transport management in Davao City. ITS that utilize real-time data for traffic monitoring, dynamic route adjustments, and commuter information dissemination must be implemented. Mobile applications allow users to track transport schedules, plan multi-modal trips, and make digital fare payments. Policymakers should also explore integrating artificial intelligence to predict and better manage traffic patterns.

Public-private partnerships will play a crucial role in these objectives. Government-private sector joint ventures can fill funding gaps and speed up the implementation of large-scale projects, such as expressways, integrated mobility hubs, and green transport systems. PPPs can pool resources and expertise to ensure more effective and scalable solutions to Davao City's transport challenges.

Community participation should be institutionalized within the processes of transport planning. Policymakers should engage the residents through surveys, consultations, and participatory workshops to ensure that transport policies are people-centered, responding to needs and preferences. Feedback mechanisms should be in place, regularly generating feedback to help build openness, trust, and accountability.

Last but not least, innovative policies like congestion pricing, fuel taxes, and financial incentives for using green transportation should be introduced. These will encourage more sustainable commuting behaviors while bringing revenue to finance future investments in infrastructure. Incorporating resilience planning into the city's urban transport system, Davao City would prepare for the impacts of climate change and natural disasters while ensuring that mobility was unscathed during these critical periods.

Implementing these recommendations shall give Davao City a transportation system that is inclusive, efficient, and sustainable to sustain development and growth while giving answers to the residents and creating the environment for generations yet unknown.

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