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Public Transportation: Modal Shift and Changes in Travel Cost (Case Study: Mamminasata Region, Indonesia)

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ABSTRACT

In selecting transportation modes for daily activities, commuters consider and weigh the comparative advantages of each option to determine the most effective alternative. The inconsistent implementation of the Trans Mamminasata service risks reversing the shift toward public transportation, underscoring the need to evaluate its tangible benefits to ensure sustainable modal change and to justify the continuation of the program as an effective urban mobility solution. This study aims to analyze the modal shift trends and changes in daily travel costs among users who have shifted to the Trans Mamminasata service, using a descriptive quantitative method. The study was conducted within the Bus Corridor 5 service area, using primary data obtained through questionnaires to identify the characteristics of Trans Mamminasata users engaged in routine mobility activities in the Mamminasata region. The findings indicate that the K5-Trans Mamminasata public transport service contributes to improved economic accessibility and supports policy initiatives aimed at expanding sustainable mobility options across the metropolitan area. The study provides valuable input for relevant institutions as a reference for formulating strategic directions and development to enhance user adoption and ensure the long-term sustainability of the Buy-The-Service (BTS) program in the Mamminasata Region.

1. INTRODUCTION

The provision of mass transportation services is an effective solution to traffic congestion that is more sustainable [1-4]. This has been proven in Jakarta, which previously ranked 4th in the world in 2017. In response, the government implemented massive improvements by introducing mass transit systems (bus rapid transit (BRT), mass rapid transit (MRT), light rail transit (LRT), Commuter Line), resulting in a reduction in traffic congestion to 90th place globally by 2025 [5]. This serves as a concrete example for cities where significant investments are linked to a reduction in congestion levels after implementation. However, challenges related to traffic congestion remain an ongoing issue in metropolitan areas. The extremely high congestion levels in Jakarta result in losses amounting to 64 trillion rupiah [6]. The low modal share of mass transit and the economic losses caused by traffic congestion have driven the implementation of priority projects. As outlined in the National Medium-Term Development Plan (RPJMN) 2020–2024, one of the major projects focuses on addressing congestion challenges in Indonesia's metropolitan areas. The aim is to reduce the potential economic losses of urban areas due to traffic congestion issues [7]. The Buy-The-Service (BTS) program is one of the collaborative initiatives, involving multiple government agencies and private sector stakeholders.

The first stage in the Travel Demand Management (TDM) concept is the provision phase, which involves fair and efficient planning that responds to consumer demands by investing in users' needs [8]. In line with the major project, Public Service Obligation (PSO) provision has been implemented, one example being the BTS in Makassar, known as Trans Mamminasata. Consistent with the expectations of relevant institutions, the aim is for the local government to assume management responsibilities by the fourth year of operation. After three years of operation, the program still shows a relatively low load factor [9]. Due to the low load factor and limited funding, route closures and rerouting have been undertaken, reducing the available corridors from four into a single corridor operation, namely corridor K5. Thus, there has been an increase in load factors during rush hour (morning and afternoon traffic). The increase in load factor indicates a trend of modal shift from private vehicles to this public transport service. Accordingly, this suggests a growing demand for alternative modes such as Trans Mamminasata, reflecting an increasing number of people willing to switch to public transportation [10]. However, the inconsistent service of Trans Mamminasata over the past three years has significantly affected demand. Should this service be discontinued, it would leave a segment of the population who are heavily dependent on it to suffer for lack of affordable public transport service. The lack of a viable public transit alternative could potentially force previous users to shift back to private vehicle use. This scenario risks increasing daily

travel costs [11].

During modal shifts, transportation costs are a decisive factor in the choice of transport services [12] and involve personal trade-offs between risk and financial costs, specifically travel cost expenses [10, 13]. The implementation of the service over the past three years has been inconsistent and has not effectively or optimally supported the overall benefits when considering all associated costs. This inconsistency has affected demand levels and created challenges for users wishing to rely on public transport, as the service provision lacks reliability and certainty.

This study aims to analyze the modal shift and changes in daily travel costs among users who have shifted to the K5-Trans Mamminasata service. Specifically, the study examines which user groups and previous transport modes are most likely to shift to the service, how the shift affects daily travel costs, and for which previous modes the economic benefits and trade-offs are greatest. The findings are intended to support government decision-making through robust analysis based on actual outcomes of the public transport service and to identify which user segments benefit most from the provision of public transportation. By focusing on a corridor-based bus service in the Mamminasata Metropolitan Area, this case study provides empirical evidence from a medium-sized metropolitan context, complementing existing studies on other public transport systems such as TransJakarta, Teman Bus in other Indonesian cities, and Trans Sulsel. This effort is directed towards the sustainability of the public transport program to enhance mobility for residents within the Mamminasata Metropolitan Area.

2. LITERATURE REVIEW

People who engage in regular activities within areas that offer good mobility options tend to shift their travel patterns toward public transportation [11]. The mode of transport is an integral part of the decision-making process by passengers or customers when selecting transport services based on user preferences [14]. Several studies on modal shift have been conducted to evaluate the impact of commuter behavior changes from previous modes after the introduction of new transit services in various cities [15, 16].

Research findings show that commuters in metropolitan areas tend to shift from private vehicles to public transportation, although some commuters remain attached to their private vehicles [14, 17]. Social marketing theory suggests that behavioral shifts occur only when individuals are sufficiently motivated to change their habits [18]. The modal shift is often attributed to perceptions that public transit is faster, more comfortable, less congested, safer, and more affordable, with some users even willing to pay a premium fare compared to their current mode [14]. Regarding trip characteristics, it was found that travelers whose origins and destinations align with public transport routes are more willing to switch modes. This suggests that areas not served by public transport or other facilities discourage users from shifting [19].

Changes in travel behavior are generally influenced by factors such as affordability, availability, and accessibility [19]. These factors have the potential to encourage private vehicle users to shift toward public transportation [20]. Several studies have found that income exhibits a significant but negative relationship with the willingness to switch modes. This negative correlation indicates that as a traveler's income increases, the likelihood of shifting to public transportation decreases, and individuals tend to continue using private vehicles [16, 17]. Research on income and modal shift also shows relatively homogeneous data across different passenger groups [19]. The findings suggest that middle-income respondents are more likely to use BRT services, particularly because the service is well-connected to government offices and institutions of higher education [16].

Basic economic theory highlights the involvement of trade-offs (balancing benefits against negative consequences) between travel costs, land prices, and other factors in household location decisions influenced by land use and mobility [13]. Metropolitan systems play a crucial role in either accelerating or constraining economic growth depending on the level of management for effectiveness and efficiency [21]. The rising economic costs of traffic congestion include wasted time, fuel consumption, vehicle wear and tear, and accidents. The most significant contributors to high transportation costs are poor urban planning, inadequate public transportation facilities, insufficient traffic systems, and safety concerns. Other economic losses include noise effects from traffic congestion, discomfort, travel unreliability, and commuter time expenditure [17].

As the distance variable increases, the time variable tends to increase correspondingly, and vice versa [22]. Willingness-to-pay values indicate that commuters perceive the time lost due to congestion as commensurate with the costs they incur [17]. This suggests that price influences modal shift decisions; if public transport is cheaper and reliable, people are more likely to switch to it.

3. MATERIALS AND METHODS

Mamminasata region is an urban agglomeration in South Sulawesi, comprising Makassar City, Gowa Regency, Maros Regency, and Takalar Regency, as designated under Presidential Regulation No. 55 of 2011, Makassar City serves as the regional growth center and the primary destination for daily travel within Mamminasata, while Gowa Regency functions as a supporting area with strong linkages to urban activities [23]. According to the Statistic Indonesia, approximately 71.5% of daily trips to Makassar are made using private vehicles, contributing significantly to congestion along the main corridors connecting the surrounding regencies and cities [24]. This situation has prompted the designation of an urban bus service route as a priority project, particularly along the corridor linking Makassar and Gowa. The route serves areas with a high concentration of educational, business, and residential activities.

This study was conducted along the service route of the BTS Teman Bus Trans Mamminasata Corridor K5 (Kampus Unhas Tamalanrea–Kampus Teknik Unhas Gowa), which operates within the administrative areas of Makassar City and Gowa Regency. A descriptive quantitative approach was employed, utilizing primary data collected through field surveys with questionnaires administered to regular K5-Trans Mamminasata users. Data collection was carried out in May 2025 on both weekdays and weekends during rush hours. The online questionnaires were provided to passengers during their trips on the bus or while waiting at bus stops. The study population consists of users who had shifted to this service. A total sample of 100 respondents was selected using purposive sampling, with respondents defined as users who had shifted

to the K5-Trans Mamminasata service, ensuring that all participants were representative regular users of the service, defined as individuals who used it at least three trips per week for their daily mobility needs.

3.1 Modal shift trend analysis

Currently, Makassar City and Gowa Regency are served by several public transport modes, such as bus (the BTS Program: Corridor K5, serving both areas), feeder (pete-pete), and ride-hailing services. The bus operates with a fixed fare of Rp4.600 (with a discounted fare of Rp2.000 for certain passenger categories) and stops only at designated bus stops for boarding and/or alighting. Feeders operate on a flat fare per trip (whether for short or long distances) ranging from Rp5.000 to IDR 10.000 and allow passengers to board and alight anywhere along the route without fixed stops. Ride-hailing services operate on a distance based fare and are used either for direct trips or as first-and last-mile connections.

This analysis examines modal shift trends using descriptive quantitative methods. It includes calculating the distribution and average number of users who shift from private vehicles to the Trans Mamminasata K5 public transport service. The analysis employs frequency distribution and cross-tabulation to observe modal shift patterns among both regular and non-regular users. Trends are further examined based on occupation type and income level.

To assess the relationships between variables, a Chi-Square test is applied at a 95% confidence level ($\alpha = 0.05$). A p-value of less than 0.05 is considered statistically significant. This approach enables the identification of whether occupation and income significantly influence the use of public transport services.

3.2 Travel cost change analysis

This analysis aims to examine changes in users' daily travel costs. In this study, travel cost is defined in two complementary ways. First, generalized travel cost is considered, comprising travel time (min) and travel distance (km) as proxies for users' time expenditure and travel effort. Second, direct monetary cost is measured as the paid fare per one-way trip (Indonesian Rupiah). The objective is to determine the average daily cost savings experienced by users who have shifted to public transportation services. The change in travel cost is calculated using the following formula:

$$\Delta B = B_{before} - B_{after} \quad (1)$$

where, ΔB represents the change in a specific travel cost variable. B_{before} is the value prior to the modal shift (e.g., when using private transport), and B_{after} is the value after shifting to the new mode (in this case, the K5-Trans Mamminasata service). A positive value of ΔB indicates cost savings, such as reduced travel time, shorter distance, or lower fare. Conversely, a negative ΔB indicates an increase in daily travel costs, reflecting a decline in travel efficiency for that particular variable.

4. RESULTS AND DISCUSSION

This section is divided into two main parts, i.e., modal shift trends and changes in travel costs.

4.1 Modal shift trend

The modal shift trend is measured using number of users who shift from private vehicles into public transport service (Read: K5-Trans Mamminasata). In addition, shifting factors are calculated to determine the main reasons behind the shifting.

4.1.1 Number of vehicle users shifting to K5-Trans Mamminasata

Figure 1 illustrates the modes of transportation used by commuters for their daily mobility. The figure highlights modal shift trends based on data collected before and after the availability of the K5-Trans Mamminasata service. The y-axis represents the share of users (%). The "Shifting (%)" line is calculated using the formula (Before − After) / Before × 100%, indicating the relative change in usage for each transport mode following the introduction of the service. As shown in the figure, while some modes of transportation increased in use, others declined.

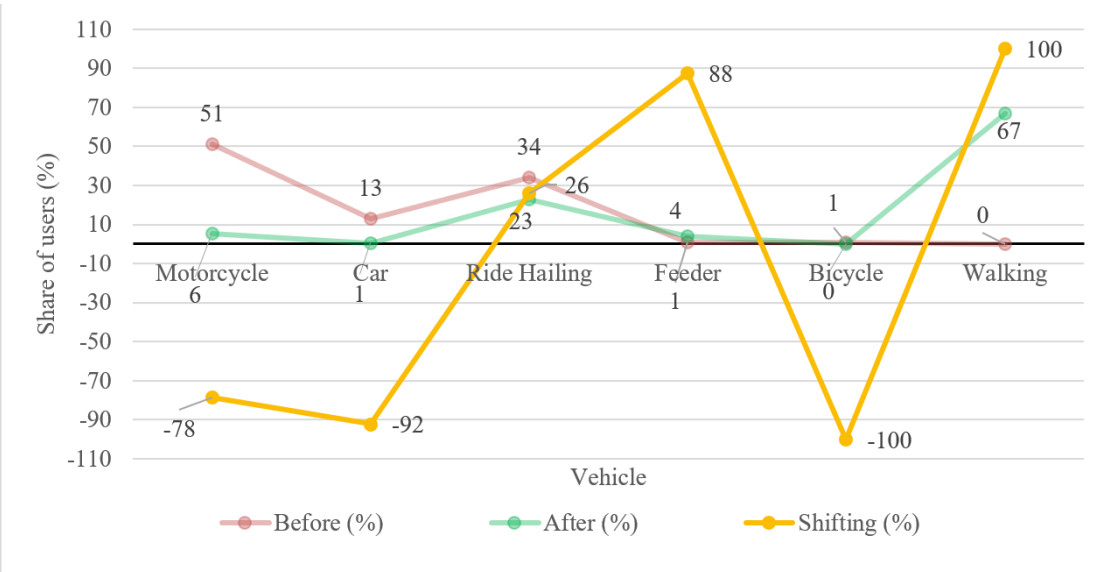

Figure 1. Number of vehicle users who have shifted

Figure 1 shows that the majority of users previously relied on private vehicles, with motorcycles (51%) and private cars (13%). After the modal shift, these figures dropped significantly to 6% and 1%, respectively, representing a modal shift of 78% from motorcycles and 92% from cars.

Conversely, walking increased after the introduction of the service. The proportion of users including walking as part of their trip rose from 0% to 67%, indicating a shift in travel behavior. This shift reflects the inclusion of walking mainly as a first- or last-mile access mode before or after using K5-Trans Mamminasata. Improved accessibility around bus stops and operator supported connectivity to activity centers have enabled users to complete their journeys on foot when accessing stops or after alighting from the bus, highlighting the importance of integrated first and last-mile conditions in supporting public transport use.

Additionally, feeder users (*Pete-pete*) increased from 1% to 4%, representing an 88% increase shift, which suggests that a portion of commuters use multimodal travel (using feeder services for first-mile or last-mile connections to reach bus stop/home). This reflects a strong tendency among commuters to integrate feeder services with main corridor public transit, potentially enhancing first-mile and last-mile connectivity. Meanwhile, ride-hailing usage decreased by 23%, indicating that some users have fully shifted from this mode to the K5-Trans Mamminasata service, although some continue to use ride-hailing as feeder modes to or from bus stops. In contrast, bicycle use declined from 1% to 0%, indicating this mode has been entirely abandoned in favor of K5-Trans Mamminasata.

Overall, the availability of the K5-Trans Mamminasata public transport service has triggered changes in daily commuter mobility behaviors, shifting from private and semi-private vehicles toward more sustainable transport options. The provision of this service acts as a catalyst and facilitator for reducing private vehicle dependency, integrating transport modes, and mitigating economic losses [4].

This modal shift aligns with findings from Rochester, New York, where the potential of BRT to accelerate modal shifts was demonstrated when supported by land use zoning that favors public transport corridors [25]. Similarly, in Bali, investment in such modes requires significant time and financial resources to succeed [26]. In Jakarta, policy support targeted at homogeneous user groups is essential for advancing transit-oriented development [15]. Cities that adopt BRT systems supported by demand provision have proven effective in driving modal transitions and enhancing urban mobility equity [8].

4.1.2 Shifting factors

To further understand modal shift behavior, cross-tabulation and Chi-Square analysis were conducted to examine the relationship between user frequency (frequent and infrequent users) and socioeconomic variables, namely occupation and monthly income.

Occupation categories were collapsed into three groups: formal employment (private-sector employees and civil servants), informal or non-formal employment (freelancers, housewives, and entrepreneurs), and students to address low expected cell counts. Table 1 presents the association between occupation and user frequency. Students represent the largest proportion of both frequent users (30 out of 65; 46.2%) and infrequent users (20 out of 35; 57.1%), followed by formal workers (30 out of 65; 46.2%) and infrequent users (7 out of 35; 20%), while informal workers accounted for a smaller proportions in both user groups. The Chi-Square test reveals a statistically significant relationship between occupation and frequency of public transport use ($\chi^2(2) = 8.780$, $p = 0.012$), with a moderate effect size (Cramér's V = 0.296), indicating that occupational status is meaningfully related to public transport usage frequency. Chi-Square assumptions were largely satisfied, as only one cell (16.7%) had an expected count below five, which remains within the commonly accepted threshold. Frequent users are mainly students and formal workers, who generally have fixed schedules and predictable or planned travel needs, making them more likely to choose structured and cost-effective public transport options. In contrast, informal workers predominantly consist of freelancers, housewives, and entrepreneurs, whose travel patterns are irregular or need-based, reducing the necessity for daily public transport use.

Table 2 presents the association between income level and user frequency. Conversely, the Chi-Square test for income and user frequency ($\chi^2(2) = 5.259$, $p = 0.072$) indicates no statistically significant relationship, although the effect size suggests a small-to-moderate association (Cramér's V = 0.229). All expected cell counts exceeded five, indicating that Chi-Square assumptions were fully satisfied. Observed patterns show that frequent users include (29 out of 65; 44.6%) with no income, followed by those (22 out of 65; 33.8%) with high income, and (14 out of 65; 21.5%) with low income. No respondents were classified in the middle-income (minimum wage level) category. Among infrequent users, the highest proportion (24 out of 35; 68.6%) is those without income (mostly students). The high proportion of frequent student users is therefore likely driven by routine or institutional travel demands rather than financial constraints.

Table 1. Occupation by user frequency of K5-Trans Mamminasata

Category	Frequent Users	Infrequent Users	χ^2 (df)	P-Value	Cramér's V
Formal	30	7			
Informal	5	8	**8.780 (2)**	**0.012**	**0.296**
Student	30	20			
Total	**65**	**35**			

Table 2. Income by user frequency of K5-Trans Mamminasata

Category	Frequent Users	Infrequent Users	χ^2 (df)	P-Value	Cramér's V
High	22	7			
Low	14	4			
Middle (Minimum Wage Level)	0	0	**5.259 (2)**	**0.072**	**0.229**
No Income	29	24			
Total	**65**	**35**			

The factors influencing modal shift related to occupation and income indicate a strategic alignment between mobility needs and the corridor design of Trans Mamminasata, especially K5, which connects academic zones, residential areas, and business districts. This finding is consistent with previous studies [25]. Employment growth among these groups directly benefits users and enhances overall productivity, thereby boosting the local economy [27-29]. Modal shift toward public transport services is strongly influenced by lifestyle characteristics; understanding which groups are more open to shifting and addressing their needs can effectively promote mobility changes [30].

4.2 Changes in travel costs

This section analyzes changes in travel cost variables, which in this study are explicitly distinguished into two components: (i) travel costs comprising travel distance and travel time, and (ii) direct monetary expenditure, represented by paid fares. The results reveal patterns of modal shift toward the K5-Trans Mamminasata public transport service and their impact on daily travel costs.

Table 3 presents changes in travel costs, measured through variations in travel distance and travel time after users shifted to public transport. The results indicate that generalized travel costs increased for most users. Specifically, 76% of users experienced an increase in travel distance, with an average additional distance of 3.86 km, while 18% of users recorded a decrease in travel distance, saving an average of 0.67 km. A small proportion of users (6%) experienced no change in travel distance. These results suggest that the public transport service corridors do not yet provide comprehensive spatial coverage. The modal shift to public transport results in longer travel distances since users first need to reach the bus stops and then travel from stops to their destinations. This contrasts with private vehicle users who can select direct routes offering the shortest travel time.

Table 3. Changes in travel costs based on distance and travel time

Change	%	Average	%
Travel Distances (km)			
No change	6	0.00	6
Loss	76	-3.86	76
Gain	18	0.67	18
Travel Time (min)			
No change	0	0	0
Loss	100	-19.08	100
Gain	0	0	0

The data in Table 3 also reveal that travel time increased for all users, with an average rise of 19.08 min per trip, while public transport provision projects tend to yield greater overall benefits and more efficient usage. To evaluate these benefits, it is sufficient to assess perceived price changes (whether fares have increased or decreased) and resulting changes in consumption [11]. However, these findings highlight a significant trade-off efficiency for users, particularly concerning travel time. There is a clear potential trade-off faced by commuters between the affordability and accessibility of public transport services versus the efficiency of their daily travel. Users must choose between a mode that is cheaper and more accessible but less time efficient, or one that is faster but more expensive or less accessible.

Table 4 examined variations in daily travel expenditures based on the mode of transport used prior to shifting. “Change (%)” represents the percentage difference in daily monetary expenditure before and after shifting modes, where positive values indicate higher costs and negative values indicate cost savings. Before shifting to the K5-Trans Mamminasata service, the average travel cost per user was Rp29.666, which decreased to Rp21.042 after shifting, resulting in an average daily travel cost saving of Rp8.623. This represents a positive reduction of 29.1% in daily monetary expenditure, indicating that shifting to the public transport mode reduces daily travel expenditures compared to previous modes.

The greatest financial benefit was observed among former ride-hailing users, who experienced a significant cost reduction in daily travel expenditure of 72.5%, from Rp77.206 to Rp21.247. This suggests that shifting modes enabled bus services to substantially reduces daily travel costs, as public transport fares are fixed and transparent ride-hailing as fares are based on shorter trips from bus stops to the origin or destination, thereby providing users with tangible monetary savings.

Conversely, users shifting from private vehicles (motorcycles and cars) experienced an increase in reported daily monetary expenditure. Motorcycle users showed a 34.1% increase (Rp16.125), while car users showed an 82.6% increase (Rp13.182). This apparent increase reflects differences in cost perception rather than actual economic loss and relates to the nature of cost comparison: private vehicle users tend to focus on perceived out-of-pocket costs (such as daily fuel expenses), while the full economic cost of private vehicle costs use includes longer-term expenses not incurred on a daily basis, such as fuel depreciation, routine maintenance, parking fees, and vehicle depreciation. Perceived out-of-pocket costs differ substantially from full economic costs, with the latter providing a more comprehensive measure of actual travel expenditure. In contrast, public transport costs are fixed and transparent, paid per trip, making the full monetary cost immediately visible to users. This difference in cost perception leads to the belief that private vehicle use is more economical than public transport, even though when full economic costs are considered, private vehicle travel often entails higher overall expenses.

Table 4. Changes in daily travel costs by fare and transport mode

Mode	%	Before (IDR)	After (IDR)	Savings (IDR)	Description	% Change in Daily Monetary Expenditure
Motorcycle	51	5.500	21.625	-16.125	Increase	-34.1
Car	13	15.956	29.138	-13.182	Increase	-82.6
Ride-hailing	34	77.206	21.247	55.959	Reduction	72.5
Chapter 1 Feeder (*Pete-pete*)	1	20.000	24.000	-4.000	Increase	-20.0
Bicycle	1	0	9.200	-9.200	Increase	N/A
Average		**29.666**	**21.042**	**8.623**	**Reduction**	**29.1**

Notes: The percentage change in daily monetary expenditure is not reported for bicycle users because the baseline (pre-shift) travel cost is zero; therefore, the percentage change is undefined. IDR = Indonesian Rupiah.

These findings suggest that while Trans Mamminasata has the potential to be a cost-efficient alternative for daily travel, the value proposition varies depending on the previous mode of travel. Users shifting from informal or costless modes (e.g., walking or cycling) or those not reporting personal travel costs may experience cost friction, despite the broader benefits public transit offers, such as safety, reliability, and congestion reduction. The results indicate that although fares decreased for certain user groups, particularly former ride-hailing users, average travel time and travel distance increased for most users. This reflects a clear trade-off between monetary savings and travel efficiency, whereby users benefit from lower out-of-pocket costs at the expense of longer travel times and greater access distances. In the Mamminasata region, some users continue to choose the Trans Mamminasata service despite its longer travel time and distance. This preference highlights the importance of comfort, safety, and schedule reliability in public transportation. Many commuters are willing to sacrifice speed in exchange for a more comfortable and predictable travel experience. They opt for the bus not because it is the fastest option, but because it offers a safer and more pleasant journey. These findings align with urban mobility literature emphasizing the need for targeted subsidies, travel incentives, or integrated pricing schemes to support the long-term sustainability of modal shifts [31, 32]. Addressing both perceived and actual affordability related trade-offs remains crucial, especially to encourage adoption among private vehicle users.

5. CONCLUSIONS

The provision and rerouting of Trans Mamminasata from Corridor K2 to K5 has resulted in a significant increase in load factor during rush hours. Despite the reduced service of the previous three corridors, gradually people start having interest in using the public transport. This shift indicates a transition from private vehicle use to public transportation services. The increased rush hour demand suggests that the change primarily stems from regular users of the service. The main empirical findings can be summarized as follows:

(1) The modal shift to K5-Trans Mamminasata is predominantly driven by students and formal employees, indicating that users with regular, structured, and predictable travel patterns are more likely to adopt public transport services.
(2) The increase in load factors during peak hours suggests that the shift mainly originates from regular commuters, reflecting growing reliance on the service despite the reduction of operations on other corridors.
(3) Changes in daily travel costs are evident, with substantial fare-related savings for former ride-hailing users, while former private vehicle users report higher perceived out-of-pocket costs.
(4) Monetary travel costs decreased for some user groups. No significant reductions in average travel time or travel distance were observed, indicating that the shift involves a trade-off between economic affordability and travel efficiency, where the primary benefit of the K5 service lies in improved economic accessibility rather than time savings.

From a policy perspective, these findings highlight the importance of strengthening first and last-mile connectivity, particularly through improved pedestrian access and feeder service integration around bus stops. Additionally, targeted fare incentives or pricing strategies for motorcycle and car users may help address perceived cost disadvantages and encourage broader modal shift. As Makassar City and Gowa Regency continue to expand as a metropolitan area, sustained investment in service reliability, network integration, and user-oriented pricing will be essential to enhance public transport attractiveness and support long-term urban mobility sustainability.

REFERENCES

[1] Abdulrazzaq, L.R., Abdulkareem, M.N., Yazid, M.R., Borhan, M.N., Mahdi, M.S. (2020). Traffic congestion: Shift from private car to public transportation. Civil Engineering Journal, 6(8): 1547-1554. https://doi.org/10.28991/cej-2020-03091566

[2] Nguyen Phuoc, D.Q., Young, W., Currie, G., Gruyte, C.D. (2020). Traffic congestion relief associated with public transport: State of the art. Public Transport, 12(2): 455-481. https://doi.org/10.1007/s12469-020-00231-3

[3] Mavlutova, I., Atstaja, D., Grasis, J., Kuzmina, J., Uvarova, I., Roga, D. (2023). Urban transportation concept and sustainable urban mobility in smart cities: A review. Energies, 16(8): 3585. https://doi.org/10.3390/en16083585

[4] Kersys, A. (2011). Sustainable urban transport system development reducing traffic congestions costs. Inžinerinė Ekonomika, 22(1): 5-13. https://doi.org/10.5755/j01.ie.22.1.1821

[5] Traffic Index Ranking: Full Ranking 2024. TomTom Traffic Index. https://www.tomtom.com/traffic-index/ranking/, accessed on Feb. 13, 2025.

[6] Harmadi, S.H., Yudhistira, M.H., Koesrindartono, D.P. (2015). How does congestion matter for Jakarta's citizens. Journal of Indonesian Economy and Business, 30(3): 220-239. https://doi.org/10.22146/jieb.10312

[7] Yudhistira, M.H., Brodjonegoro, B.P., Qibthiyyah, R.M. (2024). Unlocking urban potential. Bulletin of Indonesian Economic Studies, 60(2): 129-159. https://doi.org/10.1080/00074918.2024.2389492

[8] Litman, T. (2024). Transportation planning principles, distortions and reforms: Guidance for reducing automobile dependency and sprawl. Victoria Transport.

[9] Institute for Transportation and Development Indonesia. (2023). Dokumentasi evaluasi program buy-the-service teman bus di Indonesia. ITDP Indonesia. https://itdp-indonesia.org/publication/dokumentasi-evaluasi-program-buy-the-service-teman-bus-di-indonesia/.

[10] Göransson, J., Andersson, H. (2023). Factors that make public transport systems attractive: A review of travel preferences and travel mode choices. European Transport Research Review, 15(32): 1-18. https://doi.org/10.1186/s12544-023-00609-x

[11] Shiddiqi, A.A., Sutjiningsih, D., Tjahjono, T., Darmajanti, L., Suprayoga, G.B. (2024). Modal shift in public transport under fiscal-based policies scenarios for Jakarta. International Journal of Technology, 15(6): 1862-1872. https://doi.org/10.14716/ijtech.v15i6.5723

[12] Xylia, M., Strambo, C., Gong, J. (2024). Analyzing modal choice drivers and transport infrastructure impacts on living environment: Insights from a Swedish survey study. Transportation Research Procedia, 78: 319-326.

https://doi.org/10.1016/j.trpro.2024.02.041
[13] Zegras, C., Stewart, A., Forray, R., Hidalgo, R., Figueroa, C., Duarte, F., Wampler, J. (2016). Designing BRT-oriented development. In Restructuring Public Transport through Bus Rapid Transit, pp. 181-208. https://doi.org/10.51952/9781447326182.ch010
[14] Febriani, D., O, C.M., Sholilah, S.A., Hidajat, M. (2020). Analysis of modal shift to support MRT-based urban transportation in Jakarta. Journal of Physics: Conference Series, 1573(1): 012015. https://doi.org/10.1088/1742-6596/1573/1/012015
[15] Prayogi, L., Hanton, D. (2020). Bus rapid transit system as a potent agent for transit-oriented development: A study of transjakarta passengers' mode shift. IOP Conference Series: Earth and Environmental Science, 780(1): 012081. https://doi.org/10.1088/1755-1315/780/1/012081
[16] Naqvi, R.A., Irfan, M., Farwa, S., Wong, W.K., Ahmad, H. (2022). Mode shift behavior of commuters toward Islamabad metro bus service. Advances in Decision Sciences, 3: 1-24. https://doi.org/10.47654/V26Y2022I3P1-24
[17] Purwoko, B.A., Chotib, Yola, L. (2022). Willingness to modal shift from private to public transportation in Jakarta Metropolitan Area. Planning Malaysia Journal, 20(21): 22-34. https://doi.org/10.21837/pm.v20i21.1089
[18] Mugion, R.G., Toni, M., Raharjo, H., Pietro, L.D., Sebathu, P.S. (2018). Does the service quality of urban public transport enhance sustainable mobility? Journal of Cleaner Production, 174: 1566-1587. https://doi.org/10.1016/j.jclepro.2017.11.052
[19] Aktar, S.L., Islam, M., Anzum, N., Tahsin, S., Waliullah, M., Hasan, M.U. (2024). Modal shift potential of different mode users due to introduction of the first MRT in Dhaka: A prelaunch study. Urban Rail Transit, 10(2): 281-296. https://doi.org/10.1007/s40864-024-00233-5
[20] Anwar, A.M., Yang, J. (2017). Examining the effects of transport policy on modal shift from private car to public bus. Procedia Engineering, 180: 1413-1422. https://doi.org/10.1016/j.proeng.2017.04.304
[21] Jayasooriya, S., Bandara, Y. (2017). Measuring the economic costs of traffic congestion. In 2017 Moratuwa Engineering Research Conference (MERCon), Moratuwa, Sri Lanka, pp. 141-146. https://doi.org/10.1109/MERCon.2017.7980471
[22] Bahar, T.K., Handayeni, K.D. (2020). Commuting patterns in Sidoarjo-Surabaya. Jurnal Teknik ITS, 9(1): E70-E75. https://doi.org/10.12962/j23373539.v9i1.51206
[23] Hidayah, S., Mappasere, F.A., Usman, J., Mahsyar, A., Parawu, H.E. (2024). Actor relations in the implementation of public transportation service in South Sulawesi. KnE Social Sciences, 9(7): 254-275. https://doi.org/10.18502/kss.v9i7.15490
[24] Malik, I., N, A.B. (2025). Sustainable mobility and operational challenges of transmamminasata bus in Makassar City. Journal of Governance and Local Politics (JGLP), 7(1): 162-171. https://doi.org/10.47650/jglp.v7i1.1909
[25] Bekele, L.T. (2021). Solving Commuting Challenges with RTS Bus Rapid Transit (RTS-BRT) Rochester, NY. Rochester Institute of Technology.
[26] RakaMandi, N.B., Winaya, I.P. (2022). Transformation of public transport based on bus rapid transit (BRT) and implementation of buy the service (BTS) scheme in a metropolitan city of Sarbagita, Bali. International Journal of Current Science Research and Review, 5(7): 2775-2784. https://doi.org/10.47191/ijcsrr/V5-i7-63
[27] Weisbrod, G., Reno, A. (2009). Economic Impact of Public Transportation Investment. American Public Transportation Association.
[28] Carroll, P., Caulfield, B., Ahern, A. (2017). Examining the potential for car-shedding in the Greater Dublin Area. Transportation Research Part A: Policy and Practice, 105: 440-452. https://doi.org/10.1016/j.tra.2017.10.019
[29] Vermesch, P., Boisjoly, G., Lachapelle, U. (2021). Commuting mode share and workplace-based public transport services: An equity perspective. Case Studies on Transport Policy, 9(2): 590-599. https://doi.org/10.1016/j.cstp.2021.02.013
[30] Prato, C.G., Halldórsdóttir, K., Nielsen, O.A. (2017). Latent lifestyle and mode choice decisions when travelling short distances. Transportation, 44(6): 1343-1363. https://doi.org/10.1007/s11116-016-9703-9
[31] Hensher, D.A., Mulley, C., Nelson, J.D. (2024). Rethinking the role of the car in a MaaS framework - insights from a rural context. Journal of Transport Economics and Policy (JTEP), 58(4): 311-321. https://doi.org/10.3828/jtep.2024.58.4.311
[32] González, M.J., Lanser, S.H., v. Oort, N., Cats, O., Hoogendoorn, S. (2020). Drivers and barriers in adopting mobility as a service. Transportation Research Part A: Policy and Practice, 132: 378-401. https://doi.org/10.1016/j.tra.2019.11.022