Identifying Factors Influencing Public Transportation Use for Routine and Non-Routine Trip (Case Study: South Tangerang City, Indonesia)

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Abstract: This study examines key factors influencing the use of feeder buses for routine (e.g., work, school) and non-routine (e.g., leisure, visits) trips in South Tangerang City, Indonesia. Using stated preference surveys with 15- and 30-minute travel time-saving scenarios and binary logistic regression, the study finds that mode choice is shaped by current transport mode, cost, access time, and parking availability. For routine trips, discomfort during crowding and waiting time also matter. Mode-shift probabilities were 37%–51.7% for routine and 31%–45% for non-routine trips. The results support targeted Travel Demand Management strategies that consider trip purpose and improve public transport adoption.

Keywords: binary logistic regression; non-routine trips; public transport; routine trips; travel demand management

1. Introduction

About 20-27% of global energy consumption is contributed by the transportation sector [1)]. The growth in energy consumption gets higher year by year, impacting the environment and health. The environmental issues caused by transportation sector include air pollution, greenhouse emissions, habitat destruction, and also contribute to climate change [2)]. The energy consumption from the prevalent use of fossil fuels in the transportation sector, accelerated by increasing dependence on private cars [3)]. Single-occupancy vehicles (SOVs) contribute to higher energy consumption compared to carpooling or public transportation [4,5)].

In Indonesia, private vehicle ownership is steadily increasing. The rising use of private vehicles, coupled with insufficient public transportation options, has led to traffic congestion in various cities across the country [5)]. Traffic congestion has many drawbacks, including time losses due to longer travel times [6)], increased vehicle operational costs [7)], increased energy consumption [8)] and environmental losses such as increased carbon emissions [9)] , reduced air quality [10)], and noise pollution [11)]. Vehicle honking is identified as one of the main sources of noise in urban areas [12)]. The emission of pollutants from transportation, including greenhouse gases (GHG) and particulate matter, exacerbates air pollution and contributes to climate change [13,14)]. Both noise and air pollution result in environmental damage and have significant economic consequences [15)]. The increase in private vehicle ownership is a trend among Indonesians whose income or household financial capacity has grown, leading them to have a tendency to acquire more private vehicles [16)]. On average, the types of private vehicles owned have also increased, with car owners typically also owning motorcycles [17)]. There is a tendency for families to support each family member with high mobility by providing them with their own private vehicle [18)].

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South Tangerang is experiencing rapid urban growth with complex land use patterns, leading to increasingly intricate population movement patterns. Urban expansion is accompanied by population growth and rising motor vehicle ownership, which contribute to congestion. The complexity of mobility patterns encourages the use of private vehicles to meet transportation needs, exacerbating traffic congestion, inefficient energy consumption, and greater environmental impacts.

South Tangerang also has a very high level of interaction with Jakarta. Many daily commutes occur between the two cities, especially for work and education. Using private vehicles, the travel time between South Tangerang and Jakarta usually ranges between 50 to 120 minutes. In contrast, public transportation services such as commuter trains and BRT corridors offer relatively shorter and more consistent travel times, averaging between 30 to 60 minutes.

To address these issues, this study proposes the implementation of feeder buses public transport options that connect residential areas to major transit hubs as a means of encouraging a shift from private to public transportation. However, the success of such interventions depends on a clear understanding of local user preferences and travel behavior. These strategies can then encourage greater public transport use and foster a more sustainable urban transportation network [19].

The travel behavior of individuals is influenced by distinct factors based on whether the travel is routine or non-routine. Routine travel generally refers to daily commuting patterns such as work and school trips, which are often shaped by distance, accessibility, socio economic factors, and the built environment[20,21]. Commuters tend to prioritize travel time, cost, and safety[22,23], and higher-income individuals are more inclined to use private vehicles, while lower-income groups depend on public transportation[24,25]

The physical structure of urban neighborhoods walkability, density, and transit access also significantly affects these choices[26–28]. In contrast, non-routine travel such as for leisure, shopping, or special occasions is influenced more by situational, social, and technological factors[29]. Social events, pandemics, or environmental awareness can lead to shifts in mode choice, especially among younger demographics seeking sustainability[30–32].

Furthermore, the adoption of technology, including apps for real time information and shared mobility platforms, enhances the flexibility and attractiveness of public transport options[33–35].This understanding of segmented travel behavior is essential for developing targeted, adaptive transportation policies in fast growing urban regions like South Tangerang.

The objective of this research is to identify and analyze the key factors influencing the use of public transportation, specifically feeder buses for both routine (e.g., commuting to work or school) and non-routine (e.g., leisure, business, or family visits) trips in South Tangerang City, Indonesia. Different trip purposes are essential because each type is governed by distinct behavioral, temporal, and motivational dynamics that affect mode choice. Routine trips tend to prioritize schedule consistency and time reliability, whereas non-routine trips emphasize comfort, flexibility, and trip-specific convenience. Recognizing these differences allows planners to formulate public transportation strategies that are not only operationally efficient but also contextually sensitive, thereby enhancing their acceptance and long-term sustainability.

By conducting stated preference surveys and applying binary logistic regression analysis, the research seeks to determine the significance of factors such as travel cost, access time, comfort, parking availability, and service reliability in shaping transport mode choices. In doing so, it provides a foundation for designing user-centered public transport systems that not only accommodate diverse travel needs but also foster a shift away from single occupancy vehicle use, ultimately contributing to more sustainable urban mobility.

User preference survey will be conducted to identify the factors influencing the preferences of South Tangerang City residents in using public transportation for their daily mobility. This research will distinguish between daily mobility for routine and non-routine trips. Preferences for using public transportation for routine trips will differ from those for non-routine trips. The preference for using public transportation for routine trips refers to the tendency of respondents to use public transport for daily routine activities such as going to school and work. Meanwhile, the non-routine trips refer to business trips, non-routine refer to vacations, and social/family visits. In previous research, Yun et al. distinguished between two types of trips: work tours and non-work tours. The study found different tendencies in mode choice for work tours and non-work tours. For work tours, respondents tended to be consistent in choosing a mode of transport that they regularly use. In contrast, for non-work tours, respondents were generally more flexible in their choice of transportation mode[38]. Kumar and Sinha also found a similar tendency regarding mode choice behavior, which is influenced by the trip purpose of the respondents [36]. However, how trip purpose can become a significant variable in the use of a transportation mode will vary depending on the type of transportation mode offered. Salsabilla et al also found a similar result. In their paper, it is stated that the potential demand for the use of amphibious planes is offered to accommodate the need for inter-island mobility. The majority of the demand is for non-routine trips such as leisure, social activities, and family visits, due to the characteristics of the amphibious plane mode, which tends to be more suitable for non-routine trips [37]. Upahita et al. found that the trip purpose

variable did not significantly influence respondents' preferences in choosing between high-speed trains and airplanes [38]. Preferences based on trip purpose can serve as a foundation for developing strategies for sustainable transportation [39]. By studying user preferences, public transportation services can be designed and examined according to the type of trip purpose, making them more attractive and easier to adopt [40].

There remains a significant research gap in understanding how trip purpose (routine vs. non routine) influences mode choice behavior in specific peri urban contexts such as South Tangerang, which faces rapid urban growth, high dependence on private vehicles (SOV), and intense daily interactions with Jakarta. While previous studies have used binary logistic regression or discrete choice models to explore travel behavior, they have rarely combined stated preference modeling with trip purpose based segmentation in a city that functions as both a residential and commuting satellite to the capital. This study seeks to fill that gap by offering an evidence based framework for understanding feeder bus adoption, tailored to routine and non routine trips, thereby advancing the design of user centered Travel Demand Management strategies in South Tangerang City.

This research will employ the binary logistic regression method. The outputs of this research are the probabilities of mode shifting for respondents to use feeder buses under specific ticket price and travel time savings conditions for routine and non routine trips. Additionally, the resulting model will identify which variables significantly influence the use of feeder buses for routine and non-routine trips.

This research will identify which variables significantly influence the use of feeder buses for routine and non-routine trips. Using variable ticket price and travel time savings conditions for routine and non-routine trips. These results provide valuable insights for developing targeted Travel Demand Management strategies, aligning public transportation offerings with user preferences and needs, and optimizing urban transit systems for greater sustainability.

2. Methodology

This study will explore travel behavior, mode-shifting potential, and the factors influencing public transportation use for non-routine and routine trips in South Tangerang City. This study will further investigate the variables that influence respondents in using public transportation to accommodate their mobility needs for routine and non-routine trips. Routine trips are regular and predictable journeys that are typically part of their daily activities. Routine trips typically follow consistent patterns, influenced by factors like work hours and school schedules. These trips are usually pre-planned and often occur at specific times of the day. Non-routine trips are more irregular and occur less often than routine trips. Non-routine trips are typically marked by greater flexibility in timing and destinations compared to routine trips [41].

2.1. Data Collection

Data collection was conducted through a stated preferences survey. The stated preferences survey method is used to understand how individuals prefer a particular option, policy, service, or new offering compared to existing conditions [42]. This survey helps stakeholders comprehend public preferences for a new offering before its actual implementation, providing a foundation for formulating more effective and targeted implementation strategies [43]. In this study, the data obtained from the SP survey will be used to estimate the utility of public transport use in South Tangerang City. Stated Preference (SP) methods gather data on respondents' choices to assess how changes in the attributes of a product or service impact their perceived utility [44]. To determine public preferences for the new feeder bus mode proposed in this paper compared to existing transportation modes, the stated preference survey is an appropriate method. Respondents were sampled using a stratified random sampling technique. This approach ensured proportional representation across the subdistricts served by the proposed feeder bus corridor, which is geographically depicted in Figure 1. The sample frame targeted residents with direct or potential access to the new feeder bus service area. The sample size calculation was based on the Slovin's formula with a 5% error margin. The total population is as shown in Table 1. Using the Slovin's formula, the minimum required sample size was calculated to be 400 respondents. Based on interviews conducted by visiting the homes of residents located in the study area corridor, a total of 1089 respondents were obtained.

The potential for bias in preference surveys is inevitable,

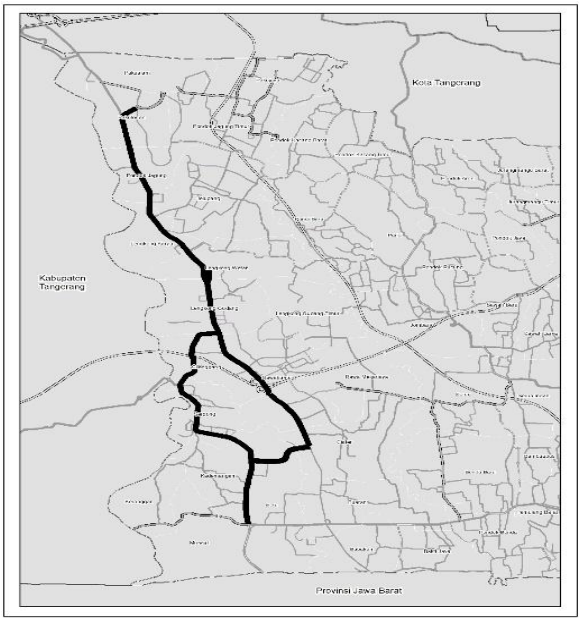

Fig. 1: The Study Area

Table 1: The population studied

Distric	Total Population
Serpong Utara	188.476
Serpong	163.451
Setu	87.100
Pamulang	324.059
Total	763.086

as respondents may not always accurately predict their behavior in real-world situations. However, several strategies were implemented to minimize this bias, including designing the questionnaire with clear and realistic scenarios to ensure respondents have sufficient information to make informed choices, conducting prior pilot testing, and employing trained surveyors to conduct face-to-face interviews with residents.

2.2. Questionnaire Design

The questionnaire consists of two main sections: (1) the collection of socio-demographic data, including gender, age, income, education level, employment status, vehicle ownership, and housing status; and (2) a stated preference (SP) experiment designed to evaluate transport mode preferences between private vehicles and feeder buses. The socio-demographic variables were selected based on their relevance to mode choice decisions, as supported by prior studies [44].

In the SP section, respondents were asked to choose between modes under various hypothetical travel conditions, incorporating variables such as travel cost, access to bus stops, waiting time, service reliability, parking availability, and perceived comfort.

The questionnaire specifically distinguishes between two trip purposes: (1) routine trips, such as commuting to work or school, and (2) non-routine trips, including leisure, social visits, or business travel. This distinction is important for capturing the differing behavioral dynamics, constraints, and motivations that influence mode choice by trip type [44].

The SP scenarios include two levels of travel time savings: 15-minute and 30-minute reductions when switching from private vehicles to feeder buses (Table 2). These values were selected based on empirical observations of actual travel patterns between South Tangerang to Jakarta. Travel by public transport typically ranges between 30–60 minutes, while private vehicles can take 50–120 minutes depending on congestion and time of day. Thus, time reductions of 15 and 30 minutes represent realistic and policy-relevant improvements within the observed range of travel durations. This approach ensures that the hypothetical scenarios reflect actual user experiences and allow for behaviorally grounded interpretations.

The fare of IDR 15,000 was chosen based on the typical range of feeder bus services operating in Greater Jakarta and South Tangerang. It reflects a realistic price point observed in similar public transport systems, ensuring that the cost presented in the SP scenarios remains relevant and familiar to respondents. This helps reduce potential bias due to unrealistic price expectations and improves external validity of the stated preference responses.

The questionnaire design followed best practices in transport behavior research and was pre-tested on a small sample to ensure clarity, internal consistency, and contextual appropriateness. The final version was administered through structured interviews conducted both online and in person across selected areas in South Tangerang City.

The dependent variable in this study is the response choice, which consists only of "yes" or "no" to switching to public transportation. The independent variables being studied include socio-demographic factors (such as age, gender, income, and occupation) [45], trip characteristics (such as access time, egress time, waiting time, and trip purpose) [46], as well as other factors influencing people's decisions to use public transportation (such as route availability, transport costs, parking area availability, and comfort levels inside the vehicle, including crowding, standing during travel, and perceived crime levels [47]. The variables used in this research are presented in Table 3.

2.3. Modeling

This study employs a binary logistic regression approach using IBM SPSS Statistics, which is particularly suitable for modeling dichotomous outcomes such as the decision to shift from private vehicles to public feeder buses. The choice of binary logistic regression is justified by the nature of the dependent variable mode choice which is binary (i.e., switch or not switch). This method accommodates categorical independent variables and does not require the assumption of normality or homoscedasticity, making it robust for behavioral travel analysis. Parameter estimation was conducted via Maximum Likelihood Estimation (MLE), operationalized through the Newton-Raphson algorithm and Iteratively Reweighted Least Squares (IRLS). This iterative procedure ensures model convergence and the robust estimation of regression coefficients, enhancing the reliability and interpretability of the findings in transportation behavior studies.

The model for binary logistic regression is presented in the formula 1.

$$P_i = \frac{e^{U_i}}{1+e^{U_i}} \quad (1)$$

Table 2: Scenario condition for the stated preferences survey

New Mode (Bus Feeder)	
Δ Time	Δ Cost
15 minutes	IDR 15.000
30 minutes	IDR 15.000

Table 3: Research variables

Variable	Category		Scale
Mode Choice (Y)	Continue Using Current Vehicle	0	Nominal
	Switch to Bus Feeder Mode	1	
Age (X_1)	0 - 20 (youth age)	1	Ordinal
	21-50 (productive age)	2	
	>51 (pra senior - senior age)	3	
Gender (X_2)	Male	1	Nominal
	Female	2	
Last Education Level (X_3)	Elementary School/	1	Ordinal
	Senior High School	2	
	Diploma 1/Diploma 3	3	
	Undergraduate (S1)	4	
	Graduate (S2/S3)	5	
	Others	6	
Job (X_4)	Government employees and office workers	1	Nominal
	Entrepreneurs/Professionals/Laborers	2	
	Students	3	
	Non-employees	4	
Income (X_5)	< Rp 3.000.000 (low income)	1	Ordinal
	Rp 3.000.001 - Rp 9.000.000 (middle income)	2	
	>Rp 9.000.001 (high income)	3	
Trip Purpose (X_6)	Routine Trips (Work/School/College)	1	Nominal
	Non-Routine Trips (Business/Vacation/Social/Family Visit)	2	
Existing Transportation Mode (X_7)	Private Vehicles (Car/Motorcycle/Non-motorized Vehicle/Walking)	1	Nominal
	Public Vehicle (Bus/Minibus/Commuter Line/MRT/Online Transportation)	2	
Existing Transportation Cost (X_8)	< Rp 10.000	1	Ordinal
	Rp 10.001 - Rp 20.000	2	
	Rp 20.001 - Rp 30.000	3	
	Rp 30.001 - Rp 40.000	4	
	Rp 40.001 - Rp 50.000	5	
	> Rp 50.000	6	
Availability of Routes that pass by the house (X_9)	Available	0	Nominal
	Not Available	1	
Access Time (X_{10})	< 5 minute (very short)	1	Ordinal
	5 - 15 minute (short)	2	
	15 - 25 minute (moderate)	3	
	> 25 minute (long)	4	
	Very long (not covered by public transportation routes)	5	
Egress Time (X_{11})	< 5 minute (very short)	1	Ordinal
	5 - 15 minute (short)	2	
	15 - 25 minute (moderate)	3	
	> 25 minute (long)	4	
	Very long (not covered by public transportation routes)	5	
Total Transfer (X_{12})	<2 transfer	1	Ordinal
	3-4 transfer	2	

	>5 transfer	3	
	Many Transfer (not covered by public transportation routes)	4	
Difficulty Finding Park Area (X_{13})	No difficulty finding parking areas	0	Nominal
	There is difficulty in finding parking areas	1	
	Never Parked at a Stop/Station	2	
Comfort level/ crowding (X_{14})	Do not feel uncomfortable when having to crowd with other passengers.	0	Nominal
	Feel uncomfortable when having to crowd with other passengers.	1	
Comfort level /standing (X_{15})	Do not feel uncomfortable when having to crowd with other passengers.	0	Nominal
	Feel uncomfortable when having to crowd with other passengers.	1	
Comfort level/criminal offenses (X_{16})	Do not feel uncomfortable when having to crowd with other passengers.	0	Nominal
	Feel uncomfortable when having to crowd with other passengers.	1	
Waiting Time (X_{17})	< 5 minute (very short)	1	Ordinal
	5 - 15 minute (short)	2	
	15 - 25 minute (moderate)	3	
	> 25 minute (long)	4	

Where P_i represents the probability of using mode i (such as the feeder bus in this paper), and U_i is the utility function of mode i [48]. The formula for calculating the utility function is shown in formula 2.

$$Ln\left(\frac{P_i}{1-P_i}\right) = U_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots \quad (2)$$

This model allows for the estimation of the probability of mode shift under various treatment conditions, including travel time savings and ticket price levels, differentiated for routine and non-routine trip purposes. These estimations inform the behavioral elasticity of users toward public transport improvements.

To strengthen model validity and capture latent heterogeneity, future refinements should consider the inclusion of interaction terms (e.g., income × cost, occupation × waiting time). Initial results suggest these interactions may improve explanatory power and enhance policy sensitivity in mode choice modeling.

3. Result and discussion

3.1. Respondent characteristics

The total number of respondents obtained was 1,089 respondents (representing the population across all districts in South Tangerang City) using random sampling. Of these, 435 respondents were government employees and office workers, accounting for 39.9% of the total respondents. A total of 255 respondents (23.4%) were entrepreneurs/professionals/laborers, while 150 respondents (13.8%) were students. Non-employees totaled 249 respondents (22.9%). The distribution of respondents' occupations can be seen in Figure 2. This distribution reflects the diverse occupational backgrounds of South Tangerang residents.

As for the respondent characteristics based on their trip purpose, they can be categorized into respondents with daily mobility for routine trips and non-routine trips. Routine trips consist of commuting for work and school, while non-routine trips include business trips, vacations, and social/family visits. A total of 705 respondents (64.7%) have routine trips, while 384 respondents (35.3%) have non-routine trips, as shown in Figure 3. This indicates that most mobility in the city is dominated by scheduled daily activities.

Meanwhile, when looking at the existing transportation modes used currently, 894 respondents (82,1%) tend to use private vehicles to meet their daily mobility needs. A total of 195 respondents (17,9 %) tend to use public transportation to meet their transportation needs, as shown in Figure 4. This phenomenon indicates a strong dependence on private vehicles among South Tangerang residents.

The integration of this data provides a comprehensive overview of urban mobility characteristics in South Tangerang. The dominance of formal workers, the high percentage of routine trips, and the strong preference for

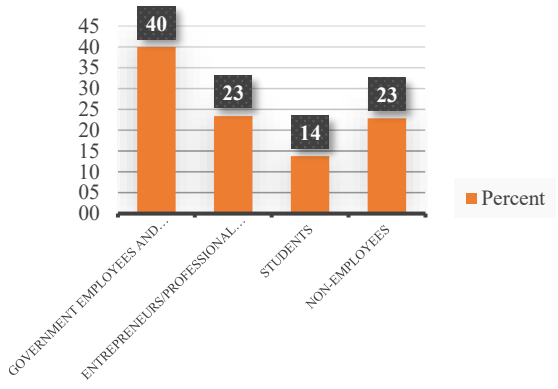

Fig. 2: Occupation of respondents

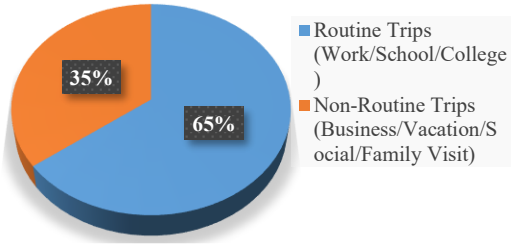

Fig. 3: Trips purpose of respondents

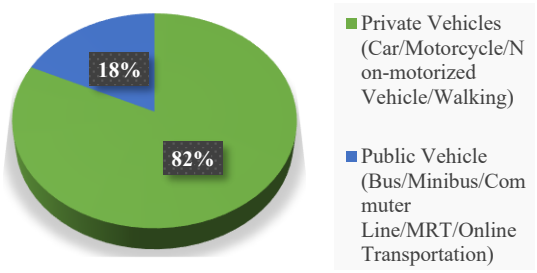

Fig. 4: Existing transportation modes of respondents

private vehicles highlight the need for developing a more effective public transportation system to reduce private vehicle dependency and improve urban mobility efficiency.

3.2. Routine trips model

Each respondent was presented with two stated preference scenarios: (1) a ticket price of IDR 15,000 with 15 minutes of travel time savings, and (2) the same fare with 30 minutes of time savings. Respondents were asked to indicate whether they would shift to feeder bus use or continue using private vehicles for routine travel. Based on their choices, binary logistic regression models were estimated, producing the following utility functions:
Scenario 1: 15-minute time savings

$$Y = 0.914X_7 + 0.418X_8 + 0.716X_9 + 0.238X_{10} - 0.727X_{14} - 4.914 \quad (3)$$

Scenario 2: 30-minute time savings

$$Y = 1.216X_7 + 0.396X_8 + 0.191X_{10} + 0.401X_{17} - 5.890 \quad (4)$$

Model fit was assessed using the Omnibus Tests of Model Coefficients and the Hosmer–Lemeshow Test. For Scenario 1, the Omnibus test yielded a chi-square value of 35.982 (df = 5, $p < 0.001$), indicating that the model significantly improves upon a null model. The Hosmer–Lemeshow test returned a p-value of 0.624 (>0.05), suggesting a good fit between predicted and observed outcomes.
Similarly, for Scenario 2, the model also demonstrated strong fit with a chi-square value of 49.656 (df = 4, $p < 0.001$) from the Omnibus test and a Hosmer–Lemeshow p-value of 0.940, indicating excellent alignment between model predictions and actual responses. These results confirm that both models are statistically significant and offer robust predictive capability for analyzing mode shift behavior under varying travel time savings scenarios.
The analysis results show that for routine trips, the dominant factors influencing the use of public transport modes (feeder buses) are existing transport modes (X_7), transport cost (X_8), public route availability (X_9), access time (X_{10}), comfort level during crowding (X_{14}), and waiting time (X_{17}). This indicates that routine trips, such as commuting to work or school, where time efficiency is critical/important. Therefore, waiting time and ease of use have a more significant impact, as people tend to optimize their daily schedules. For short time reductions (e.g., 15 minutes), users may not perceive the savings as substantial enough to offset other factors like comfort or route availability. For longer time reductions (e.g., 30 minutes), the perceived value of time saved increases, making users more willing to switch modes. Factors such as parking difficulty or waiting time then play a role in whether the switch feels worthwhile. Routine trips, such as commuting to work or school, are more influenced by factors of efficiency and time reliability. Users need a transport mode that is predictable and reliable to avoid disruptions to their daily schedules.
In the condition where the ticket price is IDR 15,000 and the travel time savings is 15 minutes, the probability of mode shifting (use of the feeder bus) was calculated with the following values: X_7 is 1 (existing transportation mode is private vehicle), X_8 is 6 (existing transportation cost > Rp 50,000), X_9 is 1 (existing public transport route available), X_{10} is 4 (existing access time > 25 minutes), and X_{14} is 1 (feel uncomfortable when crowded with other passengers). The probability of mode shift (use of the feeder bus) was found to be 37%. It shows that although the time saved is relatively small (15 minutes), the probability of mode shifting to the feeder bus remains relatively low (37%), suggesting that factors such as discomfort in crowded conditions may significantly deter potential users, even when they face high existing transportation costs and long access times. This highlights the importance of improving comfort and passenger experience to encourage mode shift.
Meanwhile, in the condition where the ticket price is IDR 15,000 and the travel time savings is 30 minutes, the probability of mode shifting (use of the feeder bus) was calculated with the following values: X_7 is 1 (existing transportation mode is private vehicle), X_8 is 6 (existing transportation cost > Rp 50,000), X_{10} is 4 (existing access time > 25 minutes), X_{17} is 4 (waiting time > 25 minutes). The probability of mode shift (use of the feeder bus) was found to be 51.7%. A probability of 51.7% indicates that,

although there are several factors that might lead someone to continue using their private vehicle (such as higher transportation costs, longer access time, and longer waiting times), a travel time savings of 30 minutes is significant enough to encourage some people to switch to the feeder bus. Factors such as long waiting times (X_{17}) and long access times (X_{10}) can make public transport more attractive, even though the higher transportation costs and comfort of private vehicles remain considerations. However, the larger time savings (30 minutes) can offset the perceived discomfort, making the use of the feeder bus more appealing to some people, with a probability of over 50%.

The analysis of routine trips shows that multiple factors influence the likelihood of switching to public transport, particularly feeder buses. In a scenario with a ticket price of IDR 15,000 and a 15-minute travel time saving, the probability of mode shift was 37% when users had private vehicles, high existing transport costs (> IDR 50,000), long access times (> 25 minutes), and discomfort in crowded conditions. Despite significant cost and access burdens, discomfort and limited time savings reduced the appeal of feeder buses. In contrast, with a 30-minute time saving under similar conditions, the probability of switching increased to 51.7%. This suggests that greater time savings can offset barriers such as long waiting and access times, making public transport more attractive. Overall, while efficiency and time reliability are key, comfort and access conditions remain critical determinants for users considering a shift from private to public transport in routine trips.

3.3. Non-routine trips model

Respondents with non-routine travel characteristics were also presented with two scenarios: (1) a ticket price of IDR 15,000 and 15 minutes of travel time savings, and (2) the same fare with 30 minutes of savings. Based on their responses, the following utility functions were derived:

Scenario 1: 15-minute time savings

$$Y = 1.0778X_7 + 0.54X_8 - 5.189 \quad (5)$$

Scenario 2: 30-minute time savings

$$Y = 1.123X_7 + 0.556X_8 + 0.317X_{10} - 0.682X_{13} - 5.249 \quad (6)$$

For Scenario 1, the Omnibus test yielded a chi-square of 24.125 (df = 2, p < 0.001), indicating that the model performs significantly better than a null model. The Hosmer–Lemeshow test produced a p-value of 0.849 (>0.05), suggesting good alignment between predicted and observed values.

For Scenario 2, the Omnibus test reported a chi-square of 40.190 (df = 4, p < 0.001), reaffirming statistical significance. The Hosmer–Lemeshow p-value of 0.262 also confirms that the model fits the data well.

These results validate the robustness and predictive accuracy of the logistic regression models for non-routine trip scenarios, providing a sound empirical basis for interpreting behavioral responses and designing targeted transport policies.

The analysis results show that for non-routine trips, the dominant factors influencing the use of public transport modes (feeder buses) are existing transport modes (X_7), transport cost (X_8), access time (X_{10}), and difficulty finding park area (X_{13}). Non-routine trips, which are more flexible and not bound by strict schedules, show that users are more influenced by factors of travel comfort rather than time efficiency directly. Factors such as cost, accessibility, and parking become more important because the purpose of the trip is usually not urgent.

In the condition where the ticket price is IDR 15,000 and the travel time savings is 15 minutes, the probability of mode shifting (use of the feeder bus) was calculated with the following values: X_7 is 1 (existing transportation mode is private vehicle) and X_8 is 6 (existing transportation cost > Rp 50,000). The probability of mode shift (use of the feeder bus) was found to be 31%.

Meanwhile,in the condition where the ticket price is IDR 15,000 and the travel time savings is 30 minutes, the probability of mode shifting (use of the feeder bus) was calculated with the following values: X_7 is 1 (existing transportation mode is private vehicle), X_8 is 6 (existing transportation cost > Rp 50,000), X_{10} is 4 (existing access time > 25 minutes), and X_{13} is 2 (never parked at a stop/station). The probability of mode shift (use of the feeder bus) was found to be 45%.

For non-routine trips, the dominant factors influencing the choice of public transport include existing transport modes (private vehicle), transport costs, access time, and difficulty finding parking. Non-routine trips, which are more flexible and not bound by strict schedules, show that users are more influenced by comfort rather than strict time efficiency. With a 15-minute travel time reduction, the probability of shifting to the feeder bus was calculated to be 31%. This relatively low probability suggests that even though there is a slight time saving, the flexibility of non-routine trips means that comfort, cost, and accessibility are more important for users. With a larger time saving (30 minutes), the probability of shifting increased to 45%. This shows that, although non-routine trips tend to prioritize comfort and flexibility, a substantial time saving still plays a role in encouraging users to switch modes. The increase in probability also suggests that parking difficulty and longer access times make public transport more appealing. Non routine trips tend to be influenced more by comfort and convenience than time efficiency. However, as the time savings increase, factors such as parking difficulties

and access time become more significant, making the feeder bus a more attractive alternative.

3.4. Mode Choice Behaviour

The study conducted in South Tangerang City provides valuable insights into urban mobility patterns and the potential for transitioning to public transportation. The analysis of respondent characteristics and trip patterns reveals several key findings. The survey captured a diverse range of occupations, with government employees and office workers comprising the largest group (39.9%). This demographic composition reflects the city's employment landscape. Notably, 64.7% of respondents reported making routine trips, primarily for work or education, indicating a significant commuter population. A striking observation is the high dependence on private vehicles, with 82.1% of respondents using them for daily mobility. This preference for private transportation presents both a challenge and an opportunity for public transit development.

Figure 4 visually presents the mode-shift probabilities across the specified scenarios for both routine and non-routine trips. For routine trips, several factors emerged as influential in the decision to use public transport, including existing transport modes, transport costs, public route availability, access time, comfort levels during crowding, and waiting time. The analysis revealed that even with a modest time saving of 15 minutes, the probability of switching to a feeder bus was only 37%, particularly when users reported discomfort in crowded conditions. This suggests that minor improvements in travel time alone may not be sufficient to encourage a significant shift to public transport, especially when comfort or access conditions are suboptimal.

Interestingly, when the time saving increased to 30 minutes, the probability of mode shift increased to 51.7%, even when access and waiting times were long. This indicates that for routine trips, larger time savings can substantially enhance the attractiveness of public transport options, reinforcing the importance of improving travel efficiency in mode shift strategies.

In contrast, for non-routine trips, the dominant factors influencing transport mode choice included existing transport modes, travel costs, access time, and difficulty in finding parking. The probability of mode shift was 31% under a 15-minute time-saving scenario and increased to 45% under the 30-minute scenario. These lower values, compared to routine trips, suggest that travelers on non-routine trips prioritize comfort and flexibility over strict time efficiency. The visual differences highlighted in Figure 5 confirm that targeted strategies for each trip type are essential for promoting public transport adoption effectively.

The results highlight the complexity of mode choice decisions and the need for a multifaceted approach to encourage public transport use. Key considerations include time efficiency, comfort and convenience, parking management, cost considerations, and route planning. While important, time savings alone may not be sufficient to induce a significant mode shift, especially for non-routine trips. Factors such as crowding levels and ease of access play a crucial role in attracting riders, particularly for routine trips. The difficulty of finding parking emerged as a factor that could make public transport more appealing, especially for non-routine trips. Transport costs remain a significant factor across both trip types, suggesting that competitive pricing could be an effective strategy. The availability of public transport routes significantly influences mode choice for routine trips, emphasizing the importance of comprehensive network coverage.

In efforts to increase public transport usage, several key factors must be considered. These include improving service reliability and frequency to minimize waiting times, enhancing the comfort of public transport to ensure competitiveness with private vehicles, implementing parking management strategies alongside public transport improvements, and developing tailored strategies for routine and non-routine trips while recognizing their distinct characteristics and influencing factors. Several studies support this approach. Research indicates that service reliability and frequency are critical factors in mode choice, as unreliable and infrequent services can discourage public transport use [49]. Additionally, comfort within public transport, including seating availability, air conditioning, and cleanliness, significantly impacts adoption [50]. Enhancing facilities and comfort can make public transport more appealing to private vehicle users. Parking management strategies, such as higher parking fees and restrictions on parking availability, can encourage people to switch to public transport [51]. These policies must be implemented alongside public transport improvements to be effective. Routine and non-routine trips have distinct characteristics, and effective strategies must account for these differences [52]. Understanding trip purposes can serve as a foundation for developing sustainable urban mobility strategies in South Tangerang City. For instance, routine trips are often more sensitive to time and cost, making

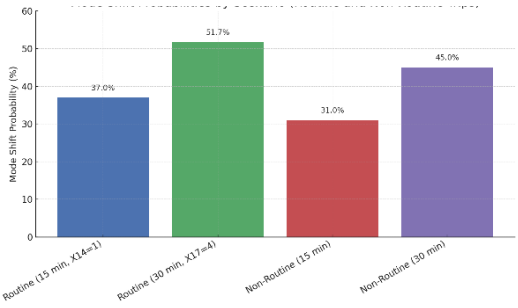

Fig. 5: Mode shift probabilities by scenario (routine and non-routine trips)

these aspects key priorities for public transport planning and design to facilitate daily mobility. In contrast, non-routine trips tend to prioritize comfort and flexibility, which should be central to designing urban transport systems that cater to leisure and weekend mobility. By considering these aspects, South Tangerang City can advance its mission to increase public transport usage as a mobility solution that meets the needs of its residents. Several previous studies have identified various factors influencing the selection and use of public transportation. However, prior research has not provided a specific understanding of how these factors interact within the context of public transport usage in South Tangerang City, as each region has distinct mobility characteristics. Therefore, further research is needed to assess the effectiveness of specific strategies in promoting a shift toward public transport in the city and to explore how local residents' travel preferences and behaviors influence the success of these strategies. This research can contribute to the development of more effective and relevant transportation policies for South Tangerang City.

3.5. Interaction Effect

The findings of this study offer critical insights into urban mobility patterns and the potential mode shift from private vehicles to public transport in South Tangerang City. Based on the characteristics of respondents and their travel patterns, it was found that the majority of participants were office workers and civil servants (39.9%), reflecting the city's employment structure. A significant proportion (64.7%) reported making routine trips, primarily for work or education, indicating the prevalence of commuter behavior in the area. Furthermore, a strong preference for private vehicles was observed, with 82.1% of respondents relying on them for daily mobility. This dependence on private transport presents both a policy challenge and a strategic opportunity to enhance the public transportation system.

For routine trips, several factors influenced the decision to use public transport, including the currently used mode, travel cost, availability of public routes, access time, comfort during crowding, and waiting time. Conversely, for non routine trips, dominant variables included travel cost, access time, and parking difficulty. These findings reinforce the differentiated behavior in mode choice based on trip purpose, as also confirmed by Kumar & Sinha [36]; Upahita et al.[38], which showed that travel type affects sensitivity to service attributes.

To enhance behavioral realism in the regression model, this study employed a logistic regression approach incorporating interaction terms to capture conditional effects among explanatory variables. The inclusion of these terms significantly improved model interpretability and policy relevance. Three statistically and substantively meaningful interaction effects are discussed below.

The interaction between income level (X_5) and existing transportation cost (X_8) demonstrated that low income respondents were more responsive to high current travel costs and more likely to shift to public transport if these costs became burdensome. In contrast, high income respondents were less sensitive to cost and prioritized comfort and time efficiency. These findings are aligned with Chen et al.[9,22,53]and Geng et al.[24], who emphasize differing cost elasticities in mode choice across income groups. Therefore, fare-based interventions such as subsidies or fare caps could be more effective for lower income populations, while improving service quality may better appeal to users with higher comfort preferences.

The interaction between trip purpose (X_6) and access time (X_{10}) indicated that access time exerted greater influence on those making routine trips compared to non-routine travellers. Routine commuters, such as office workers and students, were more deterred by long access durations due to their sensitivity to door-to-door travel time. In contrast, non routine travellers for leisure or social visits showed greater tolerance. This pattern reinforces findings by Rosli et al.[20]and Jian et al.[26], which suggest that time constrained groups are more likely to prioritize efficient access. Accordingly, enhancing first-mile and last-mile connectivity through local feeder services or improved pedestrian access is crucial for attracting routine trip users.

The interaction between occupation (X_4) and waiting time (X_{17}) revealed that formal workers and professionals were significantly less tolerant of long waiting times and less likely to use public transport when expected service punctuality was lacking. In contrast, students and unemployed individuals displayed greater flexibility, likely due to more relaxed schedules. This result is consistent with Wu et al.[35], which highlight the importance of reliability and service frequency in attracting professional users. Therefore, improving service reliability through better headways and the provision of real time arrival information could enhance service perception and encourage mode shift among time sensitive commuters.

Overall, these findings support the importance of behaviorally segmented approaches in developing context specific and targeted travel demand management strategies. They also demonstrate that mode choice decisions are not shaped by individual variables in isolation, but rather by complex interactions within the users' socio economic context. This interaction based analysis strengthens the empirical foundation for designing inclusive and adaptive public transport policies suited to the preferences of urban communities in Indonesia.

4. Conclusion

This study underscores the importance of tailoring transport policies to trip purpose differentiation. Routine

commutes are primarily influenced by efficiency and time reliability, while non-routine trips prioritize comfort and flexibility. Significant time savings, especially through optimized access and reduced waiting times, can incentivize modal shift in both segments, albeit through different mechanisms.

Policy implications suggest enhancing service reliability, comfort, and accessibility for routine trips, and addressing convenience and parking barriers for non-routine trips. Such differentiation aligns with travel demand management (TDM) strategies that integrate targeted investments, including real time tracking and park and ride facilities.

The analysis also reveals the significance of interaction effects in explaining user behavior. Mode choice decisions are shaped not solely by individual attributes but by how these variables interact for instance, the stronger cost sensitivity among low-income groups or the varying tolerance for waiting times across occupations.

This research highlights the influence of parking availability near transit hubs, reinforcing the relevance of integrated land-use and transport planning. However, the study's contextual scope limited to South Tangerang City may constrain generalizability. Additionally, the reliance on stated preference data without revealed preference validation presents a methodological limitation.

Further exploration of intermodal connectivity impacts, particularly first-mile/last-mile accessibility, is also needed. By conducting more comprehensive research implementation strategies, future studies can contribute to the development of more effective and targeted transportation policies for South Tangerang City and beyond in promoting a shift toward public transport in the city and to explore how local residents' travel preferences and behaviors influence the success of these strategies. Ultimately, this will support the creation of a more sustainable and efficient urban mobility system, reducing dependence on private vehicles and improving overall transport efficiency.

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Nomenclature

P_i	the probability of using mode i (such as the feeder bus in this paper)
U_i	utility function of mode i
β_0	a constant
$\beta_{1,\dots,}\beta_k$	coefficients
$X_{1,\dots,}X_k$	Independent variables

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