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Stated Preference Analysis of Feeder Service Plan from STTD to Jatimulya LRT Station, East Bekasi

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Abstrak: Pengembangan layanan feeder memiliki peran penting dalam meningkatkan integrasi first-mile dan last-mile dalam sistem transportasi massal berbasis rel. Penelitian ini bertujuan untuk menganalisis preferensi pengguna terhadap rencana layanan feeder dari STTD menuju Stasiun LRT Jatimulya, Bekasi Timur, dengan menggunakan pendekatan *Stated Preference* dan model *Nested Logit*. Data penelitian diperoleh melalui survei yang melibatkan 276 responden yang terdiri atas mahasiswa, staf, dan masyarakat di sekitar wilayah STTD dan Grand Wisata. Atribut yang dianalisis meliputi waktu perjalanan, biaya perjalanan, frekuensi layanan, tarif, dan kenyamanan. Hasil penelitian menunjukkan bahwa frekuensi layanan, waktu perjalanan, dan tarif merupakan faktor utama yang memengaruhi pemilihan moda transportasi. Layanan feeder memiliki probabilitas pemilihan yang lebih tinggi dibandingkan beberapa moda transportasi lainnya, terutama pada kondisi frekuensi layanan yang tinggi dan tarif yang terjangkau. Hasil estimasi model menunjukkan bahwa waktu perjalanan, biaya perjalanan, dan tarif berpengaruh negatif terhadap utilitas moda, sedangkan frekuensi layanan berpengaruh positif terhadap probabilitas pemilihan layanan feeder. Analisis *Willingness to Pay* (WTP) menunjukkan bahwa responden bersedia membayar lebih untuk waktu tunggu yang lebih singkat dan keandalan jadwal yang lebih baik. Temuan ini menunjukkan bahwa pengembangan layanan feeder yang terintegrasi dengan sistem LRT memiliki potensi yang signifikan dalam mendorong peralihan moda dari kendaraan pribadi menuju transportasi umum yang lebih berkelanjutan.

Keywords: *Stated Preference, Nested Logit, Layanan Feeder, LRT Jatimulya, Pemilihan Moda, Willingness to Pay.*

Abstract : Development feeder services have role important in increase first-mile and last-mile integration towards system transport mass rail- based research This aim For analyze preference users to plan feeder service from STTD to Jatimulya LRT Station , East Bekasi uses Stated Preference approach and Nested Logit model. Research data obtained through survey of 276 respondents consisting on students, STTD staff, and the community around STTD and Grand

Wisata areas . Analyzed attributes covering time travel, costs travel, frequency service , rates, and comfort . Research results show that frequency service, time travel, and fares is factor main influencing factors election mode . Feeder services have probability more elections tall compared to a number of fashion others , especially in conditions frequency high service and affordable rates. The model estimation results show that attribute time travel, costs travel, and fares influential negative to utilities mode, whereas frequency service influential positive to probability feeder selection . Willingness to Pay (WTP) analysis shows that respondents willing pay more For get service with time wait for more short and certain more schedule good. Findings study This show that development integrated feeder services with LRT potential push displacement use vehicle personal going to transportation more general sustainable .

Keywords: Stated Preference, Nested Logit, Feeder, Jatimulya LRT, Mode Choice, Willingness To Pay.

INTRODUCTION

Urban transportation development in Indonesia, particularly in the Jabodetabek region, increasingly emphasizes rail-based mass transit such as Light Rail Transit (LRT) to reduce congestion and dependence on private vehicles. In East Bekasi, Jatimulya LRT Station functions as a strategic node for supporting daily mobility. However, the performance of rail-based transit is strongly influenced by the quality of first-mile and last-mile connectivity, which often determines users' willingness to access and continue using public transport (Venter, 2020). Feeder services are therefore essential because they improve station accessibility, reduce transfer barriers, and strengthen the overall attractiveness of integrated public transportation systems (World Bank, 2022). Recent studies also show that limited access, travel cost, safety, walking distance, and waiting time remain key challenges in first-mile and last-mile trips, particularly in developing urban contexts (Sogbe et al., 2024). Therefore, the development of an integrated feeder service to Jatimulya LRT Station is important to support inclusive, efficient, and sustainable urban mobility.

The Indonesian Land Transportation Polytechnic-STTD is an educational activity center in East Bekasi that generates regular daily trips by students, staff, and visitors. Without an effective feeder service, access to Jatimulya LRT Station tends to rely on private motorcycles and app-based transport, which may increase congestion and dependence on less sustainable travel modes. The first-mile and last-mile problem is closely related to spatial accessibility, particularly when transit stations are not adequately connected to users' origins and destinations (Kåresdotter et al., 2022). In this context, access quality around transit stations can shape users' perceptions of public transport and influence their mode choice decisions (Venter, 2020). Therefore, improving feeder connectivity from STTD to Jatimulya LRT Station is essential to support public transport accessibility and encourage a shift from private vehicles to more sustainable modes.

App-based transport services, such as online motorcycle taxis and online car taxis, have become common alternatives for accessing transit stations because they offer flexibility, ease of booking, and relatively competitive travel times. However, their use also raises concerns related to travel safety, service reliability, user protection, and platform-based regulation. Service quality has been shown to influence passenger satisfaction in motorcycle taxi services, particularly through reliability, responsiveness, safety, and perceived value (Ong et al., 2024) In Indonesia, ride-hailing service quality also affects perceived safety, customer satisfaction, and attitudinal loyalty, indicating that users do not evaluate app-based transport only from speed and convenience, but also from security and trust (Ricardianto et al., 2024). Meanwhile, platform governance remains an important issue because ride-hailing systems depend on digital control mechanisms, driver incentives, and regulatory arrangements that shape service sustainability (Ciulli et al., 2024). Therefore, although

app-based transport provides flexible access to Jatimulya LRT Station, its role should be evaluated alongside feeder services that offer more structured, integrated, and sustainable connectivity.

In public transport planning, understanding user preferences is essential for designing services that match actual travel needs. The Stated Preference approach is widely used to evaluate hypothetical transport alternatives by presenting users with different combinations of service attributes, such as travel time, fare, frequency, comfort, and reliability (Kožul et al., 2025). These attributes are important because public transport attractiveness is commonly shaped by service reliability, access convenience, travel time, price, and comfort (Göransson & Andersson, 2023). Through this approach, users' trade-offs among service attributes can be quantified and used to estimate Willingness to Pay (WTP) for service improvements. Previous studies show that WTP analysis can support fare policy, service quality evaluation, and investment decisions in public transport planning (Bachok & Ponrahono, 2017). Therefore, the Stated Preference method is relevant for assessing the proposed STTD–Jatimulya LRT feeder service because it allows the evaluation of user preferences before the service is implemented.

User preference analysis in transportation studies can be conducted using discrete choice models because these models estimate the probability of selecting a transport mode based on variations in service attributes. The Multinomial Logit model is commonly used in mode choice analysis, but it relies on the Independence of Irrelevant Alternatives assumption, which may be restrictive when several alternatives have similar characteristics (Train, 2009). To address this limitation, the Nested Logit model allows alternatives to be grouped into nests, so correlations among similar modes can be accommodated more appropriately (Al-Salih & Esztergár-Kiss, 2021). In this study, parameter estimation is important for quantifying users' behavioral responses to changes in travel time, cost, fare, and service frequency.

Therefore, the planned STTD–Jatimulya LRT feeder service needs to be designed based on user preference analysis to ensure that the proposed service is efficient, data-driven, and aligned with daily commuter needs. This study is important because it not only examines the potential role of feeder services as a connecting mode to the LRT, but also evaluates how travel time, travel cost, fare, frequency, comfort, and safety influence users' mode choice. The findings are expected to provide practical recommendations for developing an integrated, competitive, and sustainable feeder service within the urban transportation system of East Bekasi.

METHOD

This study employed a quantitative approach using the Stated Preference (SP) method to examine user preferences for the proposed feeder service between STTD and Jatimulya LRT Station. The SP method was selected because the feeder service is still at the planning stage, meaning that revealed preference data from actual service use are not yet available. By presenting respondents with hypothetical choice scenarios, the SP approach enables researchers to evaluate how variations in travel time, travel cost, fare, frequency, and comfort affect mode choice decisions (Kožul et al., 2025). This method is also useful for estimating users' behavioral responses before a new transport service is implemented (Cherchi & Hensher, 2015).

Mode choice behavior was analyzed using the Nested Logit model because this model can accommodate correlations among transport alternatives with similar characteristics and reduce the limitations of the Independence of Irrelevant Alternatives assumption in simple logit models (Wen & Koppelman, 2001). The study was conducted along the STTD–Jatimulya LRT Station corridor, which serves as an important access route to the Jabodebek LRT system. In transit planning, the quality of access to stations strongly influences users' willingness to use public transport, especially in first-mile and last-mile contexts (Venter, 2020). The research subjects included individuals who currently travel or potentially travel to and from STTD to access LRT services, including students, PTDI-STTD staff, nearby residents around STTD and Grand Wisata, and visitors.

The study population consisted of all potential users of the proposed STTD–Jatimulya LRT Station feeder service. Respondents were selected using a non-probability sampling approach with purposive sampling, focusing on individuals who had traveled or were likely to travel to Jatimulya LRT Station. A total of 276 respondents participated in the survey.

Data were collected through a structured questionnaire distributed both offline and online. The questionnaire included three main sections: respondents' socio-economic characteristics, existing travel characteristics, and Stated Preference choice scenarios. Before the main survey, a pilot test was conducted to ensure question clarity, consistency of respondent understanding, and the suitability of the attributes used in the SP experiment (Cherchi & Hensher, 2015) .

The transport alternatives analyzed in this study consisted of public transport, online motorcycle taxis, online car taxis, the proposed STTD feeder service, private motorcycles, and private cars. The Nested Logit structure was developed based on similarities in mode characteristics and user travel behavior. This structure is commonly used when transport alternatives are not fully independent because some modes share similar attributes or usage contexts (Wen & Koppelman, 2001).

The survey data were processed and analyzed to examine how each service attribute affects the probability of choosing the proposed feeder service. The analysis also compared the choice probabilities of feeder service scenarios with existing transport alternatives and identified users' sensitivity to changes in travel time, travel cost, fare, and service frequency. In stated preference studies, such attribute-based analysis is useful for evaluating hypothetical transport services before implementation (Cherchi & Hensher, 2015a). The results were then used as the basis for formulating an operational feeder service design that reflects user needs.

In addition to model estimation, descriptive analysis was conducted to explain respondent characteristics and travel patterns. Model evaluation was based on parameter significance and the model's ability to represent respondents' mode choice behavior. The research stages included problem identification, literature review, determination of SP attributes and levels, questionnaire development and pilot testing, data collection, data transformation, model estimation, result interpretation, and formulation of feeder service policy recommendations. This systematic process is consistent with public transport service evaluation studies, where user perception, service attributes, and behavioral response are used to support transport planning decisions (Eboli & Mazzulla, 2008).

RESULTS AND DISCUSSION

Amount Respondents

The survey involved 276 respondents and provides an overview of user characteristics, travel patterns, and preferences toward the proposed STTD–Jatimulya LRT feeder service. Respondents had diverse backgrounds in terms of gender, age, occupation, and travel purpose, allowing the study to capture different mobility needs around the STTD area and Jatimulya LRT Station. The survey results also indicate that comfort, safety, travel time, travel cost, and service frequency are important factors considered in choosing a transportation mode. These attributes are commonly associated with the attractiveness and perceived quality of public transport services (Göransson & Andersson, 2023). Therefore, the proposed feeder service should be designed as an integrated, accessible, and reliable service to support station connectivity and encourage the use of sustainable public transportation.



Picture 1 Catch Screen Amount Respondents

Characteristics Respondents

The survey involved 276 respondents, including students, staff, and residents around the STTD–Jatimulya LRT corridor. Male respondents accounted for 151 participants, while female respondents accounted for 125 participants. Based on age, most respondents were in the productive age group of 24–55 years, with 148 participants, followed by respondents under 23 years old, with 111 participants. This profile indicates that the respondents represent groups with relatively high daily mobility and a strong need for reliable transportation services. Since routine commuters are generally more sensitive to accessibility, travel time, travel cost, and service reliability, these demographic characteristics provide an important basis for assessing the feasibility of the proposed feeder service (Göransson & Andersson, 2023)

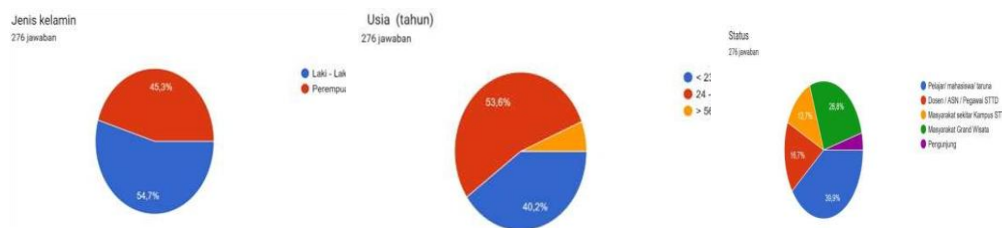


Figure 1. Characteristics Respondents Study

The main travel purposes of respondents were work and education, representing 63.8% of total trips, while the remaining trips were for recreation, shopping, and other activities. This dominance indicates that most respondents undertake routine mobility on a daily or weekly basis. Such travel patterns require public transport services that are punctual, accessible, affordable, and reliable. Therefore, respondents are likely to be sensitive to travel time, travel cost, comfort, safety, and service frequency, as these attributes strongly influence public transport attractiveness and mode choice decisions (Göransson & Andersson, 2023).

The high proportion of routine trips indicates that the proposed STTD–Jatimulya LRT feeder service has strong potential to support daily mobility, especially for students, workers, and nearby residents who need access to the mass transit network. If the service provides efficient travel time, affordable fares, reliable schedules, and safe access, it may become a more attractive alternative to private vehicles. Thus, respondents’ travel purposes provide a practical basis for designing a feeder service that is responsive to user needs and supports safer, more comfortable, and more sustainable commuting (Göransson & Andersson, 2023).

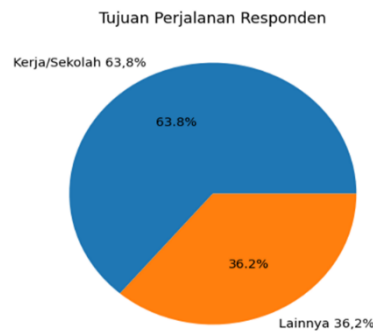


Figure 2. Distribution Objective Journey Respondents

Perception of Mode Selection Factors

The survey results indicate that travel time, travel cost, comfort, safety, and service frequency are the main factors influencing transportation mode choice. Comfort and safety received the highest level of importance, suggesting that users evaluate transport services not only based on time and cost efficiency but also on overall service quality. These aspects include vehicle condition, ease of access, cleanliness, travel safety, driver behavior, and perceived security while waiting or transferring between modes. Therefore, the proposed feeder service should be designed not only to be affordable and efficient, but also to provide a safe, comfortable, and reliable travel experience.

The high importance placed on comfort and safety indicates that the STTD–Jatimulya LRT feeder service should be designed as a comprehensive service that is comfortable, safe, accessible, affordable, and reliable. Service frequency also needs careful attention because it directly affects waiting time and travel reliability, especially during peak hours. Comfort, safety, reliability, and frequency are important components of public transport quality that influence user satisfaction and mode choice (Göransson & Andersson, 2023). Therefore, the proposed feeder service should prioritize operational quality, punctuality, easy station access, and consistent service standards to increase public trust and encourage a shift toward sustainable public transportation.

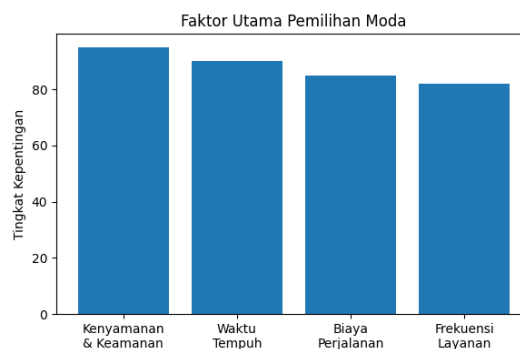


Figure 3. Main Selection Factors Fashion Transportation

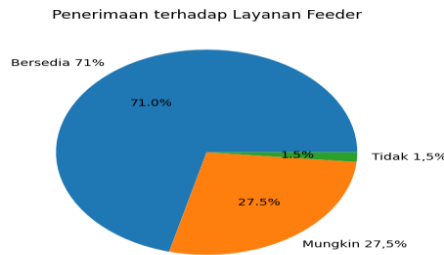


Figure 4. Acceptance Respondents to Feeder Service

Furthermore, 71% of respondents stated that they were willing to use the STTD–Jatimulya LRT feeder service, while 27.5% indicated that they might be willing to use it. Only a small proportion of respondents expressed unwillingness to use the proposed service. This high level of acceptance suggests strong potential demand for feeder services as a supporting mode for LRT access. In public transport systems, effective first-mile and last-mile integration is important because it can improve station accessibility and reduce barriers to using mass transit (Venter, 2020). Therefore, the positive response from respondents indicates that the proposed feeder service could support wider LRT usage if it is designed with reliable schedules, affordable fares, and convenient access.

Stated Preference and Choice Experiment Results

The choice experiment results show that the proposed feeder service has higher relative utility than other transport modes in most scenarios. The proportion of respondents choosing the feeder increased when the service offered higher frequency and lower fares. This finding indicates that users tend to prefer transport modes that provide better accessibility, affordability, and reliability for accessing the main transit system. Therefore, improving service frequency and maintaining affordable fares are key strategies for increasing the attractiveness of the STTD–Jatimulya LRT feeder service.

In the low-frequency and relatively high-fare scenario, the feeder service was selected by 43.8% of respondents. When service frequency increased and fares decreased, the proportion of feeder users rose to more than 60%. In contrast, preference for private motorcycles declined when fuel and parking costs increased. These results indicate that travel cost remains an important factor in transportation mode choice, while higher service frequency and affordable fares can strengthen the competitiveness of feeder services.

These findings indicate that service frequency and fare affordability are the main attributes that increase the probability of choosing the feeder service. App-based transport modes, such as online motorcycle taxis, remain attractive because they offer shorter travel times and greater flexibility. However, their attractiveness may decrease when fares increase. This condition shows that the proposed feeder service will compete directly with app-based transport in serving first-mile and last-mile trips, especially if it can offer reliable schedules, affordable fares, and convenient access to the LRT station.

Overall, the stated preference results indicate a potential modal shift from private vehicles to the proposed feeder service if the service can offer competitive travel time, adequate frequency, and affordable fares. This finding suggests that integrating feeder services with rail-based mass transit can be an effective strategy to increase public transport use and reduce dependence on private vehicles.

Nested Logit Modeling Results

This study used a Conditional Multinomial Logit (CLOGIT) approach to analyze the factors influencing transportation mode choice. The analysis was based on 2,484 observations, with four main service attributes: travel time (WP), fuel and parking cost (BP1), service

frequency (FQ), and fare (TF1). The model was estimated using the Maximum Likelihood Estimation method, with the fifth alternative used as the reference category. This approach allows the study to examine how changes in service attributes affect the probability of selecting each transportation mode.

Model Specification

Indirect utility functions in this study are formulated as follows:

$$U_{ni} = ASC_i + \beta_{WP}WP_{ni} + \beta_{BP}BP1_{ni} + \beta_{FQ}FQ_{ni} + \beta_{TF}TF1_{ni} + \varepsilon_{ni}$$

where:

- *WP*= travel time/travel burden attribute
- *BP1*= fuel and parking cost attribute
- *FQ*= service frequency attribute
- *TF1*= fare attribute
- *ASC_i*= alternative specific constant
- *ε_{ni}*= random error component assumed to follow IID Gumbel distribution

The error term ε_{ni} was assumed to be independently and identically distributed (IID) following a Gumbel distribution, as commonly applied in discrete choice logit models. Alternative 5, representing private motorcycles, was used as the base alternative, with its alternative-specific constant normalized to zero ($ASC = 0$). Parameter estimation was conducted using the Maximum Likelihood Estimation (MLE) method to obtain coefficient values that best represent respondents’ observed choices.

This method estimates the probability of each respondent choosing a particular transportation mode based on the attributes included in the model. Through this specification, the study identifies how travel time, fuel and parking cost, service frequency, and fare influence mode choice probabilities. The model also allows comparison of the relative attractiveness of the proposed feeder service against existing alternatives, such as public transport, online motorcycle taxis, online car taxis, private motorcycles, and private cars. Therefore, the estimation results provide a quantitative basis for understanding user preferences and formulating feeder service design recommendations.

Model Performance Summary

Table 1. Summary of Performance and Feasibility of Estimation Models

Indicator	Mark
Amount observation	2,484
Number of parameters	9
Final log-likelihood	-3160,698
Log-likelihood constant	-3173.202
Likelihood Ratio χ^2	25,0067
p-value	0.00005
Pseudo R ²	0.0039
Adjusted R ²	0.0032
AIC/N	2,552

The estimation results show that the model is statistically significant, with a likelihood ratio χ^2 of 25.0067 and a p-value of 0.00005. Since the p-value is below the 5% significance level, the service attributes included in the model jointly have a significant influence on transportation mode choice. This indicates that the model can be used to explain respondents’ mode choice tendencies based on the attributes offered in the stated preference scenarios.

Although the pseudo-R² value is relatively low, this condition is still acceptable in discrete choice modeling because individual travel decisions are often influenced by heterogeneous preferences, socio-economic characteristics, ability to pay, and subjective perceptions of transport services. In this study, model significance is more important for showing that attributes such as travel cost, travel time, fare, and service frequency remain relevant in explaining mode choice behavior. Therefore, the model provides a useful basis for evaluating the potential attractiveness of the proposed feeder service. The estimation results can help identify which service attributes should be prioritized in feeder planning, particularly those related to travel cost, fare structure, service frequency, and travel time. In practical terms, the model can support the formulation of operational strategies, such as setting affordable fares, improving service reliability, and adjusting feeder frequency to match user demand. Thus, the model results are not only useful for explaining respondents' preferences, but also for guiding evidence-based decisions in developing an integrated feeder service for the STTD–Jatimulya LRT corridor.

Table 2. Main Parameter Estimation

Variables	Coefficient	Std. Error	z	p-value	Significance
BW (WP)	-0.01610	0.01617	-1.00	0.319	No
BF (FQ)	-0.00028	0.04862	-0.01	0.995	No
BT (TF1)	-0.02042	0.01425	-1.43	0.152	No
BP (BP1)	-0.06878	0.01478	-4.65	0.000	***

Among the analyzed attributes, only fuel and parking cost (BP1) was statistically significant, with a negative coefficient of -0.06878. This result indicates that an increase in travel cost directly reduces the utility of a transport mode and lowers the probability of being chosen by respondents. In contrast, travel time, service frequency, and fare did not show statistical significance in the model. Although these variables were not significant, their coefficient directions still provide useful indications for service planning. Therefore, cost-related policies, such as affordable fares, parking cost management, and competitive feeder pricing, should become key considerations in designing the STTD–Jatimulya LRT feeder service.

Table 3. Constants Specific Alternative (ASC)

Fashion	Alternative	ASC	z	Interpretation
Public transportation	1	-2,524	-4.08	Absolutely not liked
Online Motorcycle Taxi	2	-0.520	-1.15	Neutral
Online Car Taxi	3	-1,951	-3.13	Low
Feeder	4	+0.466	1.64	Relatively interesting
Private Motorcycle	5	0	-	Reference
Private car	6	-1.109	-9.17	Low

The analysis of the Alternative Specific Constants (ASC) shows that Alternative 4, representing the proposed feeder service, has a positive ASC value and the highest level of preference among the available transport modes. This positive value indicates that the feeder service has greater baseline attractiveness than other alternatives when service attributes are held constant. The result suggests that respondents tend to accept the feeder service as a potential transport option, particularly if it offers affordable fares, efficient travel time, reliable service frequency, and convenient access to Jatimulya LRT Station. Therefore, the positive

ASC value strengthens the evidence that the proposed feeder service has strong potential to support mode shift and improve LRT accessibility.

In contrast, alternatives with relatively higher travel costs or fares, such as public transport, online car taxis, and private cars, have negative ASC values. These negative values indicate lower baseline attractiveness in respondents’ mode choice preferences. This condition suggests that travel cost remains an important consideration in selecting a transportation mode. Thus, the ASC results reinforce the finding that the proposed feeder service can become a more attractive connecting mode if it is supported by good service quality, competitive fares, reliable operations, and adequate integration with Jatimulya LRT services.

Table 4. Distribution Choice Respondents

Fashion	Alternative	Amount	Percentage
Public transportation	1	41	1.7%
Online Motorcycle Taxi	2	399	16.1%
Online Car Taxi	3	64	2.6%
Feeder	4	1312	52.8%
Private Motorcycle	5	540	21.7%
Private car	6	128	5.1%

The distribution of respondents’ choices shows that Alternative 4, namely the proposed feeder service, accounted for more than 50% of total observations. This finding indicates a strong preference for the feeder service compared with other transportation modes.

Table 5. Statistics Descriptive Attribute

Alternative	WP	BP	FQ	TF1
1	69.27	–	1.88	11.98
2	30.14	–	–	29.30
3	40.39	–	–	41.59
4	41.55	–	3.00	9.92
5	34.85	10.22	–	–
6	35.43	15.73	–	–

The descriptive statistics show that the feeder service has the most competitive attribute combination, with higher service frequency and lower fares compared with other transportation modes. In contrast, modes with higher fuel, parking, or fare costs tend to be less preferred by respondents.

Table 6. Marginal Effects

Variables	Marginal Effect
BP1	–0.0096
WP	–0.0022

TF1	-0.0028
FQ	-0.00004

Marginal effects analysis shows that fuel and parking costs have the largest effect on reducing the probability of mode choice. A one-unit increase in fuel and parking costs decreases the probability of choosing an alternative by approximately 0.96 percentage points. This result confirms that respondents’ mode choice behavior is more strongly influenced by cost than by other service attributes.

The small marginal effects of service frequency and fare indicate that respondents’ sensitivity to these attributes is relatively low. In other words, increasing service frequency without reducing overall travel costs may not produce a substantial change in user behavior. The model estimation results also show that travel time, travel cost, and fare have negative effects on mode utility, while service frequency has a positive effect on the probability of choosing the feeder service. This indicates that users tend to prefer transportation modes that offer faster travel, lower costs, and more reliable service availability.

The negative coefficient of travel time indicates that longer travel time reduces mode utility. Similarly, the negative coefficients of cost and fare show that respondents are sensitive to increases in travel expenditure. In contrast, higher service frequency increases feeder utility because it can reduce waiting time and improve travel certainty. This condition indicates that operational reliability is an important factor in increasing the attractiveness of feeder services as a connecting mode to the LRT.

The model results also show that the feeder service has a higher choice probability than public transport and several other modes under optimal operating conditions. This suggests that the feeder service is perceived as more capable of meeting user travel needs, particularly in terms of service regularity, travel comfort, and integration with the mass transit system. In addition, increasing the cost of private vehicle use, such as fuel and parking costs, may encourage users to shift to more economical and efficient public transport modes. Therefore, improving feeder service quality has the potential to support a shift from private vehicles to integrated public transportation.

Marginal Effects and Willingness to Pay (WTP) Analysis

Willingness to Pay (WTP) analysis was used to estimate respondents’ willingness to pay additional costs for improvements in transport service quality. In discrete choice models, WTP is calculated as the ratio between the coefficient of a non-cost attribute and the cost coefficient. This calculation shows the monetary value that users assign to improvements in specific service attributes, such as shorter travel time, higher service frequency, or better service reliability. The WTP formula is expressed as follows:

$$WTP_k = -\frac{\beta_k}{\beta_{cost}}$$

In this study, the BP1 variable, which represents fuel and parking costs, was not calculated as a Willingness to Pay (WTP) value because it functions as the cost or numeraire variable in the model. The numeraire variable serves as the monetary reference for converting the effects of other service attributes into monetary values. Therefore, BP1 is not treated as an attribute for which willingness to pay is estimated, but as the comparison basis in the WTP calculation.

The analysis of BP1 was conducted through direct coefficient interpretation, marginal effects, and demand elasticity. The BP1 coefficient indicates the direction and magnitude of

the effect of fuel and parking costs on mode choice probability. Meanwhile, marginal effects show changes in choice probability due to cost changes, while demand elasticity reflects respondents' sensitivity to changes in fuel and parking costs. Thus, BP1 remains important in the model because it represents the effect of travel cost on user preferences and serves as the basis for estimating WTP values for other service attributes.

Table 5. Willingness to Pay (WTP)

Attribute	WTP
WP	-0.234
TF1	-0.297
FQ	-0.004

The WTP value is expressed in the same unit as the cost variable (BP1). Therefore, it can be interpreted as the amount of fuel and parking cost that respondents are willing to trade for a one-unit improvement in a specific service attribute. The analysis shows that respondents are willing to pay additional costs for shorter travel time, better service frequency, and more reliable service quality. This indicates that users do not only consider travel cost, but also value comfort, reliability, and service certainty in choosing a transportation mode.

However, the WTP values for all non-cost attributes are relatively small. The WTP for travel time (WP) is -0.234, indicating that respondents are only willing to trade about 0.234 units of fuel and parking cost for a one-unit reduction in travel time. The WTP for fare (TF1) is -0.297, suggesting that fare changes have limited implicit economic value in respondents' perceptions. Meanwhile, the WTP for service frequency (FQ), which is close to zero at -0.004, indicates that frequency improvement is not yet considered sufficient to be compensated by additional costs. This finding is consistent with the parameter estimation results, which show that fuel and parking cost is the only statistically significant variable.

Thus, respondents' mode choice behavior tends to be cost-oriented, where travel decisions are more strongly driven by efforts to minimize cost than by complex trade-offs among other service attributes. Nevertheless, service quality improvement remains important for increasing the attractiveness of the feeder service, particularly if combined with strategies to manage private vehicle costs. Therefore, feeder development should not only focus on low fares, but also on operational improvements such as headway optimization, schedule synchronization with LRT, comfort enhancement, and first-mile and last-mile integration.

With a more reliable and integrated service, the feeder has the potential to encourage a shift from private vehicles to public transport, improve accessibility to Jatimulya LRT Station, and support a more efficient and sustainable urban transportation system.

Policy Implications

Based on the modeling results and mode choice analysis, the proposed STTD–Jatimulya LRT feeder service has strong potential to support first-mile and last-mile integration with the Jabodebek LRT system. However, since users tend to be cost-oriented, feeder development should not only focus on service quality improvement but also be combined with travel demand management strategies.

Improving feeder service quality remains important, particularly through reliable operations, schedule certainty, and better integration with LRT departures. Headway optimization, reduced waiting time, schedule synchronization, and improved comfort and safety can increase user utility and make the feeder more competitive than private vehicles and app-based transport. Although user sensitivity to frequency and travel time is relatively low, the positive structural preference for the feeder indicates latent demand that can be developed into

actual use. Therefore, first-mile and last-mile connectivity, bus stop accessibility, and real-time travel information should be prioritized to strengthen users' positive perception of feeder services.

The results also show that service improvement without controlling private vehicle costs may be less effective in encouraging modal shift. Therefore, incentive and disincentive policies are needed, such as progressive parking fees, park-and-ride schemes, and integrated feeder–LRT fares through through-ticketing or fare bundling. These policies can reduce the perception of the feeder as an additional travel cost while increasing the relative attractiveness of public transport. In addition to supporting transport integration, feeder development may contribute to the wider urban transport system by reducing congestion, improving area accessibility, and encouraging more sustainable mobility. Therefore, inter-agency coordination and integrated policy support are needed to ensure that feeder operations can run effectively and support sustainable mode shift.

CONCLUSION

Based on the modeling results and mode choice analysis, the proposed STTD–Jatimulya LRT feeder service has strong potential to support first-mile and last-mile integration with the Jabodebek LRT system. However, since users tend to be cost-oriented, feeder development should not only focus on service quality improvement but also be combined with travel demand management strategies.

Improving feeder service quality remains important, particularly through reliable operations, schedule certainty, and better integration with LRT departures. Headway optimization, reduced waiting time, schedule synchronization, and improved comfort and safety can increase user utility and make the feeder more competitive than private vehicles and app-based transport. Although user sensitivity to frequency and travel time is relatively low, the positive structural preference for the feeder indicates latent demand that can be developed into actual use. Therefore, first-mile and last-mile connectivity, bus stop accessibility, and real-time travel information should be prioritized to strengthen users' positive perception of feeder services.

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