

Analysing Public Preferences in Bringing Non-Folding Bicycles onto the Palembang LRT**GHINA DWI AQILA¹, CHIARA CALASTRI², ANDYKA KUSUMA³, ROBBY PURNOMO⁴**¹Department of Civil and Environmental Engineering, University of Indonesia, Indonesia.²Institute for Transport Studies, University of Leeds, Leeds, United Kingdom.³Department of Civil and Environmental Engineering, University of Indonesia, Indonesia⁴Department of Civil and Environmental Engineering, University of Indonesia, IndonesiaEmail: ¹ghinadwiaqila@gmail.com, ²C.Calastri@leeds.ac.uk, ³andyka.k@ui.ac.id, ⁴tsryp@leeds.ac.uk**Corresponding Author*: Andyka Kusuma****ABSTRACT:**

Integrating cycling with public transport is increasingly recognised as a key strategy for achieving sustainable urban mobility. This study investigates the feasibility of allowing non-folding bicycles on board the Palembang Light Rail Transit (LRT), Indonesia's first LRT system, which continues to face low ridership levels. A stated preference survey was conducted among 162 non-folding bicycle owners in Palembang to assess user preferences across three policy attributes: fare surcharge, reservation mechanism, and on-train storage provision. Using the Multinomial Logit (MNL) model, this study found that fare surcharges have a significant negative effect, while the availability of dedicated bicycle storage space has the strongest positive influence on users' willingness to bring their bicycles. Reservation mechanisms produce mixed responses; meanwhile, the no-reservation system has the highest preference among respondents. The estimated willingness to pay ranges between IDR 5,000 and 8,000 for improved storage and simpler procedures. Overall, the findings highlight that policies promoting affordability, convenience, and security are most effective, and that integrating non-folding bicycles into the Palembang LRT could play an important role in advancing sustainable urban mobility in Indonesian cities.

KEYWORDS: Bicycle–rail integration; Light Rail Transit (LRT); Stated Preference; Multinomial Logit; Sustainable mobility**Introduction**

Integrating cycling with public transport is increasingly recognised as an essential part of building sustainable urban mobility systems. Public transport provides efficient, low-carbon mobility for longer trips, yet it often fails to connect easily with people's homes and destinations—the so-called first–last mile problem. Bicycles can fill this gap. They are affordable, environmentally friendly, and flexible enough to extend the reach of mass transit networks [20]. When designed well, the two modes can complement each other: rail covers the long distance efficiently, and bicycles provide convenient access at either end of the journey.

Much of the evidence supporting this integration, however, comes from high-income countries. In the Netherlands, Germany, or Denmark, cycling is part of daily life, supported by safe infrastructure and clear regulations. In developing cities, the story is very different. Poor road safety, limited planning coordination, and social perceptions that link cycling to leisure rather than daily travel all create barriers to integration [7][9]. The question is not whether bicycle–transit integration works, but whether it can be made to work in places with such different cultural and infrastructural conditions. Indonesia provides a particularly relevant case. Despite recent discussions around sustainable transport, most urban travel still depends on motorcycles. Cycling has gained popularity since the COVID-19 pandemic, yet it remains far from being a mainstream mode of commuting. National programmes have promoted bicycle lanes and car-free days, but they focus more on recreation than on integration with public transport [6]. The Palembang Light Rail Transit (LRT), launched in 2018 as Indonesia's first modern urban rail, reflects this tension. Although it was intended to reduce congestion and modernise mobility, daily ridership has remained low, typically below 30 % [5]. Current rules only allow folding bicycles on board, excluding the majority of cyclists who own standard, non-folding bikes. This situation creates a clear policy contradiction. On the one hand, authorities want to increase LRT usage and make the system more attractive. On the other hand, existing restrictions prevent the kind of multimodal trips that could actually help achieve that goal. Allowing non-folding bicycles on board might be a simple, low-cost way to improve first–last mile accessibility and broaden the system's appeal. Yet before such a policy is introduced, it is crucial to understand how the public would respond, whether passengers see it as convenient, fair, or even necessary, and what kind of trade-offs they are willing to accept. This paper addresses that need by analysing public preferences toward a potential policy that permits non-folding bicycles on the Palembang LRT. A stated-preference survey was conducted among 162 bicycle owners to explore how people respond to different combinations of fare surcharges, reservation mechanisms, and on-train storage facilities. The data were analysed using a Multinomial Logit (MNL) model estimated in Apollo-R. This approach allows the study to quantify how each attribute affects choice and to estimate the willingness to pay for improvements in convenience or safety. Beyond providing statistical evidence, the study aims to contribute to policy learning. By identifying the factors that matter most to potential users, it offers guidance on how small design decisions, such as removing reservation requirements or providing simple bicycle racks, can make integration policies more inclusive and effective. The Palembang case also provides lessons for other Indonesian cities that are planning or expanding rail systems. It shows that even in a context dominated by motorcycles, integration between bicycles and public transport can be achieved if policies are affordable, easy to understand, and sensitive to everyday travel behaviour.

1. Methodology

1.1. Research Approach: This research adopts a stated preference (SP) approach to investigate public attitudes toward the possibility of bringing non-folding bicycles on the Palembang LRT. The choice of SP was not merely technical but conceptual. Because the policy has not yet been implemented, revealed preference data do not exist. The SP method allows researchers to simulate realistic, hypothetical situations and to uncover how people might behave under alternative policy designs [18]. In essence, SP turns the “what if” question into quantifiable behavioural evidence. It enables the analysis of trade-offs between different policy attributes, such as cost, convenience, and facility provision, that could not otherwise be observed. This makes SP particularly relevant for emerging transport systems like Palembang's LRT, where planners must make decisions ahead of real-world feedback.

The study combines explanatory and experimental elements. It is explanatory in seeking to understand which factors shape people's willingness to bring bicycles on board, and experimental because respondents were asked to make repeated, structured choices across carefully designed scenarios.

1.2. Study Area: Palembang, the capital of South Sumatra, provides a compelling context for this inquiry. The city operates Indonesia's first light-rail system, built for the 2018 Asian Games. Despite its strategic alignment along a 23-kilometre corridor linking the airport and major activity centres, the LRT has consistently struggled with low ridership [5]. At the same time, cycling in Palembang is gaining visibility. Community groups, recreational events, and social media movements have increased public awareness, even though daily commuting by bicycle remains rare. The coexistence of an underused rail system and a growing cycling culture presents an interesting policy opportunity: integration between the two could expand the LRT's catchment area and improve accessibility without major infrastructure investment.

1.3. Survey design and sampling: Data were collected through an online survey targeting residents who own and can ride non-folding bicycles. Recruitment used a mixture of purposive and convenience sampling, disseminated through local cycling communities, the official LRT social-media channels, and the researchers' networks. While this non-probabilistic approach limits generalisability, it ensures relevance: respondents represent the very group most affected by the proposed policy. The questionnaire comprised four sections:

1. Screening questions, confirming eligibility and cycling ability;
2. Socio-demographic details, including age, gender, occupation, and vehicle ownership;
3. Cycling and travel behaviour, covering trip purpose and distance to the nearest LRT station; and
4. Choice tasks, where respondents evaluated different policy options.

A total of 162 valid responses were obtained. Although modest, this sample size is consistent with best practice for D-efficient SP designs and adequate for reliable MNL estimation [28].

1.4. Experimental Design

The choice experiment was generated using Ngene software to achieve statistical efficiency and avoid respondent fatigue. Three key attributes and their levels were defined through literature review, field observation, and consultation with LRT staff to ensure realism and policy relevance (Table 1).

Table 1. Attributes and levels

Attribute	Levels	Description
Fare surcharge	Rp 1,500 / Rp 2,500 / Rp 5,000	Additional fare for bringing a bicycle
Reservation mechanism	Ticket-counter / Online / No reservation	Procedure before boarding
On-train storage	No racks / Racks available	Dedicated space for bicycles

Each choice set included three policy alternatives plus a status-quo option (no access for non-folding bicycles). This structure allowed respondents to opt out entirely, thus reducing forced-choice bias and mimicking real-world decision-making. Twenty pilot respondents tested an early version of the survey, helping to refine question clarity and validate the expected signs of coefficients (negative for fare, positive for storage). The final design contained 24 choice tasks divided into four blocks, with each respondent randomly assigned to one block and presented with six tasks.

1.5. Model specification and estimation

Responses were analysed using a Multinomial Logit (MNL) model implemented through the Apollo package in R [14]. The MNL model assumes that the probability of choosing an option is proportional to the exponential of its utility, where utility:

$$U_{ij} = (\beta_{fare} \times fare_{ij}) + (\beta_{resv} \times reservation_{ij}) + (\beta_{store} \times storage_{ij}) + \varepsilon_{ij} \tag{1}$$

Estimation used maximum likelihood methods with robust standard errors. Model performance was evaluated using log-likelihood improvement, pseudo-R², Akaike (AIC) and Bayesian (BIC) information criteria. An extended specification tested an interaction between employment status and reservation mechanism to capture behavioural heterogeneity. This interaction reflects the hypothesis that time-constrained workers may value procedural simplicity more than students or non-workers. Finally, Willingness-to-Pay (WTP) values were calculated by dividing each non-monetary coefficient by the negative of the fare coefficient, converting preferences into interpretable monetary terms.

1.6. Reliability and ethical considerations

To enhance reliability, the survey incorporated several good-practice measures: randomisation of alternative order, balanced attribute levels across blocks, and avoidance of dominant alternatives. Internal validity checks confirmed that responses followed logical patterns; for instance, higher fares reduced choice probability for most respondents. The study followed the University of Leeds ethical research protocol. Participation was voluntary, all respondents provided informed consent, and no personally identifying information was collected. Data were stored securely and used solely for academic purposes.

2. Results and Discussion

2.1. Overview of sample characteristics

A total of 162 valid responses were obtained from residents of Palembang who own and can ride non-folding bicycles. The socio-demographic profile of the sample was largely composed of men of productive age, especially those aged between 25 and 34 years. Most respondents were either full-time employees or student groups that typically have regular travel routines and are therefore relevant to potential LRT use.

Spatially, the majority of respondents lived within a radius of five kilometres from the nearest LRT station. This is important: several studies have shown that this distance band (2–5 km) is the sweet spot for bicycle–transit integration [16][24]. It is long enough to justify cycling instead of walking, but still short enough to remain practical and time-efficient. Hence, accessibility is not necessarily the main barrier—behavioural and infrastructural factors might play a larger role.

Behaviourally, most respondents reported using bicycles primarily for recreation or exercise, while motorcycles dominated their daily commuting. This confirms that in Palembang, as in many Indonesian cities, cycling remains strongly associated with leisure rather than transport utility. Yet, the existence of an active cycling community, combined with proximity to LRT stations, presents an untapped potential: these are people who already own bicycles and are familiar with cycling, but whose travel habits have not yet been connected to public transport.

2.2. Model estimation

The Multinomial Logit (MNL) model was estimated using Apollo in R. Table 2 presents the overall model fit, which shows a clear improvement from the null log-likelihood (–1347.48) to the final log-likelihood (–1047.38). The pseudo-R² value of 0.22 indicates a reasonable explanatory power for stated preference data, suggesting that the selected attributes capture the main determinants of respondents’ choices.

Table 2. Model fit statistics

Indicator	Value
Log-likelihood (start)	–1347.48
Log-likelihood (final)	–1047.38
Pseudo-p ²	0.2227
AIC	2108.75
BIC	2142.91

Fare sensitivity in table 3 was pronounced even modest surcharges discouraged participation. The storage attribute exerted the strongest positive effect, confirming the importance of security and reliability. Reservation mechanisms had mixed effects, with respondents preferring no reservations and showing mild tolerance for counter booking.

Table 3. Estimated parameters for basic MNL

Variable	Coefficient	Robust t-ratio	Sig.	Interpretation
Fare (β fare)	–0.00017	–4.98	p<0.01	Higher fare → lower utility
Ticket-counter (β ticket)	0.36	2.37	p<0.05	Slight preference over online
No reservation (β noresv)	0.84	5.32	p<0.01	Strong preference
Storage (β store)	0.89	8.02	p<0.01	Secure racks greatly valued

2.3. Interpretation of main effects

The results confirm that the fare surcharge variable has a strong and significant negative effect on the likelihood of respondents choosing to bring their bicycles onto the LRT. This finding is not surprising but remains critical. It indicates that even relatively small additional fares can meaningfully reduce public interest. This is consistent with behavioural economic theory, particularly loss aversion (Kahneman & Tversky, 1979), where people tend to perceive losses more strongly than equivalent gains. In other words, a small monetary disincentive can easily outweigh the perceived convenience of bringing a bicycle. For a public transport system like the Palembang LRT, where the base fare is already considered moderate, introducing a surcharge for bicycles could inadvertently signal exclusivity or inequality. Such a policy would risk alienating low- to middle-income users, undermining the inclusive mobility objectives that sustainable transport policy seeks to promote. The on-train storage variable, on the other hand, exerts the strongest positive influence among all attributes. This reflects a universal behavioural tendency: people value certainty and security in physical space. A designated area for bicycles reduces anxiety about obstructing others or being reprimanded by staff, and it assures users that their bicycles are safe. This result resonates with studies from European contexts [8][23], which show that secure facilities are among the most effective enablers of multimodal cycling behaviour. Interestingly, the reservation mechanism produced more nuanced results. Respondents showed a clear preference for the no-reservation option, while ticket-counter reservations were moderately acceptable and online reservations were the least favoured. This pattern may seem counterintuitive given the global shift toward digitalisation, but it aligns with Indonesia’s broader mobility culture, where spontaneity and flexibility are highly valued. Many people prefer to make travel decisions on the spot rather than plan, especially for short urban trips. The aversion to online reservation could also reflect practical barriers, such as limited trust in digital systems, inconsistent internet access, or the perception that app-based booking adds complexity rather than convenience. Overall, these findings suggest that the success of a bicycle-on-board policy depends less on sophisticated technology and more on the simplicity of the user experience. Policies that minimise procedural friction and offer visible, tangible benefits (like racks) are far more likely to succeed than those focusing on regulation or revenue.

2.4. Extended model: Employment–reservation interaction

The extended model in Table 4 shows that employed respondents have a significantly stronger preference for no-reservation policies (β = 0.731, t = 2.91), reflecting the value of flexibility among commuters.

Table 4. Interaction effects (Employment × Reservation)

Variable	Coefficient	t-ratio
Fare	–0.176	–4.98
Online reservation	–0.652	–2.83
No reservation	0.001	0.01
Storage	0.915	8.18
Emp × No reservation	0.731	2.91

The results reveal that employed respondents exhibit an even stronger preference for a no-reservation system. The positive and significant interaction coefficient (β = 0.731) implies that convenience and time flexibility are crucial for this group. For them, an additional procedural step, whether digital or manual, represents

a direct cost in time and effort. Procedural barriers often discourage adoption of sustainable transport options even when physical infrastructure is available [17]. In behavioural terms, convenience has a compounding effect: the easier a policy feels to use, the more people are likely to adopt it.

2.5. Willingness-to-pay estimates

The estimated WTP values provide a useful way to interpret the trade-offs respondents are willing to make. Table 5 summarises the results.

Table 5. Willingness-to-pay (WTP) estimation

Attribute	Basic MNL (IDR)	Interaction MNL (IDR)	Significance
Ticket-counter reservation	2,076	–	ns
Online reservation	–	6,823	ns
No reservation	4,855	8,265	**
Bike storage	5,163	5,146	**

The WTP results show that respondents value *certainty and simplicity* the most. The highest WTP, around IDR 8,000, is associated with the no-reservation option in the interaction model, especially among employed individuals. This suggests that flexibility is not just a preference but something users are willing to pay for. Similarly, the presence of bike storage is valued at around IDR 5,000, indicating that people recognise its practical and psychological benefits. By contrast, the WTP for ticket-counter or online reservations remains insignificant, reinforcing that users perceive reservation systems as unnecessary complexity rather than added value. From a policy standpoint, these numbers are telling. They indicate that the maximum acceptable price for additional convenience is roughly equivalent to the base LRT fare. Beyond that threshold, users perceive the service as too expensive or not worth the effort.

2.6. Discussion and policy interpretation

When considered together, the findings reflect a coherent behavioural pattern that extends beyond simple attribute preferences. People in Palembang, like many urban residents in Southeast Asia, tend to make travel decisions based on effort, predictability, and cost. Monetary costs are tangible, but procedural costs, the time, uncertainty, and mental load required to access a service, are equally influential.

This study underscores that integration policies must be designed not only for physical compatibility (space for bikes) but also for behavioural compatibility. The success of a bike-on-board policy depends on how well it fits with users' daily routines and mental models of convenience.

Internationally, similar lessons have emerged. In Europe, where cycling is embedded in everyday life, integration focuses on expanding capacity and comfort [20]. In contrast, cities like Singapore and Japan have chosen strict procedural control to preserve order, limiting access for standard bicycles [19][22]. Palembang's context lies somewhere in between: infrastructure and regulation are still developing, but the openness to cycling is growing. The implication is that Palembang should avoid over-regulating a system that has not yet matured. Instead, they should begin with low-barrier, low-cost interventions that prioritise ease of use and visible benefits. A no-reservation, no-surcharge policy with dedicated bicycle areas would not only match public preferences but also signal a progressive, user-oriented image for the LRT. Finally, the behavioural insights from this study go beyond Palembang. They suggest a general principle for developing cities: people do not reject sustainable transport because they dislike it, but because it feels inconvenient, uncertain, or costly. The role of policy, therefore, is to remove friction like physical, procedural, and psychological, so that sustainable choices become the easiest ones to make.

3. Conclusions and Policy Implications

This study set out to explore how the public would respond to a potential policy allowing non-folding bicycles on the Palembang Light Rail Transit (LRT). Using a stated preference approach and Multinomial Logit modelling, the analysis provides both quantitative evidence and behavioural insight into how cost, convenience, and infrastructure shape people's willingness to adopt multimodal travel.

At its core, the findings illustrate a simple but powerful behavioural truth: people are motivated by ease, safety, and predictability, but they are also highly sensitive to additional costs. The quantitative results show that fare surcharges significantly reduce utility, while on-train storage exerts the strongest positive influence. Respondents also expressed a strong preference for no-reservation systems, indicating that they value spontaneity and dislike procedural complexity. These preferences were particularly pronounced among employed individuals, who are typically more time-constrained and less tolerant of administrative steps.

From a broader perspective, these findings reveal that the barriers to integration in Palembang are not technological; it is behavioural and perceptual. The public does not oppose integration; rather, they want it to be simple, intuitive, and fair. When policies impose unnecessary steps or costs, they inadvertently send a message that integration is a privilege rather than a right. Conversely, when policies make sustainable choices easier, people naturally shift toward them.

3.1. Policy implications for Palembang

The study's results point to several concrete policy directions for the Palembang LRT and other similar urban rail systems in Indonesia:

1. Prioritise comfort and certainty through on-train storage.

Providing visible, designated bicycle areas on board will address one of the strongest behavioural drivers: the need for security and predictability. This should not be treated as an optional facility but as a central part of passenger experience design.

2. Avoid fare surcharges for bicycles.

The strong negative response to additional costs highlights the importance of affordability. Integrating bicycles should be framed as a public benefit—enhancing accessibility and ridership—rather than as a premium service. If costs must be applied, they should be symbolic or offset by discounts during pilot stages.

3. Simplify procedures—eliminate reservations whenever possible.

A no-reservation policy, particularly during off-peak hours, will encourage spontaneous use without overwhelming capacity. If reservations are deemed necessary, they should be optional and user-friendly, avoiding complex verification or digital-only requirements.

4. Implement pilot trials before full rollout.

A limited pilot during weekends or non-peak hours can test operational feasibility while generating public feedback. Observing real-world behaviour will help refine both design and communication strategies.

5. Integrate with broader cycling infrastructure.

On-board policies must be supported by complementary measures such as bicycle parking, safe access routes, and signage near stations. Without last-mile connectivity, even well-designed LRT policies will have limited impact.

6. Communicate the change effectively.

Public awareness campaigns should frame the policy as an invitation to new mobility habits; emphasising health, convenience, and shared benefits, rather than a technical rule change. Language and imagery matter: people adopt what they can imagine themselves doing.

3.2. Implications for broader Indonesian urban transport

While centred on Palembang, the insights from this study resonate across Indonesian cities currently expanding their rail networks. Cities such as Jakarta, Yogyakarta, and Surabaya face similar structural and cultural conditions: high motorcycle dependency, weak cycling infrastructure, and emerging interest in sustainable mobility. The results suggest that integration policies do not need to be expensive or complex to be effective. In contexts where institutional capacity is still growing, removing friction—whether financial, procedural, or psychological—is more impactful than introducing new technology or regulation.

This shift in perspective is crucial: instead of asking how to regulate bicycle access, policymakers should ask how to make it effortless. Furthermore, the study underscores the need for policy empathy—understanding how everyday users perceive, interpret, and emotionally respond to policies. When users feel respected and considered, even small interventions can change behaviour. In contrast, when rules feel rigid or elitist, people resist them regardless of their objective benefits.

3.3. Limitations and future directions

As with any stated preference study, this research relies on hypothetical scenarios, which may not fully capture real-life behaviour once policies are implemented. The sample, while valid for model estimation, is relatively modest and concentrated in Palembang's urban core. Future studies should aim to collect larger samples

across different demographic and spatial contexts to enhance external validity. Methodologically, the Multinomial Logit model's assumption of independence from irrelevant alternatives (IIA) may oversimplify decision-making processes. Future work could employ Mixed Logit or Latent Class models to account for unobserved heterogeneity and better capture behavioural diversity. It would also be valuable to conduct revealed preference studies after a pilot policy is implemented, allowing researchers to observe actual changes in travel behaviour and validate stated preferences with real-world data.

3.4. Concluding remarks

Ultimately, this study shows that enabling non-folding bicycles on the Palembang LRT is not just a logistical question; it is a behavioural one. It challenges the assumption that people resist sustainable mobility, revealing instead that they simply resist inconvenience. When integration is made intuitive, safe, and fair, people are not only willing but eager to participate. For Palembang, adopting a simple, low-cost, and human-centred approach could transform a modest LRT network into a more inclusive, connected system that reflects the daily lives of its users.

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6. Conflict of interest

The authors declare that there is no conflict of interest

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