



BEYOND ACCESS: EXPLAINING THE INTENTION-BEHAVIOUR GAP IN LIGHT RAIL TRANSIT USE WITHIN TRANSIT-ORIENTED DEVELOPMENTS

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Abstract

Despite the proximity of apartment complexes to Jabodebek Light Rail Transit (LRT) stations, ridership within Jakarta's Transit-Oriented Development (TOD) areas remains below expectations. This study applies the Theory of Planned Behaviour (TPB) and Partial Least Squares Structural Equation Modelling (PLS-SEM) to examine factors associated with Behavioural Reluctance to Use LRT among TOD apartment residents. The results show that Attitude and Subjective Norm are significantly associated with Intention, while Perceived Behavioural Control is negatively associated with Intention, contrary to the hypothesised direction. Both Intention and Perceived Behavioural Control are significantly associated with Behavioural Reluctance to Use LRT, with Perceived Behavioural Control emerging as the strongest predictor. Environmental Norm is not significantly associated with Intention. The model explains 58.3% of the variance in Intention, 49.5% in Habit, and 35.9% in Behavioural Reluctance to Use LRT. However, relationships involving Attitude, Subjective Norm, Intention, and Habit should be regarded as provisional because discriminant validity was not fully established. By contrast, the association between Perceived Behavioural Control and behavioural reluctance represents the most consistently supported relationship in the estimated model.

Keywords: Transit-Oriented Development, Theory of Planned Behaviour, PLS-SEM, public transport behaviour, Jakarta, Light Rail Transit

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INTRODUCTION

Urban mobility in the Jabodetabek metropolitan region faces persistent challenges amid rapid urbanisation and a population exceeding 30 million (Silver, 2024). High population density and fragmented public transport services have weakened the competitiveness of mass transit, reinforcing dependence on private vehicles and contributing to environmental pressures (Camagni et al., 2002). In response, Transit-Oriented Development (TOD) has been promoted as an approach to reduce car dependency by integrating dense urban development with mass transit within walkable catchment areas, aligning land use and transport planning to encourage public transport use (Zhang, 2025).

In Indonesia, TOD has been operationalised through the Jabodebek LRT, which commenced operations in August 2023 to support sustainable mobility across Jakarta, Bekasi, and Depok (Hasibuan & Mulyani, 2022). In March 2024, average daily ridership was reported at approximately 60,000-61,000 passengers, below the target of more than 65,000 passengers per day, leading operators to postpone planned increases in service frequency (Rahayu & Djumena, 2024). Subsequent operational data indicate that average daily ridership reached approximately 54,640 passengers on weekdays and 30,842 passengers on weekends, representing only about 40% of the first-year target of 137,000 passengers per day (Maruf, 2025; Utami & Ananda, 2023).

In contrast, both emerging and mature rail systems demonstrate that substantially higher ridership levels are achievable. Relatively young networks such as the Delhi Metro have surpassed previous ridership records, while Singapore's MRT recorded its highest average daily ridership in 2024. These comparisons highlight the comparatively weaker performance of the Jabodebek LRT, which has achieved only around one-third of its intended first-year demand (Chen et al., 2019; Kormos et al., 2021).

This situation challenges the assumption that proximity and accessibility alone are sufficient to encourage public transport use. Although TOD has traditionally emphasised physical factors such as density, mixed land use, and transit accessibility, growing evidence suggests that these conditions may be necessary but not sufficient to induce modal shift (Zhang, 2025). In high-access environments, behavioural and psychological factors may also be associated with whether residents choose public transport or continue to rely on private modes.

Behavioural perspectives provide a useful framework for understanding these dynamics, with the Theory of Planned Behaviour (TPB) widely applied to explain public transport use through attitudes, subjective norms, and perceived behavioural control. Previous studies have highlighted an intention-behaviour gap, whereby favourable intentions do not always translate into actual public transport use, particularly in contexts characterised by execution barriers such as

service reliability, multimodal integration, and perceived convenience (Murray & Davis, 2001).

Despite growing attention to the intention-behaviour gap, behavioural responses to public transport in TOD settings, particularly in rapidly urbanising megacities, remain underexplored. TOD research has largely focused on spatial outcomes, whereas behavioural studies have generally examined broader urban populations rather than TOD residents. As a result, limited evidence exists regarding how TPB mechanisms operate in environments where accessibility is high but public transport uptake remains relatively low (Murray et al., 1998).

This study examines behavioural barriers associated with LRT use among TOD apartment residents living within walking distance of Jabodebek LRT stations. Using the Theory of Planned Behaviour and PLS-SEM, the study focuses on Behavioural Reluctance to Use LRT despite physical access and evaluates the roles of Attitude, Subjective Norm, Perceived Behavioural Control, Habit, and Environmental Norm in shaping Intention and Behavioural Reluctance to Use LRT.

RESEARCH BACKGROUND

In transport planning, access and accessibility are related but conceptually distinct. Access refers to the physical and economic ability to enter a transit system, whereas accessibility reflects how effectively the system enables users to reach destinations within acceptable time, effort, and reliability constraints (Cascetta et al., 2015; Ewing & Cervero, 2001). While access ensures availability, accessibility determines the usefulness of public transport in daily travel.

Transit-Oriented Development (TOD) is explicitly designed to strengthen both dimensions. By concentrating high-density residential development and mixed land uses within walkable distances of mass transit stations, TOD aims to minimise barriers and reduce generalised travel costs (Zhang, 2025). Empirical evidence consistently shows that residents living in dense, mixed-use neighbourhoods with convenient transit access are more likely to rely on public transport than those in car-oriented environments (Cervero, 2002; Evans IV et al., 2007; Ghosh et al., 2025).

Physical proximity remains a core benchmark of TOD effectiveness. International planning standards and Indonesian spatial regulations (*Peraturan Menteri ATR/BPN No. 16/2017*) commonly adopt an 800-metre walking radius as the threshold for effective station catchment areas. This study adheres to that benchmark by focusing on apartment developments located within 800 metres of Jabodebek LRT stations.

Additionally, economic access is a key pull factor in megacities where fare sensitivity is high, and affordability strongly shapes ridership (Sogbe et al., 2025). In the Jakarta metropolitan region, where the minimum monthly wage is

approximately IDR 5.7 million (BPS, 2026), assuming an LRT fare of IDR 20,000 per trip and 20 commuting days per month, round-trip commuting costs would amount to approximately IDR 800,000 per month, equivalent to 14.0% of the DKI Jakarta Provincial Minimum Wage. In response, Jabodebek LRT operators have introduced peak-hour discounts and off-peak fare reductions, signalling policy efforts to strengthen economic access and enhance the system's pull factors.

Taken together, physical and economic access, along with network accessibility, create the structural conditions necessary for public transport adoption in TOD areas. However, their effectiveness depends on complementary factors related to ease of use. This limitation of access-based explanations highlights the need for planning approaches that move beyond physical design (Cervero, 2002; Zhang, 2025).

While pull factors create opportunities for public transport use, behavioural factors often determine whether these opportunities translate into adoption. Behavioural constraints such as attitudes, habits, perceived behavioural control, and intention, interact with accessibility and the built environment to shape mode choice, particularly among individuals reluctant to shift from private vehicles (Donald et al., 2014; Ghosh et al., 2025).

One of the most widely applied frameworks for analysing such behavioural determinants is the Theory of Planned Behaviour (TPB) (Yuda Bakti et al., 2020). TPB posits that behaviour is primarily guided by behavioural intention, which in turn is shaped by three core components: attitude toward the behaviour, subjective norms, and perceived behavioural control. Attitude reflects an individual's evaluation of the desirability of a behaviour, subjective norms capture perceived social pressure, and perceived behavioural control represents beliefs about one's ability to perform the behaviour given existing constraints (Ali et al., 2023). In transport contexts, TPB has been extended to incorporate habit and environmental or moral norms, acknowledging that behavioural and value-based considerations can be associated with travel choices alongside rational evaluation (Yuda Bakti et al., 2020).

Empirical applications of TPB have demonstrated its explanatory power across diverse transport contexts. Studies in developing countries show that attitudes, social influence, and control perceptions significantly shape intentions to use public transport, particularly rail-based systems in urban areas (Donald et al., 2014). Similar findings have been reported in developed-country contexts, where TPB-based models successfully explain intentions to use transit and other sustainable modes (Hu et al., 2021).

THEORETICAL FRAMEWORK

This study is grounded in the Theory of Planned Behaviour (TPB), which posits that human behaviour is primarily associated with intention, which is shaped by attitude, subjective norms, and perceived behavioural control (Ajzen, 1991). TPB has been widely applied in transport behaviour research to explain individuals' decisions to adopt or avoid public transport, particularly in urban contexts where multiple alternatives are available.

In transport studies, TPB is frequently extended to incorporate additional constructs such as habit and environmental norms. Habit reflects the routinised nature of travel behaviour, which can either reinforce existing mode choices or constrain behavioural change. Environmental norms represent individuals' moral considerations regarding sustainability and environmental impact. Prior studies suggest that while these factors may be associated with stated preferences, their ability to be associated with actual behaviour depends strongly on contextual constraints.

However, a recurring insight from this literature is the presence of an intention-behaviour gap (Limtanakool et al., 2006). Even with favourable attitudes and strong intentions, public transport use may not materialise under operational constraints or strong competition from private modes, as perceived behavioural control may be associated with behaviour, while habits reinforce existing travel routines (Murray et al., 1998). Environmental norms, although salient in stated preferences, may remain secondary when instrumental barriers dominate everyday travel decisions.

In TOD settings, this gap becomes particularly salient. Residents living near transit stations typically face fewer spatial barriers, yet adoption rates may still lag expectations. This suggests that behavioural factors, such as control perceptions, social influence, and entrenched habits, may be associated with actual behavioural outcomes. Despite this, behavioural mechanisms within TOD contexts have received limited empirical attention, as much of the literature continues to prioritise spatial metrics and accessibility indicators.

Building on prior work, this study applies an extended Theory of Planned Behaviour framework to examine Behavioural Reluctance to Use LRT among TOD apartment residents, defined as non-use despite physical access. This study examines behaviour, operationalised as Behavioural Reluctance to Use LRT, among residents of TOD apartments. Higher Y scores indicate greater Behavioural Reluctance to Use LRT.

The model incorporates attitude, subjective norms, perceived behavioural control, habit, and environmental norms to capture both motivational and execution-related dimensions of travel behaviour. While the primary hypotheses focus on Intention and Behavioural Reluctance to Use LRT, the paths involving Habit are retained as exploratory relationships based on prior TPB

extensions and transport behaviour literature. These paths are intended to provide additional insight into potential behavioural mechanisms rather than constitute the primary focus of hypothesis testing. The constructs and initial indicators are summarised in Table 1.

Table 1: Constructs and Initial Indicators Included in the Model

Construct	Indicators	Code
Behaviour/Dependent Variable	Behavioural Reluctance to use LRT	Y
Habit	Public Transport Usage	H1
	Spontaneity	H2
	Dependency	H3
Intention	Time Intention	I1
	Cost Intention	I2
	Accessibility Intention	I3
Attitude	Security	S1
	Pedestrian Quality	S2
	Passenger Density	S3
	Cost-Benefit	S4
	Facilities	S5
	Route	S6
	Trip Purpose	S7
Subjective Norm	Recommendation	NS1
	Time Efficiency	NS2
	Cost	NS3
	Social Influence	NS4
	Environment	NS5
	Media Influence	NS6
	Social Pressure	NS7
Perceived Behavioural Control	Parking Availability	PKP1
	Feeder Connectivity	PKP2
	Headway	PKP3
	Transit Difficulty	PKP4
	Payment Method	PKP5
	Real-time Info	PKP6
	Punctuality	PKP7
	Alternative Public Options	PKP8
	Private Options	PKP9
Environmental Norm	Air Pollution	NL1
	Traffic Congestion	NL2
	Environmental Protection	NL3

Source: Authors' analysis (2025)

The model is centred on Behavioural Reluctance to Use LRT as the focal dependent construct. This construct is operationalised as a single-item measure, as it represents a specific behavioural outcome that can be directly and unambiguously assessed through a single indicator. Intention and Habit are included as intermediate endogenous constructs within the extended Theory of Planned Behaviour (TPB) framework. The primary hypotheses focus on the determinants of Intention and Behavioural Reluctance to Use LRT, whilst the additional paths involving Habit are retained as theoretically informed supplementary relationships that provide further insight into the behavioural mechanisms underlying reluctance to use LRT.

METHODOLOGY

This study adopts a quantitative, explanatory-exploratory design grounded in the Theory of Planned Behaviour to examine Behavioural Reluctance to Use LRT among residents of TOD apartments. The hypothesised relationships were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM), which is well suited for examining complex relationships among latent constructs (Hair et al., 2019, 2022) and has been widely applied in transport behaviour research (Ali et al., 2023; Yuda Bakti et al., 2020). Based on the TPB framework and prior transport behaviour research, six hypotheses were formulated:

H1: A less favourable attitude towards LRT use is associated with a weaker Intention to use the LRT.

H2: Weaker subjective norms supporting LRT use are associated with a weaker Intention to use the LRT.

H3: Lower perceived behavioural control is associated with a weaker Intention to use the LRT.

H4: Weaker environmental norms are associated with a weaker Intention to use the LRT.

H5: A weaker intention to use the LRT is associated with greater Behavioural Reluctance to Use LRT.

H6: Lower perceived behavioural control is associated with greater Behavioural Reluctance to Use LRT.

These hypotheses reflect the proposition that public transport behaviour in TOD contexts is associated not only with physical access, but also with

attitude, social influence, environmental considerations, intention, and perceived behavioural control. The structural model follows the theoretical relationships proposed in the extended TPB framework. However, the primary hypotheses focus on the determinants of intention and behavioural reluctance to use LRT, while additional paths involving habit are retained to preserve the theoretical structure and improve model explanatory power.

Although Habit is included in the structural model, no formal hypotheses were developed for the Habit-related paths. These relationships are retained as exploratory paths based on previous transport behaviour studies that suggest Habit may influence behavioural outcomes and related TPB constructs. The path model used to examine these relationships is presented in Figure 1.

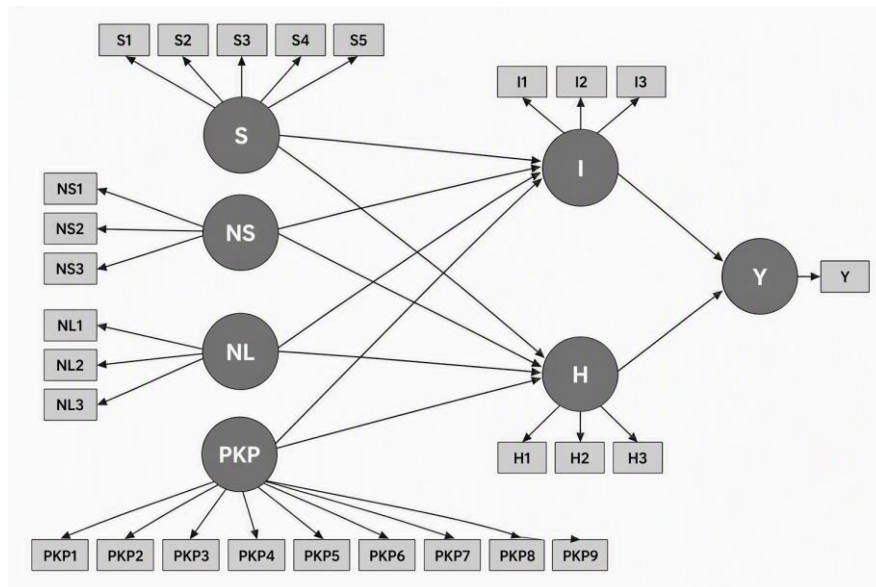


Figure 1: PLS-SEM Path Model
Source: Authors' analysis (2025)

To complement the quantitative findings, supplementary stakeholder interviews were conducted with representatives of PT Adhi Karya (Persero) Tbk., PT Adhi Commuter Properti Tbk., and ITDP Indonesia. These consultations were undertaken to obtain contextual insights regarding the operational and institutional conditions surrounding LRT implementation and TOD development. The stakeholder perspectives were used to support the interpretation of findings and the development of practical recommendations and were not included as part of the PLS-SEM analysis.

SAMPLING AND PARTICIPANTS

The study population consisted of residents of occupied TOD apartments surrounding Jabodebek LRT stations, comprising approximately 5,493 residential units across eight apartment developments.

Respondents were recruited through an intercept-based purposive sampling approach across eight occupied apartment developments located within 800 metres of Jabodebek LRT stations. Eligibility was limited to individuals residing in the selected apartment developments. Eligible residents encountered within the apartment premises were invited to participate, without additional selection based on age or occupation.

Table 2: Distribution of Respondents Across TOD Apartment Developments

Apartment Development	Nearest LRT Station	TOD Zone	Respondents (%)
Grand Dhika City	Jatimulya Station	Core TOD Area (< 400 m)	22%
The Hive Tamansari	Cawang Station	Supporting TOD Area (400-800 m)	16%
Signature Park Grande	Cawang Station	Supporting TOD Area (400-800 m)	14%
LRT City Ciracas	Ciracas Station	Core TOD Area (< 400 m)	10%
LRT City Bekasi	Bekasi Barat Station	Supporting TOD Area (400-800 m)	10%
The Conexio	Cikunir 1 Station	Core TOD Area (< 400 m)	10%
Sakura Garden City	Ciracas Station	Supporting TOD Area (400-800 m)	9%
LRT City Jatibening	Jatibening Baru Station	Core TOD Area (< 400 m)	9%

Source: Authors' analysis (2025)

Following current best practices in Partial Least Squares Structural Equation Modelling (PLS-SEM), sample size adequacy was determined using a statistical power analysis approach, which is recommended over heuristic rules such as the “10-times rule” (Hair et al., 2022). Assuming a significance level (α) of 0.05, as suggested by Cohen (1992), the minimum required sample size was estimated at 155 respondents.

Due to questionnaire length considerations, respondent profiling was limited to age and occupation characteristics. Future research could incorporate income, vehicle ownership, residential tenure, primary travel mode, and frequency of LRT use to provide a more detailed assessment of sample composition and behavioural heterogeneity. The age and occupation profiles of the respondents are presented below.

Table 3: Age Distribution of Respondents

Generation	Age Range	Frequency	Percentage
Gen Z	13-28	42	26%
Millennial	29-44	114	70%
Gen X	45-60	8	4%

Source: Authors' analysis (2025)

Table 4: Occupational Distribution of Respondents

Occupation	Frequency	Percentage
Employee	60	37%
Homemakers	45	27%
Student	33	20%
Self-employed	26	16%

Source: Authors' analysis (2025)

The respondent profile was dominated by Millennials (70%), followed by Generation Z (26%) and Generation X (4%). With regard to occupation, Employees represented the largest proportion of respondents (37%), followed by Homemakers (27%), Students (20%), and Self-employed respondents (16%). Overall, the sample reflects a predominantly working-age population residing within TOD apartment developments surrounding Jabodebek LRT stations.

The final dataset comprised 164 valid and complete responses from a total of 177 collected responses, exceeding the minimum sample size requirement. Thirteen responses were excluded due to incomplete information. Consequently, the final sample exceeded the estimated minimum sample requirement and was considered adequate for the PLS-SEM analysis.

DATA COLLECTION METHODS

Primary data were collected through a structured questionnaire administered to residents of TOD apartments located within the defined study area. All items were measured using a four-point Likert scale (1-4) to eliminate the neutral midpoint and encourage respondents to take a clear evaluative stance, thereby reducing central tendency bias and non-committal responses (Chyung et al., 2017; Garland, 1991; Thomander & Krosnick, 2024).

All questionnaire items were phrased in the direction of barriers. For example, “*I have not yet used the Jabodebek LRT for my daily activities.*” Responses ranged from 1, “strongly disagree”, to 4, “strongly agree”. Accordingly, higher construct scores indicate stronger negative evaluations, weaker perceived behavioural control, weaker intention to use the LRT, and greater Behavioural Reluctance to Use LRT, depending on the construct. The interpretation of each path coefficient therefore follows the substantive direction

of the corresponding items rather than assuming that higher scores represent stronger willingness to use the LRT.

Respondents were recruited through an intercept-based purposive sampling approach across eight occupied apartment developments located within 800 metres of Jabodebek LRT stations. Eligibility was limited to individuals residing in the selected apartment developments. Eligible residents encountered within the apartment premises were invited to participate, without additional selection based on age or occupation.

Questionnaires were administered through both paper-based and online formats covering all study variables. Data collection was conducted between 9 and 25 February 2025 from 09:00 to 21:00 across the selected apartment developments. Eligibility was restricted to residents living within TOD apartment developments located within 800 metres walking distance of a Jabodebek LRT station.

DATA ANALYSIS

The hypothesised relationships were analysed using PLS-SEM implemented in SmartPLS 4 through the following steps:

1. **Measurement Model Evaluation**
The reflective measurement model was evaluated using outer loadings, Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE), applying thresholds of 0.70 and 0.50 to assess reliability, internal consistency, and convergent validity (Hair et al., 2019, 2022).
2. **Structural Model Evaluation**
The structural model was evaluated using bootstrapping procedures to examine the hypothesised relationships among constructs. Model performance was assessed using path coefficients, confidence intervals, R^2 , Q^2 , and f^2 values. Collinearity was assessed using Variance Inflation Factor (VIF) values below 5.0 (Cohen, 1992; Hair et al., 2019, 2022).
3. **Validity and Reliability Testing**
The reliability and validity of the measurement model were assessed using Cronbach's Alpha, Composite Reliability (ρ_A and ρ_C), and Average Variance Extracted (AVE). Composite Reliability values above 0.70 indicate adequate internal consistency reliability, while AVE values above 0.50 demonstrate convergent validity (Hair et al., 2019, 2022).
4. **Omitted Variable Bias Test**
Omitted variable bias was assessed by introducing age as an additional predictor of intention, with results showing no substantive change in estimated relationships and indicating model stability (Pearl, 2009; Wooldridge, 2002).

ANALYSIS AND DISCUSSION

This section presents the empirical results of the PLS-SEM analysis, beginning with an assessment of the measurement model to establish construct reliability and validity before evaluating the structural relationships. Consistent with the analytical procedure described in the Methodology section, indicator reliability was first assessed using outer loadings and their statistical significance.

1. Measurement Model

In the measurement model, most indicators exhibited significant loadings above the recommended threshold of 0.70. Constructs including Habit, Environmental Norm, and Perceived Behavioural Control demonstrated acceptable measurement properties. However, indicators with low loadings for Subjective Norm (NS4-NS7) and Attitude (S6-S7) were removed in accordance with PLS-SEM best practices. The initial measurement model, prior to indicator removal, is presented in Table 5.

Table 5: Initial Measurement Model Before Indicator Removal

Factor	Variable	Loading Value
Habit	H1	0.780
	H2	0.826
	H3	0.778
Intention	I1	0.811
	I2	0.785
	I3	0.772
Attitude	S1	0.782
	S2	0.756
	S3	0.831
	S4	0.824
	S5	0.776
	S6	0.618
	S7	0.640
Subjective Norm	NS1	0.827
	NS2	0.790
	NS3	0.820
	NS4	-0.200
	NS5	0.061
	NS6	0.060
	NS7	0.046
Perceived Behavioural Control	PKP1	0.732
	PKP2	0.710
	PKP3	0.763
	PKP4	0.796
	PKP5	0.705
	PKP6	0.796

Factor	Variable	Loading Value
Environmental Norm	PKP7	0.770
	PKP8	0.677
	PKP9	0.743
	NL1	0.890
	NL2	0.881
	NL3	0.910

Source: Authors' analysis (2025)

Following the initial measurement model assessment presented in Table 5, indicators S6, S7, and NS4-NS7 were removed due to low or non-significant outer loadings. After refinement, PKP8 and PKP2 recorded outer loadings of 0.682 and 0.685, respectively, slightly below the recommended threshold of 0.70. However, both indicators were retained because of their theoretical importance and because their removal did not improve the reliability, convergent validity, or overall quality of the measurement model. Reliability and validity were subsequently reassessed using the refined measurement model. The results are presented in Table 6.

Table 6: Measurement Model After Indicator Removal

Factor	Variable	Loading Value
Habit	H1	0.770
	H2	0.825
	H3	0.789
Intention	I1	0.812
	I2	0.789
	I3	0.767
Attitude	S1	0.854
	S2	0.823
	S3	0.853
	S4	0.832
	S5	0.811
	S6	<i>removed</i>
	S7	<i>removed</i>
Subjective Norm	NS1	0.834
	NS2	0.790
	NS3	0.834
	NS4	<i>removed</i>
	NS5	<i>removed</i>
	NS6	<i>removed</i>
	NS7	<i>removed</i>
Perceived Behavioural Control	PKP1	0.754
	PKP2	0.685
	PKP3	0.767
	PKP4	0.797

Factor	Variable	Loading Value
Environmental Norm	PKP5	0.734
	PKP6	0.822
	PKP7	0.791
	PKP8	0.682
	PKP9	0.797
	NL1	0.890
	NL2	0.881
	NL3	0.909

Source: Authors' analysis (2025)

2. Reliability & Validity Testing

Following indicator refinement, Composite Reliability (CR), Average Variance Extracted (AVE), and Cronbach's Alpha were recalculated for all constructs. Composite Reliability (ρ_c) values exceeded 0.70 and AVE values exceeded 0.50 for all constructs. Although the Cronbach's Alpha and ρ_A values for Intention (0.698) were marginally below the recommended threshold, the construct remained acceptable given its Composite Reliability ($\rho_c = 0.832$).

Table 7: Reliability & Convergent Validity Assessment

Construct	Cronbach's Alpha	Composite Reliability (ρ_a)	Composite Reliability (ρ_c)	Average Variance Extracted (AVE)
Intention	0.698	0.698	0.832	0.624
Habit	0.709	0.710	0.837	0.632
Environmental Norm	0.874	0.878	0.922	0.798
Subjective Norm	0.756	0.758	0.860	0.672
Perceived Behavioural Control	0.899	0.902	0.918	0.585
Attitude	0.891	0.892	0.920	0.697

Source: Authors' analysis (2025)

Predictive relevance was assessed using the Q^2 criterion. All endogenous constructs recorded Q^2 values greater than zero, indicating satisfactory predictive relevance. Intention exhibited the highest predictive relevance ($Q^2 = 0.528$), followed by Habit ($Q^2 = 0.459$) and Behavioural Reluctance to Use LRT ($Q^2 = 0.349$). These findings suggest that the model demonstrates adequate predictive capability for the endogenous constructs included in the study.

Table 8: Predictive Relevance

Construct	Q ²
Intention	0.528
Habit	0.459
Behavioural Reluctance to Use LRT	0.349

Source: Authors' analysis (2025)

3. Measurement Model Evaluation

The HTMT assessment identified potential discriminant validity concerns among Intention, Habit, Subjective Norm, and Attitude, as several HTMT values exceeded the conservative threshold of 0.90. These results suggest a degree of conceptual overlap among the constructs.

Most retained indicators exceeded the recommended outer loading threshold of 0.70, while PKP2 and PKP8 recorded slightly lower values of 0.685 and 0.682, respectively. As shown in Table 9, all retained indicators loaded more strongly on their assigned constructs than on any alternative construct, thereby satisfying the cross-loading criterion. Although the cross-loading criterion was satisfied, this result does not override the HTMT assessment. Discriminant validity therefore remains inconclusive for the affected constructs.

Table 9: Cross-loading Assessment

Indicator	Intended Construct	Own Loading	Highest Cross-Loading	Cross-Loading Value	Gap
H1	Habit	0.770	Intention	0.688	0.082
H2		0.825		0.715	0.110
H3		0.789		0.683	0.106
I1	Intention	0.812	Attitude	0.717	0.095
I2		0.789		0.720	0.069
I3		0.767		0.728	0.039
NL1	Environmental Norm	0.890	Perceived Behavioural Control	0.759	0.131
NL2		0.881		0.714	0.167
NL3		0.909		0.756	0.153
NS1	Subjective Norm	0.834	Attitude	0.661	0.173
NS2		0.790		0.743	0.047
NS3		0.834		0.735	0.099
PKP1	Perceived Behavioural Control	0.754	Environmental Norm	0.734	0.020
PKP2		0.685		0.662	0.023
PKP3		0.767		0.706	0.061
PKP4		0.797		0.676	0.121

Indicator	Intended Construct	Own Loading	Highest Cross-Loading	Cross-Loading Value	Gap
PKP5	Attitude	0.734	Intention	0.725	0.009
PKP6		0.822		0.702	0.120
PKP7		0.791		0.741	0.050
PKP8		0.682		0.606	0.076
PKP9		0.797		0.704	0.093
S1		0.854		0.692	0.162
S2		0.823		0.677	0.146
S3		0.853		0.708	0.145
S4		0.832		0.735	0.097
S5		0.811		0.703	0.108

Source: Authors' analysis (2025)

The HTMT assessment indicated that discriminant validity was not fully established, particularly among Attitude, Subjective Norm, Intention, and Habit. However, all retained indicators loaded more strongly on their intended constructs than on alternative constructs, while internal consistency reliability and convergent validity remained acceptable. Because indicator removal reduced construct reliability and weakened the theoretical representation of the core TPB constructs, the original constructs were retained. Consequently, structural relationships involving the affected constructs are interpreted as provisional and should not be regarded as definitive evidence of empirically distinct effects.

Table 10: HTMT Matrix

Construct	Intention	Habit	Behavioural Reluctance to Use LRT	Environmental Norm	Subjective Norm	Perceived Behavioural Control	Attitude
Intention							
Habit	0.950						
Behavioural Reluctance to Use LRT	0.412	0.346					
Environmental Norm	0.262	0.167	0.564				
Subjective Norm	0.974	0.914	0.328	0.341			
Perceived Behavioural Control	0.144	0.144	0.472	0.537	0.136		
Attitude	0.881	0.781	0.249	0.354	1.016	0.141	

Source: Authors' analysis (2025)

4. Structural Model Evaluation

All predictor constructs exhibited VIF values below 2.170, which is well below the commonly accepted threshold of 5.0. These results indicate that multicollinearity is unlikely to affect the estimated structural relationships.

5. Path Coefficient & Hypothesis Testing

The bootstrapping results indicate that Attitude and Subjective Norm are positively and significantly associated with Intention, supporting H1 and H2. Perceived Behavioural Control exhibits a significant negative association with Intention, contrary to the hypothesised direction; therefore, H3 is not supported. Environmental Norm is not significantly associated with Intention and therefore does not support H4. Furthermore, both Intention and Perceived Behavioural Control are significantly associated with Behavioural Reluctance to Use LRT, supporting H5 and H6. Among the structural relationships examined, Perceived Behavioural Control exhibits the strongest association with Behavioural Reluctance to Use LRT. The detailed bootstrapping results are presented in Table 13.

6. Explanatory Power (R^2)

Explanatory power was assessed using the coefficient of determination. The model explained 58.3% of the variance in Intention, 49.5% in Habit, and 35.9% in Behavioural Reluctance to Use LRT.

Table 11: R-squared (R^2) Assessment

R Square	Value
Intention	0.583
Habit	0.495
Behavioural Reluctance to Use LRT	0.359

Source: Authors' analysis (2025)

7. Effect Size (f^2)

The f^2 analysis indicates that Perceived Behavioural Control had the largest substantive association with Behavioural Reluctance to Use LRT ($f^2 = 0.365$), representing a large effect size. Subjective Norm demonstrated a medium effect on Habit ($f^2 = 0.160$). All other relationships exhibited small effects ($f^2 = 0.039$ – 0.142), while the effect of Habit on Behavioural Reluctance to Use LRT was negligible ($f^2 = 0.009$).

The inclusion of Habit served an exploratory purpose. Although the model explained 49.5% of the variance in Habit, the effect of Habit on Behavioural Reluctance to Use LRT was negligible ($f^2 = 0.009$), suggesting that habitual tendencies were less strongly associated with the dependent variable than perceived behavioural control and intention. These results suggest that

perceptions of behavioural control are more strongly associated with Behavioural Reluctance to Use LRT than attitudinal, normative, or habitual factors.

Table 12: Effect Size Assessment (f^2)

Path	f^2	Interpretation
Intention towards Behavioural Reluctance to Use LRT	0.083	Small
Habit towards Behavioural Reluctance to Use LRT	0.009	Negligible
Environmental Norm towards Intention	0.070	Small
Environmental Norm towards Habit	0.041	Small
Subjective Norm towards Intention	0.142	Small
Subjective Norm towards Habit	0.160	Medium
Perceived Behavioural Control towards Intention	0.085	Small
Perceived Behavioural Control towards Habit	0.045	Small
Perceived Behavioural Control towards Behavioural Reluctance to Use LRT	0.365	Large
Attitude towards Intention	0.113	Small
Attitude towards Habit	0.039	Small

Source: Authors' analysis (2025)

8. Robustness Check: Omitted Variable Bias (OVB)

To assess model robustness, age was incorporated as a control variable. The inclusion of this variable produced no substantial changes in the estimated path coefficients or R^2 values, and no significant associations were observed between age and the endogenous constructs. These findings provide evidence of the stability of the estimated relationships, although they should be interpreted as a sensitivity assessment rather than conclusive proof of the absence of omitted variable bias.

9. Hypothesis Testing Summary

The bootstrapping results indicate that Attitude and Subjective Norm are positively and significantly associated with Intention, supporting H1 and H2. Perceived Behavioural Control exhibits a significant negative relationship with Intention ($\beta = -0.198$, 95% CI [-0.362, -0.011], $p = 0.024$), contrary to the hypothesised direction; therefore, H3 is not supported. Because higher scores represent weaker perceived behavioural control and weaker intention, the negative coefficient indicates a relationship opposite to the hypothesised direction. H3 is therefore not supported despite being statistically significant.

Environmental Norm is not significantly associated with Intention, as the confidence interval includes zero ($\beta = 0.209$, 95% CI [-0.029, 0.422], $p =$

0.069). Therefore, H4 is not supported. Intention is positively and significantly associated with Behavioural Reluctance to Use LRT ($\beta = 0.283$, 95% CI [0.036, 0.564], $p = 0.040$), supporting H5. Perceived Behavioural Control also demonstrates a significant positive association with Behavioural Reluctance to Use LRT ($\beta = 0.526$, 95% CI [0.440, 0.641], $p < 0.001$), supporting H6. Given the barrier-oriented coding of the questionnaire, the positive coefficient indicates that weaker perceived behavioural control, or stronger perceived constraints, is associated with greater Behavioural Reluctance to Use LRT.

Table 13: Structural Path Coefficients and Hypothesis-Testing Results

Hypothesis	Path	β (O)	M	STDEV	t	95% CI	p	Decision
H1	Attitude towards Intention	0.391	0.404	0.115	3.403	[0.173, 0.629]	0.001	Supported
H2	Subjective Norm towards Intention	0.442	0.433	0.096	4.598	[0.238, 0.616]	<0.001	Supported
H3	Perceived Behavioural Control towards Intention	-0.198	-0.185	0.088	2.262	[-0.362, -0.011]	0.024	Not Supported
H4	Environmental Norm towards Intention	0.209	0.197	0.115	1.821	[-0.029, 0.422]	0.069	Not Supported
H5	Intention towards Behavioural Reluctance to Use LRT	0.283	0.292	0.138	2.052	[0.036, 0.564]	0.040	Supported
H6	Perceived Behavioural Control towards Behavioural Reluctance to Use LRT	0.526	0.541	0.051	10.286	[0.440, 0.641]	<0.001	Supported

Source: Authors' analysis (2025)

This study examines factors associated with Behavioural Reluctance to Use LRT among residents of TOD apartment developments located within walking distance (<800 m) of Jabodebek LRT stations. The results indicate that Attitude and Subjective Norm are significantly associated with Intention, while Perceived Behavioural Control exhibits a significant negative association with Intention. Furthermore, both Intention and Perceived Behavioural Control are significantly associated with Behavioural Reluctance to Use LRT, with Perceived Behavioural Control emerging as the strongest statistical predictor. These findings suggest that physical access alone may be insufficient to explain Behavioural Reluctance to Use LRT among TOD residents (Donald et al., 2014; Hu et al., 2021; Yuda Bakti et al., 2020).

The strong role of subjective norms highlights the salience of social influence in dense residential settings, consistent with prior evidence that intention is shaped by shared social and peer environments (Ismael & Duleba, 2021; Mayo & Taboada, 2020). Perceived Behavioural Control exhibits a significant negative association with Intention and a strong positive association

with Behavioural Reluctance to Use LRT, suggesting that perceived constraints may be associated with both behavioural motivation and behavioural outcomes. These findings are consistent with previous studies emphasising the importance of operational factors such as reliability, connectivity, and convenience in public transport decision-making (Ali et al., 2023; Frank et al., 2005; Prayogi & Lissimia, 2021; Schlossberg & Brown, 2004; Yuda Bakti et al., 2020).

The negligible effect of Habit on Behavioural Reluctance to Use LRT, together with the non-significant association between Environmental Norm and Intention, suggests that behavioural reluctance in TOD contexts may be more strongly associated with practical considerations than with habitual or value-based motivations (De Oña et al., 2015; Frank et al., 2005; Gomez et al., 2019; Hu et al., 2021; Uddin et al., 2023).

These findings are also consistent with the TOD and built-environment literature, which suggests that density, land-use mix, and proximity increase opportunities for public transport use but do not necessarily correspond with lower Behavioural Reluctance to Use LRT (Murray et al., 1998; Shi & Zeng, 2025; Zhang, 2025). Behavioural Reluctance to Use LRT appears to be associated with perceptions of convenience, accessibility, and ease of use (Frank et al., 2005; Prayogi & Lissimia, 2021; Schlossberg & Brown, 2004).

In the Indonesian context, particularly within the Jabodebek LRT corridor, these findings suggest a shift in emphasis from TOD as a spatial planning concept towards TOD as a performance-oriented transport system. Efforts to improve perceived behavioural control may include improvements in service reliability, headway consistency, and first- and last-mile connectivity, as these factors are likely to be associated with users' perceptions of convenience and feasibility (Frank et al., 2005; Prayogi & Lissimia, 2021; Schlossberg & Brown, 2004).

Table 14: Descriptive Statistics

Variable	Mean	Std. Dev	Skewness		Kurtosis	
			Statistics	Std. Error	Statistics	Std. Error
Pedestrian Quality	2.39	0.757	-0.048	0.184	-0.389	0.366
Feeder Connectivity	2.49	0.758	0.120		-0.316	
Punctuality	2.45	0.701	-0.068		-0.237	
Headway	2.45	0.685	-0.105		-0.229	
Real-time Information	2.49	0.695	-0.189		-0.211	

Source: Authors' analysis (2025)

Several limitations should be noted. The cross-sectional design limits analysis of behavioural change over time, and self-reported data may introduce

response bias. Although key TPB constructs are included, additional operational and institutional factors may also be associated with Behavioural Reluctance to Use LRT and were not included in the present model.

Additionally, the significant associations of Attitude and Subjective Norm with Intention should be interpreted cautiously because the HTMT results indicate substantial empirical overlap among these constructs. These findings may reflect closely related dimensions of respondents' overall evaluation of LRT use rather than fully distinct construct-specific effects. By contrast, Perceived Behavioural Control demonstrated adequate empirical distinction from behavioural reluctance and emerged as the strongest statistical predictor in the estimated model. The policy discussion therefore places greater emphasis on perceived feasibility and operational constraints.

Table 15: Recommended Actions to Improve LRT Accessibility and Use

Priority Issue	Recommended Action	Primary Actors	Relationship to Findings
Waiting time and service frequency	Optimize the deployment of available rolling stock and establish a measurable service-frequency target during peak periods. Publish actual headway performance to help users assess waiting time reliability.	LRT operator, central government, infrastructure and operating partners	Responds to the strong association between Perceived Behavioral Control and Behavioral Reluctance to Use LRT
Punctuality communication	Regularly publish punctuality performance through stations, official applications, social media, and apartment communication channels. Reported operational performance should be communicated in a clear and verifiable format.	LRT operator and apartment property managers	May strengthen perceptions of service reliability and reduce uncertainty
Real-time passenger information	Improve the visibility and accuracy of arrival, disruption, and interchange information at stations and through digital platforms. Existing external applications may be retained while an integrated internal information system is developed.	LRT operator, JakLingko, relevant government agencies	Addresses informational barriers associated with Perceived Behavioral Control
Travel-time efficiency	Use operational monitoring, automated systems, and preventive maintenance to identify and reduce avoidable delays across the passenger journey. Performance indicators	LRT operator and infrastructure partners	May improve perceptions of efficiency and feasibility

Priority Issue	Recommended Action	Primary Actors	Relationship to Findings
	should include total journey time rather than in-vehicle time alone.		
Fare affordability	Evaluate targeted fare packages for frequent users, apartment residents, and eligible groups rather than relying solely on general discounts. Information regarding existing discounts should also be communicated more actively within TOD apartment developments.	Central government, LRT operator, apartment property managers	Supports the financial dimension of perceived control and Intention
Payment and top-up methods	Improve the reliability of existing ticketing machines and expand functional payment channels, including interoperable cards, QR-based payments, mobile banking, and electronic wallets.	LRT operator, payment providers, and government agencies	May reduce transaction-related barriers associated with Behavioral Reluctance to Use LRT
Apartment-to-station access	Improve pedestrian routes, crossings, lighting, weather protection, wayfinding, and safe pick-up and drop-off points between apartment developments and stations.	Local government, apartment developers, property managers, and LRT operator	Supports the accessibility and convenience dimensions of Perceived Behavioral Control
Parking management	Prioritise integrated access and mobility management rather than automatically expanding parking capacity. Where park-and-ride facilities are necessary, their design and pricing should support public transport use without encouraging additional private-vehicle dependence.	Local government, property managers, developers, and transport authorities	Addresses competing incentives between private-vehicle convenience and LRT use
Feeder services	Coordinate feeder routes, schedules, pick-up points, and service information with LRT operating hours. Internal apartment feeders should be connected to a wider area-based network where operationally feasible.	Local government, LRT operator, bus and feeder operators, property managers	Responds to connectivity barriers associated with Perceived Behavioral Control
Intermodal integration	Establish clearer institutional responsibility for physical, operational, informational, and payment of integration between	Central and local governments, JakLingko, transport operators	Addresses fragmented responsibility identified in

Priority Issue	Recommended Action	Primary Actors	Relationship to Findings
	the LRT and other public transport services.		stakeholder consultations
Private-vehicle dependence	Consider progressive parking charges, maximum parking standards, public transport incentives, and the reallocation of street space towards walking, cycling, feeder services, and public transport access.	Central and local governments, developers, and property managers	May reduce the relative convenience of private vehicles while improving LRT accessibility
Institutional coordination	Create a formal coordination mechanism with defined responsibilities, service indicators, reporting requirements, and funding arrangements for station access and intermodal integration.	Central government, local governments, transport operators, developers, and property managers	Addresses institutional fragmentation across the identified interventions

CONCLUSION

This study examined factors associated with behavioural reluctance to use the Jabodebek LRT among residents of apartment developments located within 800 metres of LRT stations. The results indicate that physical proximity alone does not necessarily correspond with lower reluctance to use the LRT. Attitude and Subjective Norm were positively associated with Intention, whereas Perceived Behavioural Control was negatively associated with Intention, contrary to the hypothesised direction. Environmental Norm was not significantly associated with Intention. Both Intention and Perceived Behavioural Control were significantly associated with behavioural reluctance, with Perceived Behavioural Control showing the strongest relationship in the estimated model.

The model explained 58.3% of the variance in Intention, 49.5% in Habit, and 35.9% in behavioural reluctance. The association between Perceived Behavioural Control and behavioural reluctance represents the most consistently supported relationship in the estimated model. This finding suggests that perceived operational and practical constraints, including service reliability, feeder connectivity, waiting time, payment methods, real-time information, and first- and last-mile access, warrant particular attention when examining LRT use in high-access TOD settings.

The findings involving Attitude, Subjective Norm, Intention, and Habit should nevertheless be interpreted cautiously. Although the retained indicators satisfied the cross-loading criterion, several HTMT values exceeded 0.90, indicating that discriminant validity was not fully established for these constructs. The corresponding coefficients should therefore be regarded as provisional

associations rather than distinct construct-specific effects. The cross-sectional design, purposive intercept sampling, limited respondent profile, and single-item measurement of behavioural reluctance further constrain causal interpretation and generalisability. In this study, behavioural reluctance refers specifically to self-reported non-use of the LRT for daily activities despite residential proximity to a station; it does not measure psychological resistance or observed travel frequency.

For TOD implementation, the findings support greater attention to the operational conditions that affect residents' perceived ability to use the LRT. Potential priorities include improving service frequency and punctuality, coordinating feeder services, strengthening pedestrian connections between apartments and stations, expanding integrated payment and real-time information systems, and clarifying institutional responsibilities for intermodal integration. These measures should be treated as priorities for implementation and evaluation rather than as definitive causal solutions. Future research should refine the overlapping TPB measures, incorporate more detailed socioeconomic and travel-behaviour characteristics, use observed ridership or travel-frequency data, and validate the model using longitudinal or independent samples.

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