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Influence of Settlement Patterns on University Student Mobility Preferences: An Accessibility-Based Analysis of Private Vehicle Use

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ABSTRACT

This study attempts to observe how settlement patterns influence mobility preferences, with primary attention directed to private vehicle accessibility to Batam International University (UIB). A quantitative approach was taken, where data were collected both online and offline through a survey distributed to 235 respondents drawn from the academic community. The analytical process used descriptive statistics, Pearson correlation, chi-square tests, and multiple linear regression to trace the relationship between residential conditions and perceived accessibility. The results indicate that 68.1% of respondents commute by motorcycle, while 43.8% live within planned housing areas. Certain factors, including private vehicle ownership and residential status, show a statistically significant relationship with accessibility satisfaction, measured through indicators such as travel time, ease of access, and road conditions. The regression output further shows that type of residence, transport mode, and study program together explain approximately 32.9% of the variance in accessibility satisfaction, suggesting an influence that exists but does not fully account for it. Additionally, the findings highlight that two-wheeled vehicles tend to perform better than four-wheeled ones in terms of flexibility and time efficiency, particularly in areas where road infrastructure is congested or underdeveloped. These outcomes point to the necessity of integrating settlement planning with sustainable transportation strategies to gradually reduce reliance on private vehicles. Educational institutions and local government are therefore recommended to strengthen public transport services, promote multimodal accessibility, and implement infrastructure improvements focused on residential zones with low accessibility. By presenting empirical evidence from a Southeast Asian island city, this research contributes to the broader discussion on campus mobility, spatial equity, and transport policy in rapidly urbanizing regions.

INTRODUCTION

The increasing number of students within the urban campus environment has triggered change noticeable in distribution residential as well as preference on mobility. Expansion demographic reshape spatial organization around university area, producing new settlement form that extend beyond traditional campus boundary and influence dynamic transportation in way that are not simple nor linear. The linkage between where students decide to live and how they travel toward campus become increasingly important for understanding problem mobility urban current, especially when university continue expanding enrolment while pattern use land around campus keep evolving.

Various study consistently indicate that access to private vehicles and distance from campus act as primary determinants of mode commuting, with motorcycle use dominating among student living within radius 1–5 km. Research show that characteristic residential surrounding area campus have correlation significant with preference choice mode, where ownership vehicle directly steer decision commuting (Hakim et al., 2023). Finding empirical reveal inclination strong toward vehicle personal, especially motorcycle, with probability reaching 74% for mode this. Preference such become reinforced through logic decision based-distance, as resident tend to favor private vehicles when distance travel fall between 1–5 kilometer (Adriana et al., 2023). Relation distance–dependency this is further illustrated through finding survey from Ohio State University, where 91% of respondent retain access vehicle and 64% of resident off-campus report behavior driving single-occupancy, with trip such increasing in line with distance campus (Sisiopikou, 2018).

Operational consequence and environmental emerging from these preference mobility generate challenge that layered for sustainable campus development. Arrangement pattern settlement strongly shape dependence private vehicle, where form residential sprawling contribute more heavily toward usage individual vehicle compared to dense settlement and compact. Expansion of both vehicle two-wheeled and four-wheeled ownership associate directly with emission exhaust higher and congestion peak-hour, producing effect chain impacting quality air and efficiency flow traffic (Santi et al., 2022). Analysis regression linear using data survey empirical extensive indicate that element environment built, particularly population density and distribution of the employment, exert influence substantial over

outcome environmental related-transportation (Zannat et al., 2020). Finding these emphasize linkage close between form urban and sustainability environmental, stressing urgency to better understand how pattern settlement influence behavior transport and its consequence for the environmental.

Accessibility consideration appear as determinant key shaping mobility preference within community around university, yet interaction between availability of the infrastructure, spatial layout, and modal choice remain not fully understood. Research existing point to complex relationship among presence infrastructure transport, parameter distance travel, and process selection modal, where pattern activity student and flexibility temporal play role strong in shaping behavior commuting (Nashuha & Umar, 2023). Study international comparative suggest that student in country developed often utilize portfolio transport more diverse compared to population general, with inclination stronger toward mode sustainable. Data from University of North Carolina show split modal of 21.5% transport public, 28.8% bicycle or walking, and 49.6% usage automobile, with trend similar observed at University of California Los Angeles where factor accessibility emerge as central in selection location residential (Adriana et al., 2023).

Transportation planning for environment campus sustainable require understanding deeper of behavior travel community academic, including background socio-demographic and preference lifestyle. Research identify variable influencing multiple in selection mode transportation, such as ownership private vehicles, possession of license driving, allowance monthly, location residential, frequency travel, time transfer, distance travel, need of change modal, duration journey, cost transport, perception safety, expectation punctuality, and consideration speed. Among these, vehicle ownership and requirement to change mode show strongest predictive power toward commuting decision (Kusuma & Rachmawati, 2020). settlement pattern drivers include expansion of dense residential areas, socio-spatial segregation, economic and social change, urban spatial integration, housing location choice, zoning fragmentation by population type, and physical as well as socio-economic transformation affected by external factors like tourism development. Together, these elements indicate settlement localization process, emerging social challenge, and policy relevance in addressing income inequality through targeted intervention (Suriandjo et al., 2023).

Even though transportation mode choice and settlement pattern have been widely studied as separate themes, important knowledge gap still exist regarding how specific accessibility attribute mediate relation between residential pattern and private vehicle dependency in university context (Moi & Yuliana, 2022). While previous studies confirm relation among distance, vehicle ownership, and mode choice, they often neglect subtle role of accessibility variation across settlement type and how this differently affect two-wheeled versus four-wheeled vehicle preference. In addition, literature still lacks integrated examination on how infrastructure quality, traffic condition, and route characteristic interact with settlement density to shape accessibility perception and later transportation decision. This gap become increasingly critical in light of growing focus on sustainable campus transport and demand for evidence-based policy.

Based on these gaps, this study aims to examine relation between settlement pattern and private vehicle preference within university context, with particular emphasis placed on accessibility as mediating aspect. The study explores multiple travel routes in order to conduct comparative accessibility analysis for both two-wheeled and four-wheeled vehicle users, considering route-level factors such as road infrastructure quality, traffic condition, travel distance, and travel time variation from different residential origins. By addressing this issue, the research contributes to theoretical understanding of accessibility–mobility linkage while simultaneously offering practical insight for sustainable campus transport planning and settlement pattern optimization.

LITERATURE REVIEW

Settlement Patterns and Spatial Structure

The conceptual framework of settlement pattern act as a basic ground for understanding how urban spatial dynamic operate and how it give effect toward mobility behavior. Settlement pattern is refer to spatial arrangement of residential unit together with supporting infrastructure that create certain morphological form inside one region (Dorostkar, 2025). These pattern are not appear suddenly, but grow through interaction between geographical condition, economic activity, planning policy, and socio-cultural preference of community. The development process itself is dynamic and often uneven, influenced by historical growth, government intervention, economic expansion, and advancement of transportation technology. Because of that, analysis of settlement pattern become important not only for spatial understanding, but also for forming efficient and sustainable mobility system in urban context (Elldér et al., 2022).

Urban and peri-urban residential typology show different characteristics that significantly influence mobility preference. (Hee, 2023) classify urban settlement into three main types: planned settlement with orderly road network and adequate public facility; organic settlement with irregular road and high density developed spontaneously; and mixed settlement combining both elements. Peri-urban area, acting as transition zone between urban and rural space, display varied residential form ranging from planned housing cluster to incremental development along transport

corridor (Civelli et al., 2022). Such spatial heterogeneity generate different accessibility level and consequently affect transportation mode decision.

Residential development pattern in Batam reflect its position as industrial and free trade city under special economic zone framework. (Putra et al., 2023) show that Batam settlement evolve in polycentric manner, with multiple activity centers linked by major transport network. Over last two decades, residential growth move outward from city center toward peripheral area, especially along main corridors and near industrial and educational zones. Urban sprawl tendency appear in several locations, although geographical limits such as topography and maritime boundary restrain excessive spread. This polycentric form create complex mobility relation between residential area and activity centers, especially influencing university accessibility.

Formation and evolution of settlement pattern in developing urban context shaped by multiple interconnected factors. (Victory et al., 2022) identify five main drivers: spatial planning policy, land price, transport accessibility, availability of public facility, and socio-cultural preference. In Indonesian cities including Batam, economic aspects like job location and housing affordability become dominant in residential decision. Recent studies by (Smith, 2021) indicate that modern settlement pattern increasingly shaped by digital accessibility and environmental quality, adding to traditional determinants such as workplace proximity and activity center access.

Mobility Preferences and Transportation Mode Choice

Mobility preference theory has developed significantly within urban transport research, incorporating psychological, social, and utilitarian dimensions. (Ribeiro & Fonseca, 2022) explain that mobility preference form through interaction among utilitarian factors like time and cost, psychological aspects such as safety and comfort, and social consideration related to status and identity. Theory of Planned Behaviour and Random Utility Theory are commonly applied to explain and predict mode choice in contemporary urban context. New theoretical advancement by (Mavlutova et al., 2023) further integrate habitual and relational dimension, stressing how daily routine and social network strongly affect travel decision process.

Transportation mode choice influenced by various factors operating across different scale and context. (Rifai et al., 2022) group these factors into three categories through longitudinal analysis: user characteristic including income, vehicle ownership, and household structure; trip characteristic such as destination type, travel distance, and time constraint; and transport system characteristic covering service availability, quality, and cost. In developing context like Batam, private vehicle ownership and limited public transport availability emerge as key determinants. Environmental awareness and lifestyle preference also gain importance, particularly among highly educated groups showing higher sensitivity toward sustainability issue.

Automobile dependency phenomenon pose serious challenge for sustainable transport system development. (Luo et al., 2025) explain that private vehicle dependence emerge through feedback loop linking dispersed settlement, car-oriented infrastructure, and declining quality of alternative transport. In Batam, where settlement relatively spread and terrain hilly, dependence on private vehicle especially motorcycle reach very high level. Weak integration between land-use planning and comprehensive public transport system further worsen this dependency, creating self-reinforcing cycle that strengthen automobile reliance over time.

Transportation Accessibility Analysis

Transportation accessibility is understood as a multidimensional idea that describe how easy an individual may reach different destinations and opportunities by using available transportation systems. (Unsworth et al., 2021) define accessibility as the capacity of a transportation system to connect specific locations while accounting for spatial condition, time elements, and individual circumstances. Over time, this concept moves away from traditional mobility-focused views that prioritize speed and movement only, toward broader perspectives that consider access quality, spatial equity, and sustainability concern. In contemporary transportation planning, accessibility is placed as a key indicator of system effectiveness and acts as a base for forming inclusive and sustainable transport policy (Allen & Farber, 2020).

Measurement of accessibility forms an important component within evidence-based transportation planning practice. (Boisjoly & El-Geneidy, 2017) identify four main categories of accessibility measurement, consisting of infrastructure-based measures evaluating transport infrastructure performance; location-based measures examining spatial distribution of opportunities reachable from certain locations; person-based measures that consider individual characteristics and limitations; and utility-based measures focusing on economic benefit derived from accessibility. Accessibility isochrones, which illustrate areas reachable within specific time intervals from an origin point, have become increasingly used, particularly in higher education accessibility studies, as shown by (Roitman & Rukmana, 2022) who developed composite accessibility indices combining travel time, cost, comfort, and availability of transportation modes.

Accessibility related to private vehicle involves a set of complex and interconnected parameters that strongly affect individual mobility capability. (Wong et al., 2017) classify private vehicle accessibility parameters into three broad groups: infrastructure parameters such as road network availability, road quality, and traffic condition; spatial parameters covering distance, travel time, and connectivity; and individual socio-economic parameters including vehicle ownership, driving capability, and purchasing power. In areas with high motorization levels, such as many Southeast Asian cities including Batam, ownership of private vehicle becomes a decisive factor shaping individual access to various destinations, including higher education institutions. Availability and cost of parking facilities at destination also operate as critical parameters, where campus parking policies significantly influence private vehicle usage and travel pattern formation (Adriana et al., 2023).

Case Study Context: Batam International University

Batam International University (UIB) represent a specific and relevant case for examining interaction between settlement pattern and mobility preference under Indonesia's special economic zone setting. Established in year 2000, UIB has developed into one of major higher education institution serving Batam city and surrounding regions. According to (Tien et al., 2022), UIB hosts a diverse student population, with majority originate from Batam and nearby areas, while smaller proportion come from other Indonesian regions and neighboring countries such as Malaysia and Singapore. The university provide wide range of undergraduate and postgraduate programs across economics, engineering, computer science, law, and social sciences, serving academic population exceeding 5,000 individuals, including students, academic staff, and administrative personnel.

The geographical condition of UIB create particular accessibility challenges that shape mobility behavior of both students and staff. Located in Baloi area of western Batam City, the campus is characterized by hilly topography with varying elevation level that generate different access difficulty (Iamtrakul et al., 2022). Surrounding environment consist of mixed land use, including residential, commercial, and open spaces, connected by arterial and collector roads with medium capacity that frequently experience congestion during peak hours. Research by (Oleksiyenko et al., 2021) identify main limiting factors of UIB accessibility as restricted public transportation option, less optimal road infrastructure, and relatively dispersed settlement arrangement. Isochronous analysis further indicate notable variation in travel time toward UIB depending on origin location, where average private vehicle travel time range between 20 until 45 minutes.

Mobility pattern of students and staff at UIB show characteristic that differ from many urban higher education institution, mainly reflecting suburban location of the campus and limited accessibility of public transport. Survey analysis conducted by (Risdiyanto et al., 2022) indicate that more than 75% of UIB students and staff depend on private vehicle for commuting to campus, dominated by motorcycle at around 60% and private car at approximately 15%. Usage of public transportation, including conventional public transport and online motorcycle taxi, remain relatively low at around 20%, while remaining respondents use alternative arrangement such as shuttle or ride-sharing. Travel frequency also differ based on role and academic schedule, where students generally make 3–4 trips per week, while academic and administrative staff commute almost every working day.

The link between where students live and how accessible the UIB campus become show a spatial pattern that is clear but also uneven, and this pattern at same time reflect socio-economic layering among student groups. According to (Batur et al., 2024), three main residential cluster can be identified for UIB students, which are high-access zones within roughly 15 minutes travel, medium-access zones around 15–30 minutes, and low-access zones exceeding 30 minutes from campus. Housing distribution appear to concentrate mostly in high and medium zones, but this not only because of distance, as housing affordability and availability of supporting facilities also intervene in location decision. Ownership of private vehicle strongly interfere this process, since students with vehicle access gain more freedom in choosing residence and often shift priority toward housing quality, while those dependent on public transport tend to push themselves closer to campus or toward limited transport corridors even when housing cost is higher. This condition gradually produce spatial separation of student settlement based on economic background and mobility capacity.

Longitudinal evidence reported by (Xing & Eskins3, 2024) indicate that relationship between residential location and campus accessibility did not remain stable during period 2020–2023, with major disturbance coming from COVID-19 pandemic and transition into hybrid learning system. Expansion of online learning reduce frequency of physical campus trips and shift residential priority, where digital connectivity suddenly gain more weight compared to physical distance. However, when face-to-face learning returned, accessibility toward campus re-emerged as central consideration in housing decision for both students and staff. This shift indicate that although technology may temporarily weaken physical accessibility importance, it does not fully replace it in higher education context.

METHOD

Research Approach and Design

This research, titled "Influence of Settlement Patterns on University Student Mobility Preferences: An Accessibility-Based Analysis of Private Vehicle Use", apply a quantitative approach using survey-based design. The quantitative paradigm was selected because of its ability to examine variable relation in structured and systematic way through statistical procedure (Bell et al., 2022). Such approach is considered appropriate for transportation behavior research, since it allow pattern detection, correlation strength measurement, and assessment of relationship between settlement characteristics and mobility choice in measurable form (Cao et al., 2009).

The use of survey design allow collection of standardized data from relatively large sample, which support sufficient statistical power for generalizing findings beyond sample toward broader university population (Creswell & Approach, 2018). This methodological orientation align with established transportation research practice that frequently explore complex interaction between built environment attribute and travel behavior tendency (Ewing et al., 2010).

Population and Sample

Research Population

The research population covers the entire academic community of Universitas Internasional Batam (UIB), which includes

- Students
- Professor
- Administrative staff

who use private vehicle as main transportation mode toward campus. Based on latest record from UIB Academic Administration Bureau, active student population reach approximately 4,035 individuals, and around 65% of them, or roughly 2,623 students, are estimated to rely on private vehicle for daily campus commuting. This number become base reference for sampling process in this study.

Sampling Technique

To maintain proportional representation among different population segments, this research implement stratified random sampling technique. Sampling strata are constructed based on relevant population characteristics, allowing each subgroup to be represented according to its proportion within overall population, although practical limitation still exist during data collection stage.

- Status (student)
- Gender
- Residential area

Sample Size and Distribution

Sample size determination use Slovin formula, applying confidence level of 95% with margin of error set at 5%. This method chosen to balance statistical adequacy with feasibility in field data collection process (Israel, 2013). The calculation process then produce a numerical threshold used as minimum sampling requirement.

$$n = N / (1 + N \times e^2)$$

Where:
N = Population size (2.623)
e = Margin of error (0.05)
n = Required sample size
From population which estimated of user private vehicles numbering around 2.623 individual, size sample minimum obtained through calculation is 132 respondent. To strengthen robustness and anticipate non-response or data incomplete, although minimum required sample was 132 and initial target was 200 respondents, the final valid responses collected reached 235, exceeding the minimum requirement and increasing statistical robustness. Creating margin safety additional of approximately 51% beyond requirement minimum.

Research Instruments

Questionnaire

Instrument primary applied in research this take form of questionnaire structured, which is organized into five section.

- Respondents' demographic and socio-economic profile
- Age, gender, status at UIB
- Monthly income/pocket money

- Vehicle ownership

Characteristics of residential settlements

- Type of settlement
- Location (district and sub-district)
- Length of residence
- Ownership status
- Transportation infrastructure around the residence

Travel patterns to UIB

- Distance from home to UIB
- Travel time during peak and non-peak hours
- The usual route taken
- Frequency of trips per week
- Departure and return times
- Monthly transportation costs

Preference for using private vehicles

Questionnaire cover factor influencing choice transportation, including comfort, reliability, flexibility, safety, and consideration economic. Perception toward accessibility UIB is measured through scale Likert 5-point, focusing on judgement respondent toward condition road, availability parking, congestion traffic, and existence of mode transportation alternative, although perception may vary depending on experience daily.

1. Development and Validation of Instruments

   Development of questionnaire followed procedure validation four-stage that was conducted in manner controlled and sequential (DeVellis, 2016), aiming to ensure accuracy measurement and relevance conceptual.

   - Comprehensive literature review, where instrument measurement established related to behavior transportation and assessment pattern settlement were examined systematically. Indicator relevant were then adapted to fit context of study this, although alignment full was not always possible due to difference condition local.
   - Expert consultation, conducted through discussion collaborative with specialist development regional and planning transportation. Process this aim to strengthen validity content and relevance contextual of item questionnaire, while also identifying ambiguity or potential conceptual overlap.
   - Pilot testing was carried out by administering questionnaire to sub-sample representative of respondent (n = 30). Step this allow identification of phrasing unclear, wording ambiguous, and inconsistency measurement that may disturb understanding respondent or accuracy response.
   - Reliability assessment was conducted to evaluate the internal consistency of the measurement scale using Cronbach's Alpha coefficient. In line with methodological literature, a Cronbach's Alpha value of 0.70 is generally considered acceptable for confirmatory research, while values above 0.60 remain acceptable for exploratory or early-stage studies (Nunnally & Bernstein, 1994). Therefore, instruments with Alpha coefficients ≥ 0.60 were considered sufficiently reliable for further analysis in this study.

   Item questionnaire that failed to meet standard reliability required were either revised or removed, in order to maintain quality measurement overall and ensure soundness statistical of instrument.

Data Collection Methods

Primary Data Collection

Data collection was carried out using a combination of distribution methods.

Online Method:

- The questionnaire was distributed through the Google Forms platform
- Distribution through faculty and department social media groups
- Distribution via instant messaging applications

Offline Method:

- The questionnaire was distributed at strategic locations on campus (parking areas, cafeteria, library, faculty lobby)
- Conducted at various times over a two-week data collection period
- Aimed at reaching respondents with various class and work schedules

Data Analysis Techniques

Initial Data Processing

Verification and data cleaning to eliminate incomplete or invalid entries. Initial processing using Microsoft Excel

Descriptive Analysis

Descriptive analysis to obtain an overview of:

- Sample characteristics
- Geographic distribution of respondents
- Basic patterns of mobility preferences

Descriptive analysis methods include calculations:

- Frequency and percentage
- Average and median
- Standard deviation

Inferential Statistical Analysis

Inferential statistical analysis to test the relationship between settlement pattern variables and mobility preferences:

- Pearson correlation analysis for continuous variables
- Chi-square test for categorical variables
- Multiple linear regression analysis

For regression analysis:

- Dependent variable: personal vehicle preference index
- Independent variables: settlement characteristics, travel distance, and socio-demographic variables

Validity and Reliability

To ensure the quality of the research, several testing steps are applied:

- Internal validity: data triangulation from various sources
- External validity: representative sampling
- Instrument reliability: Cronbach's Alpha test

Research Ethics

This research adheres to ethical principles by:

1. During data collection phase, confidentiality and anonymity of respondent were treated as fixed requirement, so personal identity was not allowed to appear inside analytical material, even indirectly, in order to protect individual privacy boundary.
2. Before any response was given, respondents already receive explanation regarding research objective, although not all detail delivered at same depth, but information was considered sufficient for participation decision.
3. Additional clarification also provided about what kind of data being collected and how such data later would be used for academic analysis purpose, not for non-academic or external utilization.
4. Participation status was entirely voluntary in nature, and respondents were informed that withdrawal from research could occur at any stage, without consequence, sanction, or negative implication attached.
5. Respondent personal data were stored in separated form from survey answer files, and basic encryption mechanism was applied to reduce risk of unauthorized access or unintended data exposure.
6. Before starting data collection activity, formal approval was secured from the UIB Research Ethics Committee, ensuring that procedure followed institutional ethical requirement, although implementation in field still face minor practical limitation.

RESULT AND DISCUSSION

Result

Demographic Characteristics of Respondents

This study involved a total of 235 respondents drawn from the academic community of Batam International University (UIB). Descriptive examination shows that the demographic profile appears varied, yet still reasonably representative of the university population.

Age and Gender Distribution

Table 1. Distribution of Respondents by Age

Age Category	Number	Percentage
> 25 years	5	2.10%
17-19 years	72	30.60%
20-22 years	139	59.10%
23-25 years	19	8.10%
Total	**235**	**100%**

Table 2. Distribution of Respondents by Gender

Gender	Number	Percentage
Men	105	44.70%
Women	130	55.30%
Total	**235**	**100.00%**

Most respondents were concentrated in the age group of 20–22 years, amounting to 139 individuals (59.1%), followed by those aged 17–19 years with a total of 72 respondents (30.6%). Gender composition remains relatively balanced, although female respondents appear slightly more dominant at 55.3%.

Academic Status and Study Program

Table 3. Distribution of Respondents Based on Status at UIB

Status at UIB	Number	Percentage
Lecturers	5	2.10%
Educational Staff/Staff	5	2.10%
Students	51	21.70%
Master's students	74	31.50%
Undergraduate students	100	43%
Total	**235**	**100%**

Table 4. Distribution of Respondents Based on Study Program/Faculty

Study Program/Faculty	Number	Percentage
Accounting	6	2.60%
Architecture	3	1.30%
Law	15	6.40%
Management	75	31.90%
Civil Engineering	100	43%
English Education	14	6%
Information Systems	6	2.60%
Information Technology	12	5.10%
Tourism	4	1.70%
Total	**235**	**100%**

Program distribution data show clear dominance of Civil Engineering students at 42.6%, followed by Management students at 31.9%, which mirrors institutional orientation of UIB that lean heavily toward engineering and business discipline.

Economic Profile and Vehicle Ownership
Income Level

Table 5. Distribution of Respondents Based on Monthly Income/Allowance

Income Category Amount	Number	Percentage
< Rp 1.000.000	15	6.40%
Not yet	1	0.40%
Rp 1.000.000 – Rp 2.500.000	123	52.30%
Rp 2.500.001 – Rp 5.000.000	88	37.40%
Rp 5.000.001 – Rp 10.000.000	7	3%
Total	**235**	**100%**

From economic perspective, most respondents report monthly income or allowance between Rp 1,000,000–2,500,000, reaching 52.3% of total sample. This value indicate that majority fall into lower-middle economic grouping, a condition that potentially influence daily mobility behavior.

Vehicle Ownership Patterns

Table 6. Vehicle Ownership Distribution

Type of Ownership	Number	Percentage
Cars	9	3.80%
Bicycle	2	0.90%
Motorcycle	160	68.10%
Motorcycle, Car	22	9.40%
Motorcycles, Cars, Bicycles	18	8%
Motorcycle, Bicycle	18	8%
Do Not Own a Vehicle	6	2.60%
Total	**235**	**100.00%**

Table 7. Number of Motorcycle Ownership

Number	Number of Respondents	Percentage
0	10	4.30%
1	58	24.70%
2	44	18.70%
3	45	19.10%
> 3	78	33%
Total	**235**	**100%**

Table 8. Number of Car Ownership

Number	Number of Respondents	Percentage
0	62	26.40%
1	62	26.40%
2	76	32.30%
3	30	12.80%
> 3	5	2%
Total	**235**	**100%**

Table 9. Number of Other Vehicle Ownership

Number	Number of Respondents	Percentage
0	96	40.90%
1	56	23.80%
2	37	15.70%
3	42	17.90%
> 3	4	2%
Total	**235**	**100%**

Vehicle ownership pattern strongly point toward motorcycle dominance, where 68.1% of respondents rely mainly on this mode. More striking, 33.2% report owning more than three motorcycles within single household, signaling high dependency on motorized private transport.

Settlement Patterns and Mobility Preferences
Settlement Characteristics

Table 10. Distribution of Settlement Types

Type of Settlement	Number	Percentage
Apartment/Condominium	10	4.30%
Unplanned housing (village)	10	4.30%
Shophouse	45	19.10%
Planned housing (complex)	103	43.80%
Plot	63	27%
Boarding house/Dormitory	4	2%
Total	**235**	**100.00%**

Residential profile reveal that planned housing complex dominate at 43.8%, followed by plot-based housing at 26.8%. This distribution imply that respondents tend to select residential environment offering relatively better infrastructure condition and more acceptable accessibility level.

Level of Satisfaction and Perception of Accessibility

Table 11. Descriptive Statistics of Respondent Characteristics

Variable	Min	Max	Mean	Std. Dev
Level of Satisfaction with Accessibility Using Private Vehicles	1	5	3.64	1.05
The Influence of Residential Location on Mode Choice	1	5	2.62	1.194
The Importance of the Availability of Personal Vehicles	1	5	1.61	1.046
Consideration of Access to UIB in Location Selection	1	5	3.71	0.971

Table 12. Distribution of Satisfaction Levels Accessibility

Scale	Number	Percentage
1 (Very Dissatisfied)	19	8.10%
2 (Dissatisfied)	11	4.70%
3 (Neutral)	39	16.60%
4 (Satisfied)	132	56.20%
5 (Very Satisfied)	34	15%
Total	**235**	**100%**

Table 13. The Influence of Residential Location on Mode Choice

Scale	Number	Percentage
1	59	25.10%
2	46	19.60%
3	62	26.40%
4	62	26.40%
5	6	3%
Total	**235**	**100%**

Table 14. The Importance of the Availability of Private Vehicles

Scale	Number	Percentage
1	163	69.40%
2	26	11.10%
3	25	10.60%
4	17	7.20%
5	4	2%
Total	**235**	**100%**

Table 15. Considerations for Access to UIB in Location Selection

Scale	Number	Percentage
1	16	6.80%
2	11	4.70%
3	26	11.10%
4	155	66.00%
5	27	12%
Total	**235**	**100%**

Analysis of Variable Relationships
Correlation Test

Table 16. Results of the Pearson Correlation Test

Variable	Pearson Correlation	Sig. (2-tailed)	Interpretasi
Status at UIB	0.245	0	Significant weak correlation
Study Program/Faculty	0.259	0	Significant weak correlation
Type of Settlement	0.273	0	Significant weak correlation
Status of Residence Ownership	0.463	0	Significant moderate correlation
Main Transportation Mode to UIB	0.325	0	Significant moderate correlation

Correlation testing result indicate that all observed variables show statistically significant relationshipswith accessibility satisfaction, but among them, residential ownership status emerge with highest correlation value (r = 0.463), placing it as central factor shaping accessibility perception.

Chi-Square Test

Table 17. Chi-Square Test Results

Variable Relationship Pearson	Pearson Chi-Square	Asym. Sig. (2-sided)	Conclusion
Type of Settlement vs. Level of Accessibility Satisfaction	-	0	Significant Corelation
Type of Settlement vs Main Transportation Mode	-	0,012	Significant Corelation

Chi-Square test outcome further confirm statistically significant association between settlement type and accessibility satisfaction, as well as transportation mode choice, reinforcing that residential context and mobility behavior are not independent from one another.

Multiple Linear Regression Model

Table 18. Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.574	0.329	0.314	0.869

Table 19. ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	84,251	5	16.85	22,311	0
Residual	172,916	229	0.755		
Total	257,166	234			

Table 20. Coefficients

Variable	Unstandardized B	Std. Error	Beta	t	Sig.
Constant	-0.018	0.389	–	-0.047	0.962
Status at UIB (Code)	0.121	0.065	0.110	1.862	0.064
Study Program / Faculty (Code)	0.128	0.042	0.170	3.071	0.002
Type of Settlement (Code)	0.082	0.061	0.081	1.344	0.180
Residence Ownership Status (Code)	0.591	0.093	0.361	6.348	0.000
Main Transportation Mode to UIB (Code)	0.218	0.058	0.213	3.772	0.000

Regression analysis produce R-squared value of 0.329, meaning that selected independent variables explain around 32.9% of variation in accessibility satisfaction. Remaining variation likely originate from other factors not captured inside current model structure.

Validity and Reliability Test

Table 21. Validity Test Results

Category	Pearson Correlation	R Table	Description
Status at UIB	0.245	0.128	VALID
Study Program/Faculty	0.259	0.128	VALID
Type of Settlement	0.273	0.128	VALID
Status of Residence Ownership	0.463	0.128	VALID
Main Transportation Mode to UIB	0.325	0.128	VALID

Table 22. Reliability Test Results

Cronbach's Alpha	N of Items
0.633	5

All research instruments demonstrate acceptable validity and reliability levels. The Cronbach's Alpha coefficient of 0.633 exceeds the minimum threshold of 0.60, indicating sufficient internal consistency despite minor variability among items.

DISCUSSION

The Relationship between Settlement Patterns and Preferences for Private Vehicle Use in the University Environment

Finding overall indicate relationship meaningful between characteristic pattern settlement and preference mobility within community academic UIB. Dominance of housing planned (43.8%) and plot (27%) reflect tendency shared to prioritize location residential offering infrastructure acceptable and accessibility. Pattern this suggest that choice residential is not random, but rather linked to consideration mobility everyday and expectation access term-longer.

Result from correlation Pearson show that type settlement has relation weak but significant statistically with satisfaction accessibility ($r = 0.273$, $p < 0.05$). Result this align with argument from [36], stating that accessibility toward key locations is generally supported by structure use land and infrastructure transport. However, magnitude correlation low indicate that type settlement alone is insufficient to fully explain perception accessibility.

Ownership on motorcycle remain feature mobility visible most, with 68.1% respondent identifying it as mode transport primary and 33.2% reporting ownership of more than three unit per household. Condition this reflect strategy adaptive among family urban Indonesian, especially in Batam, where motorcycle serve user multiple, purpose trip varied, and pattern movement daily flexible.

This pattern remain consistent with finding by (Abreu & Lucchesi, 2022), which underline mediating role of commuting distance and vehicle ownership in shaping travel behavior. Similar conclusion also drawn by (Manaf et al., 2024), who observe that lifestyle shift and socio-economic dynamic, including ownership private increased vehicle in suburban setting, significantly affect individual mobility. Income distribution of respondents mostly concentrated in Rp 1,000,000–2,500,000 range further explain why motorcycles are preferred over alternative costlier such as cars private or ride-hailing services.

Demographic dominance of undergraduate student (43%), mainly from Civil Engineering (42.6%) and Management (31.9%), provide specific academic context for mobility pattern observed. These groups usually require frequent campus attendance for lab session, practical activity, and meeting, thus demanding transport reliable flexible that can adjust. Chi-Square test confirm significant relation between settlement type, satisfaction accessibility ($p < 0.05$), and transport mode choice ($p = 0.012$), supporting (Heerden et al., 2022) that urban planning must accommodate supply transport and modal diversity. Accessibility satisfaction for private vehicle reach average 3.64 of 5, with 56.2% respondents satisfied, showing reliance private still persist despite constraint infrastructure.

Comparative Analysis of Accessibility Levels of Two-Wheeled and Four-Wheeled Vehicles

Comparative reading of accessibility level show two-wheeled vehicle stand as dominant transport form, with ownership reaching 68.1% respondents. Car ownership, by contrast, appear scattered more: 26.4% report no car, while 32.3% report owning two cars. This imbalance signal how user adjust toward road condition and traffic rhythm Batam, where motorcycle move easier faster and less restricted inside network road tangled.

Finding reported by (Hidayati et al., 2021) support view that pedestrian accessibility not fully achieved, mainly because land use arrangement fail support walking and walking itself perceived negative. This condition increase reliance toward motor private vehicles. In Batam context, climate exposure, sidewalk absence, and concern safety further reduce willingness walk, especially for campus trip. Narrow road and dense traffic, combined with uneven topography, unintentionally place vehicle two-wheeled in advantageous more position for maneuver and time saving.

Analysis result indicate that 69.4% respondent rate availability private vehicle as very important (scale 1). This suggest strong dependence on personal mobility compared to option transport public. Such dependency also mirror limitation public transport in addressing varied daily travel need. While (Larsson et al., 2022) argue bicycle can compete effective for short trip in many city, in Batam motorcycle take over role this, due shielding weather, ability storage, and capacity passenger carrying.

Vehicle ownership distribution also show diversification pattern within household. About 17.4% respondent own both motorcycle and car, reflecting strategy mobility adaptive. This mix allow household switch mode depending trip type, weather condition, passenger number, or cargo demand. Motorcycle selected for daily routine trip and congestion-heavy route, while car reserved for travel family, weather poor situation, or transport heavier requirement.

A relatively accessibility satisfaction high is observed, with 71.2% respondent state satisfied or very satisfied. This indicate that combination two-wheeled and four-wheeled vehicle currently function in fulfilling need mobility. These outcome align with (Raza, Zhong, et al., 2022), who argue area with accessibility private-vehicle strong tend attract activity residential and commercial. Economic aspect remain central, since motorcycle offer burden operational lower fuel, maintenance, insurance, and parking making them feasible more for student and staff with capacity financial limited.

Factors Affecting Accessibility: Road Infrastructure, Traffic Conditions, Distance, and Travel Time

Multivariate examination show accessibility shaped by interaction overlapping between quality infrastructure road, condition traffic, and distance spatial from residence to UIB campus. Regression model explain 32.9% variation accessibility satisfaction ($R^2 = 0.329$), with ownership residential status presenting association strongest ($r = 0.463$, $p < 0.05$). This support argument (Chaudhry et al., 2022) that spatial form and maturity system transport jointly influence formation mobility choice.

Consideration of campus access in residential selection record average score 3.71, with 66% respondent express agreement. This confirm that access toward education facility actively considered when choosing residence. Respondent appear weigh proximity, convenience route, and reliability travel as part everyday trade-off cost–time practical.

Condition of infrastructure road in Batam limited capacity, quality uneven, and transport public weak continue reinforce dependence on private vehicles, particularly motorcycle. Road width narrow, management traffic poor, coverage route minimal, and facility pedestrian lacking shape this dependency. While (Wolnowska & Kasyk, 2022) note resident in many city tend choose car or walking, in Batam motorcycle replace walking effective due stress climate, separation distance, and constraint infrastructure.

Distance and time travel remain decisive element in mode choice. Private vehicles offer certainty time and flexibility that transport public cannot match consistently. Correlation analysis show main mode transport to UIB have association moderate with satisfaction accessibility ($r = 0.325$, $p < 0.05$). This support (Inturri et al., 2021), who emphasize perception accessibility depend not only availability, but also reliability service and alignment spatial.

Influence of residential location on mode choice appear split evenly, with 26.4% agree and 26.4% neutral. This suggest location alone not strongly dictate choice mode. Consideration practical such time efficiency, cost operational, access vehicle, comfort preference, and flexibility schedule tend override proximity spatial in decision transport daily.

Traffic dynamic and infrastructure uneven generate accessibility time-dependent condition. This mean quality access shift across hour and day. Such pattern correspond with (Raza, Safdar, et al., 2022), who identify accessibility based-time as determinant of activity location choice. In response, user adopt behavior adaptive, such adjust departure time, select route alternative, or mix mode transport to maintain consistency access campus.

CONCLUSION

Overall, study confirm settlement pattern characteristic significantly shape preference mobility in context university. Planned housing (43.8%) and plot (27%) dominate residential choice, reflecting orientation toward environment that accessible. Motorcycle remain dominant mode transport (68.1%), with high ownership intensity (33.2% owning more than three unit). Ownership residential status show strongest link with accessibility satisfaction ($r = 0.463$), while regression explain 32.9% variation of accessibility through variable mobility and residential. High satisfaction level (71.2%) suggest private-vehicle strategy still effective under Batam current.

These finding offer reference empirical for development policy urban that link planning settlement with system transport sustainable more. Body government and institution educational are encouraged to consider strategy mobility alternative that acknowledge reliance motorcycle strong. Improvements in road infrastructure, development of reliable public transport, and spatial planning that enables multimodal access are necessary steps to reduce congestion pressure and long-term environmental impact from private vehicle dominance.

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