

Assessing the Characteristics of Affordable and Adequate Housing with Access to Public Transportation: A Case Study in Urban Sub-Districts of Bandar Lampung, Indonesia

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Abstract

Rapid urbanization in developing countries has increased the demand for affordable and adequate housing, as well as access to efficient public transportation systems. These challenges are closely related to the targets outlined in Sustainable Development Goal (SDG) 11, which seeks to ensure inclusive, safe, resilient, and sustainable cities. Adequate housing is defined not only by physical infrastructure but also by access to clean water, sanitation, healthcare, and transport connectivity. This study aims to examine the characteristics of affordable and adequate housing in relation to public transportation accessibility in Bandar Lampung, Indonesia, focusing on the sub-districts of Tanjung Karang Pusat, Tanjung Karang Timur, and Tanjung Karang Barat. The research employed a field-based survey method involving interviews and direct observations of 70 household samples. Key variables measured include the proportion of households with access to adequate and affordable housing, the percentage of the population with convenient access to public transportation, and the extent of service coverage by public transit. The findings reveal that 77% of households fulfill the criteria for adequate and affordable housing, whereas only 13% of the population enjoys convenient access to public transport, and 68% are covered by public transportation services. These results highlight a substantial disparity between housing provision and transportation accessibility, underscoring the necessity for integrated urban policies that promote spatial equity and sustainable development in rapidly growing urban areas.

Keywords: *Developing Cities; SDGs 11; Spatial Equity; TOD; Urban Planning*

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INTRODUCTION

The ongoing acceleration of urban growth in many developing nations has led to increasing demands on cities to fulfill basic service needs, including housing, sanitation, water supply, and transportation infrastructure (Bai et al., 2012; Swapan et al., 2017). This trend has brought global attention to the importance of managing urbanization in a sustainable manner (Cohen, 2006; Hassan & Lee, 2015). As a response, the United Nations introduced the Sustainable Development Goals (SDGs), adopted by 193 member countries including Indonesia, which aim to address multifaceted development challenges through 17 goals, 169 targets, and 319 indicators (Muskanan et al., 2024). Specifically, SDG 11 focuses on promoting inclusive, safe, resilient, and sustainable urban settlements by the year 2030 (Ionescu et al., 2024). Indonesia has adapted this agenda into national development strategies through the coordination of Bappenas, aligning SDGs with sectoral policies across environmental, social, economic, and governance dimensions. Ensuring access to decent housing and efficient public transportation remains a central concern within these frameworks. Without effective intervention, rapid urbanization can worsen social inequality and environmental degradation. A study in Bandar Lampung found that motor vehicle traffic contributes significantly to noise pollution in urban environments, affecting residents' comfort and well-being (Ardianti et al., 2024). Addressing these concerns requires integrated urban governance that bridges the gap between residential development and mobility systems.

In many parts of the developing world, large segments of the urban population still lack access to safe drinking water, reliable sanitation, and adequate housing. Global estimates suggest that over 220 million urban residents lack access to potable water, and more than 420 million are without adequate sanitation facilities (Satterthwaite, 2016). Additionally, poor waste management and exposure to high levels of air pollution continue to threaten the health and quality of life of more than a billion people residing in vulnerable urban environments (Manisalidis et al., 2020). These systemic challenges are often aggravated by rising land prices, limited urban space, and increasing pressure on public services (Abdulla & Ibrahim, 2023). As a result, governments are frequently confronted with the dual challenge of providing affordable housing and building resilient, sustainable infrastructure. Indonesia is no exception; several of its major cities struggle to balance urban development with the principles of environmental and social sustainability (Sutadji, 2024). In densely populated cities, the inability to meet the rising demand for safe housing and transport can contribute to spatial injustice and inequality. These conditions highlight the critical need for city-level policies that are both socially inclusive and environmentally sound.

Bandar Lampung, the capital of Lampung Province and a rapidly growing urban center in Sumatra, exemplifies these challenges. As the third most populated city on the island after Medan and Palembang, it is projected to experience continued demographic growth, reaching up to 2.4 million residents by 2030 (Lukitaningsih & Swandhani, 2024). This demographic pressure increases the city's need for affordable housing and adequate transport systems. While various programs such as KOTAKU, NUSP-2, BSPS, and FLPP have been introduced to improve housing conditions and

reduce urban slum areas, the gap between residential needs and transport accessibility remains significant. These initiatives, although helpful, often operate in isolation, lacking coordination with transport planning. Consequently, many residents still face constraints in accessing public transport or live in areas with poor connectivity to economic centers. Urban development in Bandar Lampung therefore demands a more integrated approach that addresses both the spatial distribution of housing and the availability of public transport. A thorough assessment of this relationship is essential to guide future urban policies.

Although research on urban housing and public transportation exists, most studies examine these sectors separately, particularly in the context of Indonesia's larger metropolitan areas (Dewita et al., 2020). Mid-sized cities such as Bandar Lampung remain understudied, especially regarding the interaction between housing adequacy and transport service coverage. Moreover, existing literature tends to focus on physical infrastructure outputs rather than evaluating accessibility and affordability from the user's perspective. This fragmented approach limits policymakers' ability to design strategies that effectively address both housing and mobility challenges. The lack of detailed household-level data further complicates efforts to develop evidence-based interventions. As a result, a research gap persists in linking spatial housing conditions with urban transport accessibility. Understanding this linkage is essential for supporting sustainable, inclusive urban development, as envisioned in SDG 11. To address this shortcoming, the current study explores the intersection of housing and transport access in a mid-sized Indonesian city.

This study investigates the characteristics of affordable and adequate housing and their relationship with public transportation access in Bandar Lampung. The research is conducted in three selected sub districts Tanjung Karang Pusat, Tanjung Karang Timur, and Tanjung Karang Barat which represent diverse urban typologies within the city. Using a micro-scale household approach, the study collects primary data through structured interviews and field observations. Key indicators include the proportion of households with access to affordable, safe, and livable housing; the share of the population with convenient public transport access; and the extent of service coverage. Through spatial analysis, this study aims to reveal patterns of accessibility and gaps in infrastructure provision. The results are expected to inform local government strategies to better integrate housing and transport policies. Furthermore, this research contributes to the broader discourse on sustainable urban development aligned with the SDG framework. Ultimately, it aims to support policy interventions that create livable, inclusive, and resilient urban spaces in Indonesia.

METHODS

This study was conducted in Bandar Lampung, Indonesia, during the period of August to September 2022. The research focused on three urban sub-districts: Tanjung Karang Pusat, Tanjung Karang Timur, and Tanjung Karang Barat. A stratified random sampling technique was employed to select respondents, ensuring that the sample represented distinct strata within the population. In this method, the population is first divided into specific subgroups or strata, after

which random sampling is performed within each group to ensure balanced representation across different segments. Based on the total population of the three sub-districts, a sample of 70 respondents was determined. These respondents were selected using a random table approach, resulting in a proportional distribution: 10 respondents from Tanjung Karang Pusat, 20 from Tanjung Karang Timur, and 40 from Tanjung Karang Barat.

Primary data were collected directly from the respondents through structured questionnaires and interviews. Additionally, observational techniques were used to gather contextual data on housing and environmental conditions. In this context, sources of data include both human subjects (respondents) and non-human elements such as physical infrastructure or processes observed in the field. The inclusion criteria for respondents required individuals to be at least 17 years of age at the time of the survey. This study utilized a cross-sectional design, which involves the collection of data at a single point in time, enabling a snapshot analysis of the population characteristics and conditions in the selected urban areas.

RESULT AND DISCUSSIONS

The analysis of housing adequacy and access to public transportation was conducted by classifying key variables related to livable housing standards and transport accessibility. These variables include the type of roofing material used by households, type of wall construction, flooring materials, ownership status of the dwelling, adequacy of living space, source of drinking water, type of toilet facility, occupation type, household income, distance to public transportation facilities such as bus stops, terminals, and stations, as well as the frequency of public transport use by households.

Table 1. Type of Rooting Material Used by Households

No	Indicator	Number of Respondent	Percentage (%)	Category
1	Households using zinc roofing	48	68%	Adequate
2	Households using asbestos roofing	5	7,14%	Inadequate
3	Households using clay tiles	17	24,86%	Adequate
	Total	70	100%	

The results in Table 2 show that a majority of households (68%) use zinc roofs, which are categorized as adequate for basic housing. Meanwhile, 7.14% of respondents still use asbestos roofing, which is considered substandard and poses health risks. Households using traditional clay tiles make up 24.86%, and are also classified as meeting the criteria for adequate housing.

Table 2. Type of Wall Construction Used by Households

No	Indicator	Number of Respondent	Percentage (%)	Category
1	Households using brick/concrete wall	65	93%	Adequate
2	Households using gypsum board walls	2	3%	-
3	Households using wooden plank walls	3	4%	-
	Total	70	100%	

As illustrated in Table 3, the majority of respondents (93%) reside in houses with permanent wall materials such as brick or concrete, which fulfill the requirements for adequate housing. A small percentage of households use alternative materials such as gypsum board (3%) or wooden planks (4%), which may not fully meet structural and durability standards for livable housing.

Table 3. Type of Flooring Material Used by Households

No	Indicator	Number of Respondent	Percentage (%)	Category
1	Households using ceramic tiles	54	77%	Adequate
2	Households using cement flooring	12	17%	-
3	Households using wooden flooring	1	2%	-
4	Households using granite flooring	1	1%	-
5	Households using standard tiles	2	3%	-
	Total	70	100%	

As shown in Table 4, a significant majority of respondents (77%) reported the use of ceramic tile flooring, which is considered a standard indicator of adequate housing. The remaining respondents use alternative materials such as cement (17%), wood (2%), granite (1%), and conventional tiles (3%), which vary in durability and comfort levels but are less frequently associated with adequate housing standards.

Table 4. Home Ownership Status

No	Indicator	Number of Respondent	Percentage (%)	Category
1	Households with free certificate (SHM)	55	81%	Secure
2	Households without certificate	1	2%	Insecure
3	Households living on borrowed land/houses	1	2%	Insecure
4	Households renting property	7	10%	Insecure
5	Households living in parents' property	2	3%	Insecure

6	Households living in relatives' property	1	1%	Insecure
7	Households in rent free arrangements	1	1%	Insecure
	Total	70	100%	

The data indicate that most households (81%) possess formal legal ownership through freehold certificates (SHM), ensuring secure tenure. However, 19% of respondents reside under insecure arrangements, such as informal occupancy, renting, or shared ownership with relatives, which may limit their legal protection and access to housing support programs.

Table 5. Sources of Drinking Water

No	Indicator	Number of Respondent	Percentage (%)	Category
1	Households using bottled drinking water	41	59%	Adequate
2	Households using piped water	3	4%	Adequate
3	Households using borehole water	12	17%	-
4	Households using dug well water	11	16%	-
5	Households using rainwater	3	4%	-
	Total	70	100%	

Most respondents (59%) reported using bottled mineral water, and a smaller proportion (4%) had access to piped water, both of which meet the criteria for safe drinking water. Meanwhile, other sources such as boreholes (17%), dug wells (16%), and rainwater (4%) are less consistent in terms of safety and quality and may require further treatment, making them less ideal as primary sources of consumption.

Table 6. Type of Sanitation Facility (Toilet)

No	Indicator	Number of Respondent	Percentage (%)	Category
1	Households with private toilet (flush, septic tank)	63	90%	Adequate
2	Households sharing toilet facilities	3	4%	Inadequate
3	Households with toilet without proper waste disposal	3	4%	Inadequate
4	Households using open-pit/pond toilets	1	2%	Inadequate
	Total	70	100%	

Sanitation data reveals that 90% of households have access to private toilet facilities equipped with septic tanks, meeting the standards for safe sanitation. However, the remaining 10% rely on shared

or unsafe sanitation methods, including open-pit systems or toilets without proper disposal, which are categorized as inadequate and pose significant health risks.

Table 7. Sufficiency of Housing Space per Household

No	Indicator	Number of Respondent	Percentage (%)	Category
1	Sufficient living space (≥ 7.2 m ² /person)	65	93%	Adequate
2	Insufficient living space (> 7.2 m ² /person)	5	7%	Inadequate
	Total	70	100%	

As indicated in Table 8, the majority of households (93%) met the minimum housing adequacy standard in terms of living space, with each individual having at least 7.2 square meters of area, in accordance with national regulations. The remaining 7% were found to be living in overcrowded conditions, falling short of the required per capita space.

Table 8. Classification of Livable and Secure Housing

No	Indicator	Number of Respondents	Percentage (%)
1	Livable and secure	54	77%
2	Livable but insecure	4	6%
3	Inadequate but secure	8	11%
4	Inadequate and insecure	4	6%
	Total	70	100%

The classification in Table 9 shows that 77% of respondents were living in dwellings that are both physically adequate and legally secure. These households met multiple criteria for livability, including proper wall and flooring materials, availability of a private toilet with septic system, legal ownership documentation, and sufficient living space. Conversely, 6% of households, categorized as both inadequate and insecure, failed to meet these indicators. Some of these homes still used hazardous materials such as asbestos for roofing, lacked sufficient floor area, or relied on shared sanitation facilities, increasing the risk of disease transmission.

Table 9. Distance from Households to Public Transport Stops

No	Indicator (Distance to Stop/Station/Terminal)	Number Respondents	Percentage (%)	Accessibility Category
1	Less than 500 meters	9	13%	Convenient Access
2	500-1000 meters	3	4%	Less Convenient Access
3	1000-1500 meters	11	16%	Less Convenient Access
4	More than 1500 meters	27	38%	Inconvenient Access
5	No access to public transport stops	20	29%	Not Served
	Total	70	100%	

Field observations on public transport access show that only 13% of respondents live within 500 meters of a public transport facility an approximate walking distance perceived by most households as comfortable. An additional 4% live within a 500-1.000 meter radius, and 16% within 1,000-1,500 meters, indicating less favorable conditions for pedestrian access. Meanwhile, 38% of respondents reside more than 1,500 meters away from a public transport stop, suggesting poor connectivity. Furthermore, 29% of households reported not having any access to formal transport stops, placing them in underserved areas.

Table 10. Households Using Public Transportation

No	Indicator	Number Respondents	Percentage (%)	Accessibility Category
1	Households Using city minibus (angkot)	44	68%	Served
2	Households using Trans Bandar Lampung	1	1%	Served
3	Households not using public transportation	20	31%	Not Served
	Total	70	100%	

As shown in Table 10, approximately 68% of households reported using public transportation, primarily city minibuses (angkot). Only one respondent used the Trans Bandar Lampung bus system, suggesting limited coverage or preference. Meanwhile, 31% of respondents reported never using any form of public transportation, indicating issues with accessibility or service adequacy.

Table 11. Households Using Public Transportation

No	Indicator	Number Respondents	Percentage (%)	Accessibility Category
1	Households using public transportation	7	10%	Served
2	Households not using public transportation	57	81%	Not Served
3	No response	6	9%	-
	Total	70	100%	

In terms of daily commuting behavior, only 10% of households reported using public transportation regularly, while 81.4% indicated complete reliance on other modes, including private or informal transport options. The remaining 9% did not specify their mode of transportation. These results highlight a significant gap in daily public transport usage, even among those who live near transit access points.

Table 12. Type of Employment

No	Occupation Type	Number of Respondents	Percentage (%)
1	Homemaker	16	31%
2	Trader	17	33%
3	Laborer	9	17%
4	Private sector employee	1	2%
5	Civil servant (ASN)	1	2%
6	Entrepreneur	4	7%
7	Courier	1	2%
8	Student	2	4%
9	Parking Attendant	1	2%
	Total	70	100%

The majority of respondents worked in the informal sector, with traders (33%) and homemakers (31%) comprising the largest segments. Only a small portion were employed in formal sectors such as civil service or private companies, which may influence both mobility patterns and income levels.

Table 13. Monthly Household Income

No	Income Range (IDR)	Number of Respondents	Percentage (%)
1	< 500.000	10	14%
2	500.000 – 1.000.000	8	12%
3	1.000.000 – 2.000.000	17	24%
4	2.000.000 – 3.000.000	13	19%
5	3.000.000 – 5.000.000	5	7%
6	No response	17	24%
Total		70	100%

Nearly one-fourth of respondents reported earning between IDR 1,000,000 and IDR 2,000,000 per month. Another 14% reported incomes below IDR 500,000, indicating high levels of financial vulnerability. The income distribution suggests that affordability constraints may play a critical role in shaping residential location choices, particularly in relation to proximity to public transport infrastructure.

Public Transport Access Analysis

According to Bappenas, the standard benchmark for convenient public transportation access is a maximum walking distance of approximately 500 meters from residential areas to a bus stop or station. Nationally, Lampung Province ranks 28th in public transport access, with only 44% of households enjoying this level of convenience below the national average. Field observations in this study, however, revealed a more critical situation. Only 13% of the 70 surveyed households lived within 500 meters of a bus stop, terminal, or train station. This indicates that the majority of households (87%) experience suboptimal access to public transportation infrastructure. Despite this, 68% of households reported that they use some form of public transport, suggesting that accessibility barriers do not necessarily preclude usage but may impose travel discomfort or time costs. Several factors contribute to the limited proximity to transit services. One notable determinant is income. Households with monthly earnings between IDR 1,000,000 and IDR 2,000,000 were more likely to live in distant or less accessible areas due to affordability constraints. These households often prioritize lower housing costs over proximity to public transport, thereby affecting their mobility and access to urban opportunities.

Discussion

Urban sustainability continues to be a critical agenda in the face of rapid urbanization, particularly in developing countries where spatial planning, land use transformation, and transportation systems evolve under significant socioeconomic pressures. The configuration of urban space has a direct impact on land value, access to infrastructure, and social equity, shaping the trajectory of inclusive or exclusive development. In many cities, inadequate integration between housing and transport policies has led to spatial inequalities, especially affecting low-income groups who face both high mobility costs and limited access to affordable housing. The rise in motorized transport,

without corresponding regulatory and spatial buffering, contributes to environmental issues such as elevated noise levels and deteriorating air quality. While urban expansion may drive economic growth, it also presents dilemmas in resource management, public health, and the degradation of ecological systems, revealing the urgent need for urban planning that prioritizes environmental resilience and human well-being. Beyond the physical structure of cities, institutional frameworks and governance practices play a decisive role in determining the success of sustainability initiatives. Transparent and accountable governance ensures that urban development aligns with long-term sustainability goals, while fostering community participation and intersectoral coordination. Contemporary discourse on urban futures emphasizes the integration of technological innovation with culturally adaptive planning to envision cities that are not only efficient but also socially harmonious. Historical legacies and existing urban dichotomies must be critically addressed to avoid the reproduction of spatial injustices. A holistic approach—encompassing spatial design, environmental safeguards, inclusive policies, and responsive governance is essential to achieving sustainable urban ecosystems that are adaptable to future challenges and equitable for all inhabitants.

Implication

The implications of the reviewed studies highlight the pressing need for integrated and forward-looking urban planning approaches that balance economic growth with environmental and social sustainability. Urban spatial structures must be deliberately designed to promote accessibility, equity, and resilience, particularly in rapidly expanding urban areas. This requires strengthening the synergy between land use regulation, transportation planning, and environmental management. If left uncoordinated, urban growth can exacerbate spatial segregation, environmental degradation, and infrastructure inefficiencies. Therefore, the findings underscore the importance of adopting inclusive urban policies that anticipate demographic pressures, mitigate environmental risks, and foster sustainable urban development practices through evidence-based decision-making. Furthermore, the evidence suggests that advancing sustainability in urban settings demands institutional reform and capacity building across governance levels. Local governments, as key urban actors, must be equipped to manage dynamic urban transformations while engaging communities in participatory planning processes. The adoption of technological innovations, such as spatial analysis tools and environmental monitoring systems, can support more adaptive and accountable governance models. By aligning urban development goals with the broader targets of climate resilience and social justice, stakeholders including policymakers, planners, and civil society can collectively shape urban environments that are more inclusive, responsive, and capable of withstanding future uncertainties.

Limitation and Suggestion for Further Research

This study acknowledges several limitations that may influence the generalizability and depth of its findings. First, the analysis primarily relies on secondary data from a wide range of peer-reviewed sources, which, while academically credible, may not fully capture the dynamic and context-specific realities of urbanization and sustainability practices across diverse regions. The

use of literature spanning different time periods, socio-political settings, and geographic scopes may result in variations in data interpretation. Additionally, the lack of primary data collection, such as interviews or field surveys, restricts the study's ability to validate theoretical insights with empirical evidence, especially regarding community-level experiences and the effectiveness of local policy implementations. Future research should consider employing a mixed-methods approach that combines both qualitative and quantitative techniques to enhance analytical rigor and contextual depth. Conducting longitudinal studies across multiple urban settings could provide a more nuanced understanding of how spatial planning, governance models, and socio-economic dynamics interact over time. Moreover, greater emphasis on participatory research involving local stakeholders, including marginalized communities, would offer valuable perspectives often overlooked in top-down urban planning discourses. Integrating geospatial analysis, climate vulnerability assessments, and real-time data monitoring tools could also strengthen the precision of urban sustainability evaluations, thereby informing more adaptive and inclusive policy frameworks.

CONCLUSION

This study demonstrates that while the majority of households in Bandar Lampung meet the physical criteria for adequate housing such as durable construction materials, sufficient living space, and access to sanitation there remains a substantial gap in public transportation accessibility. Only 13% of households are located within a convenient walking distance (≤ 500 meters) from transport nodes, despite 68% reporting use of public transportation, predominantly through informal modes. Economic limitations, particularly among households earning between IDR 1,000,000 and IDR 2,000,000 per month, appear to constrain residential choices, leading to settlement in areas with limited transit access. These conditions reflect a broader pattern of spatial inequality, where housing affordability often comes at the cost of connectivity and mobility. The findings emphasize the urgent need for integrated urban policies that link affordable housing development with equitable access to public transportation infrastructure. Such alignment is essential for promoting inclusive, livable, and sustainable urban environments, in accordance with the targets of Sustainable Development Goal 11.

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AUTHORS CONTRIBUTIONS STATEMENT

Mia Agustina was responsible for initiating the research idea, designing the study framework, collecting primary data, conducting field observations, and drafting the initial manuscript. Eko Kuswanto contributed to the development of the research methodology, performed the spatial and statistical analyses, and provided technical validation and critical revisions of the manuscript. Siti Munawarah Panggabean supported the refinement of the theoretical framework on housing and urban planning, contributed to the interpretation of findings in relation to sustainable development, and participated in the final editing and proofreading process. All authors reviewed and approved the final version of the manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper. All analyses and interpretations presented are conducted objectively and independently, without any financial, professional, or personal relationships that could have influenced the outcomes or perspectives discussed in the study.

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