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LAND ACQUISITION ESTIMATE FOR THE BANDUNG INTRA-URBAN TOLL ROAD (BIUTR) CONSTRUCTION PROJECT

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ABSTRACT

The Bandung Intra-Urban Toll Road (BIUTR) serves as the government's initiative to address persistent traffic congestion in Metropolitan areas. However, A critical challenge in realizing this infrastructure is the land acquisition phase, which demands precise estimates and a comprehensive approach. This research aims to calculate the extend and monetary value of land impacted by the construction of BIUTR using a Geographic Information System (GIS) approach and spatial modeling. The research was conducted by establishing a 60-meter buffer zone on both sides of the toll road route as a road space. The analytical indicate that the BIUTR project will cross 14 sub-districts in Bandung City with a total affecting a total land area of 3,503,671.63 m² and with compensation value of more than IDR 70 trillion. Several sub-districts such as Cinambo, Cibeunying Kidul, and Cibeunying Kaler have high compensation values due to high land values and residential density. Result from his research highlight the necessity of conducting on fostering community engagement to develop a land acquisition strategy that is fair, efficient and minimize potential conflicts. emphasizes the importance of field verification and community participation in formulating a fair, efficient, and conflict-free land acquisition strategy.

Keywords : Toll road, land acquisition, GIS, land value estimation, Bandung

1. INTRODUCTION

Infrastructure development is undertaken to accelerate regional economic growth, specifically through the construction of road networks. The presence of road networks yields positive impacts by facilitating mobility, providing access to isolated regions, opening new markets, and driving economic growth (Rahayu, 2025). This aligns with the current government's mission through the eight asta cita, in the infrastructure development section.
However, infrastructure development often faces obstacles, such as land acquisition. These issues often lead to conflicts between landowners and the project developers which can trigger conflicts over civil rights violations. Although the government is protected by Law Number 2 of 2012 concerning Land Procurement for Development in the Public Interest, it must not arbitrarily acquire community land (Qomariyah et al., 2024; Rahayu, 2025). One of the conflicts that has occurred in Indonesia related to land acquisition is that the residents of Klaten, whose land was crossed by the Jogja-Solo Toll Road. The residents rejected the construction of the toll road because the price offered by the developer was not appropriate (Zahrani et al., 2024). To anticipate such issues, this research aims to estimate land acquisition costs for the Bandung Inner City Toll Road project, employing data sourced from the Ministry of ATR/BPN's via the Bhumi ATR portal.
The construction of this toll road is one of the main strategies to enhance connectivity and accelerate the mobility of the public , as well as the distribution of goods and services. The Gedebage - Pasteur Toll Road, as part of the West Java toll road system, as expected to reduce congestion on existing routes and improve transportation efficiency in Bandung and its surrounding areas. However, one of the main challenges in toll road development is the land acquisition process. In Indonesia, land acquisition remains a frequently encountered issue in toll road construction. (Nur Hasanah et al., 2023). When land acquisition for a toll road construction project is delayed, it leads to cost escalation and makes investors reluctant to invest in the ongoing project (Listyaningsih & Utomo, 2014).
Previous researchers have conducted similar studies but with different objectives and results. The first study described the compensation assessment process and its classification according to the ongoing project (Andriany, 2019). The second study focused on calculating the land acquisition area, the number of indicative land parcels affected, and the total land compensation for the Toll Road to

Patimban Port (Haryono & Daris, 2024). This study focuses on examining the budget ceiling value of projects in Jakarta while analyzing the factors that affect the accuracy of cost predictions in the conceptual stage (Subagijo et al., 2025).
Penelitian ini menghadirkan keterbaruan dalam menghitung estimasi pembebasan lahan dalam Pembangunan jalan to l. Selain itu, Penelitian ini melakukan estimasi terhadap penduduk yang terdampak dalam Pembangunan BIUTR serta memberikan rekomendasi Lokasi untuk relokasi Masyarakat yang terdampak Pembangunan BIUTR. This study presents a new approach to calculating land acquisition estimates in road construction. In addition, this study estimates the number of residents affected by the BIUTR construction and provides recommendations for relocation sites for communities affected by the BIUTR construction. The objective of this study is to develop a land acquisition estimation method for the Gedebage - Pasteur Toll Road project using a GIS-based approach and spatial modeling, specifically considering a 60-meter buffer as the Right of Way. However, this study is subject to a limitation regarding the use of land value data sourced from ATR/BPN. It is recommended that future research verify this data through field surveys.

2. DATA AND METHODS

2.1 Study Location

This study was conducted in Bandung City, West Java Province. The selected route for this study starts from Pasteur, passes through Ujungberung, and ends at Gedebage. This route extends for a total length of 19.89 km, incorporating a buffer on both sides of the road to establish a 60-meter wide Right of Way.

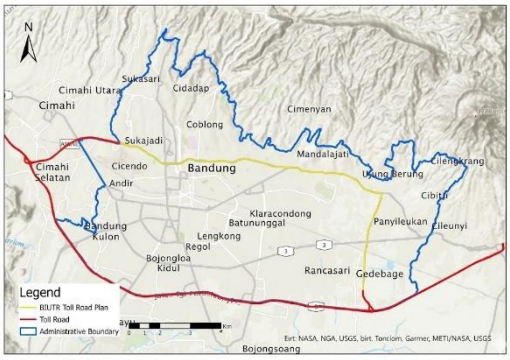

Figure 1. Map of The Study Area
Source: Author (2025)

2.2 Data

This study uses the following data.
Table 1. Research Data

No	Data	Spacial Resolution	Source
1	Land Use Data for the City of Bandung	1:25,000	BIG (2022)
2	Land Value Zone	-	ATR/BPN (2025)
3	BIUTR Route Plan	-	Bappeda of Bandung City (2022)
4	DEM	30 Meters	NASA (2025)
5	Rainfall Data	5 KM	CHIRPS (2025)
6	Soil Map	1:25,000	BBSDLP (2016)

2.3 Method

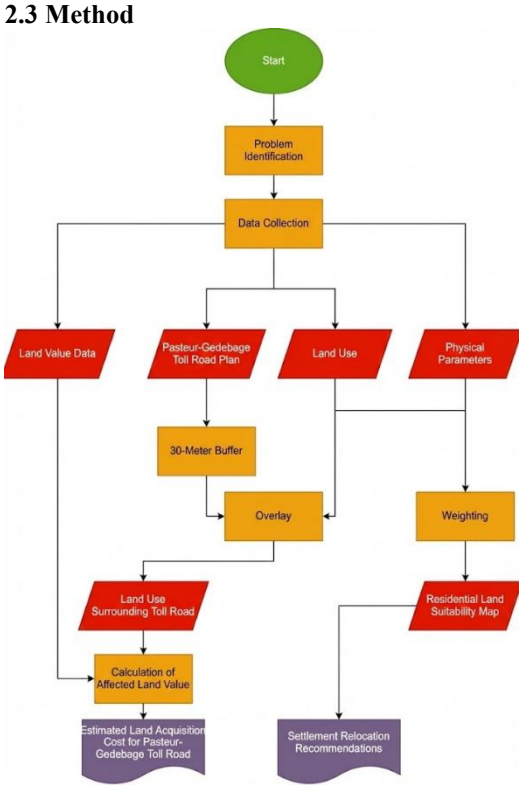

Figure 2. Flowchart
Source: Author (2025)

2.3.1 Highway Buffer Plan

The buffer method is a valuable technique in spatial analysis for evaluating the impact of land

acquisition caused by infrastructure development, such as toll roads. Specifically, regarding the measurement of land affected by toll road development, the use of a buffer with a 60-meter radius provides insights into land use changes and their implications for the community and the surrounding environment.

The use of the buffer method with a specific radius allows for the identification of areas directly affected by the road network. Setiawan stated that buffer analysis applied to road networks indicates three criteria for residential land suitability—namely very good, good, and poor—based on these distance observations (H. Setiawan, 2023). Therefore, the application of a 60-meter radius to toll road infrastructure provides a preliminary overview of the land directly affected by the development.

2.3.2 Intersect Land Use

The Intersect process between existing land use and the toll road design buffer is a crucial step in estimating land acquisition costs . In this context, the buffer serves to define the area surrounding the toll road alignment that will be affected by the development. Through overlay analysis of the buffer area and the land use map, authorities can identify the types of land to be acquired and estimate the compensation values required for affected landowners.

The Intersect analysis functions is to identify the overlap between the buffer zone and the existing land use map. This process requires a systematic approach, beginning with the identification of all land use types within the impacted area. Furthermore, a careful assessment of land use changes is a key element in the analysis model for better land estimation and management; however, this reference is not listed and needs to be added to support this statement.

2.3.3 Land Acquisition Cost Estimate Calculation

Estimating land acquisition costs also involves determining the market value of the land to be acquired. In this regard, spatial analysis is necessary to understand the value associated with each type of land use. Information on land market values can be obtained from historical sales data in the surrounding area, as well as land values determined by the local government. This study conducted by Putri and Noer demonstrates how **social risk analysis** can influence land procurement decisions, particularly in the context of costs and the compensation offered to the community (Putri & Noer, 2023).

Integrating these datasets enables authorities to calculate the total estimated cost of land acquisition. **Regulatory compliance** and a **mutual understanding** between the government and the community are critical in this process, particularly to ensure that all affected landowners receive **fair compensation** in accordance with applicable regulations (Winarda et al., 2021). Therefore, **community support** and transparency in this process will also contribute to the **seamless execution** of the toll road construction.

2.3.4 Scoring and Weighting for Residential Land Suitability

Scoring and weighting methods in Geographic Information Systems (GIS) are common methods for producing thematic maps, such as those used for settlement suitability analysis. (A. Setiawan et al., 2024). Each parameter map was assigned a score and weight. The parameter maps were then subjected to an overlay analysis to produce the residential land suitability map. The scores and weights utilized for each parameter in this study are listed below (Ndun et al., 2021).

Table 2. Land Cover Map Score

No.	Land Cover	Score
1	Rice Field	4
2	Bushes	4
3	Vacant Land	4
4	Field	3
5	Non-cultivated Vegetation	3
6	Plantation	2
7	Settlement	1
8	Building	1
9	Forest	1
10	Lake	0
11	River	0

Table 2. Soil Type Map Score

No.	Soil Type	Score
1	Settlement	5
2	Umbric Andosol	4
3	Eutric Andosol	4
4	Roduk Andosol	3
5	Eutric Cambisol	3
6	Latosol Oxyc	2
7	Latosol Cromic	2

No.	Soil Type	Score
8	Eutric Gleisol	1
9	District Gleisol	1
10	Bodies of Water	0
11	District Regosol	0
12	Escarpments	0

Table 3. Rainfall Map Score

No.	Milimeters/Rainy Day	Score
1	>38.4	5
2	27.7 – 34.8	4
3	20.7 – 27.7	3
4	13.6 – 20.7	2
5	<13.6	1

Table 4. Slope Map Score

No.	Slope Gradient	Score
1	<8%	5
2	8 - 15 %	4
3	15 - 25%	3
4	25 - 40%	2
5	>40%	1

3. RESULTS AND DISCUSSION

3.1 Estimated Cost and Land Affected by Toll Road Construction

The construction of this intra-urban toll road, connecting the Gedebage and Pasteur areas, requires comprehensive spatial planning. A crucial aspect of such planning is the estimation of land acquisition, particularly given the characteristics of the traversed area, which is predominantly densely populated and has undergone intensive development.

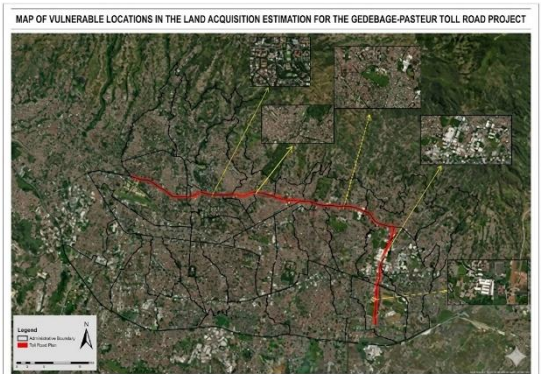

Figure 3. Map of BIUTR Project Land Acquisition Locations
Source: Author (2025)

Based on the land acquisition estimation map constructed using a Geographic Information System (GIS) approach, the BIUTR toll road route is projected to intersect at least 14 districts within Bandung City. The route encompasses strategic areas such as Gedebage, Kiaracondong, Coblong, and Pasteur. In a spatial context, a 60-meter buffer was applied along both sides of the main alignment to define the land acquisition estimation zone. This zone serves as a preliminary indicator of the extent and distribution of areas potentially affected by the toll road development. **Table 6**. presents the land acquisition estimates by district.

No	District	Area (m^2)
1	Antapani	62,374.62
2	Arcamanik	251,927.25
3	Bandung Wetan	209,302.30
4	Cibeunying Kaler	415,868.21
5	Cibeunying Kidul	433,680.91
6	Cicendo	245,029.17
7	Cinambo	560,627.89
8	Coblong	209,098.36
9	Gedebage	271,099.63
10	Kiaracondong	64,060.75
11	Mandalajati	304,831.18
12	Panyileukan	33,350.41
13	Sukajadi	292,455.72
14	Ujungberung	149,965.24
	QUANTITY	**3,503,671.63**

Source: Author Analysis (2025)

Based on **Table 6**, the estimated land acquisition area varies across districts. **Cinambo District** is recorded as the area with the largest estimated acquisition, at **560,627.89 m²**, while **Panyileukan District** has the smallest affected area, at **33,350.41 m²**. The total estimated land area potentially acquired across all districts reaches **3,503,671.63 m²**.

Table 5. Land Cover Area

No	Land Cover	Area (Ha)
1	Dana	0.241799
2	Building	7.92877
3	Plantation	1.42374
4	Settlement	164.874
5	Rice Field	25.9284
6	Vacant Land/Bare Land	36.5255

No	Land Cover	Area (Ha)
7	Field/Farmland	1.74136
	QUANTITY	**238.664**

Source: Author Analysis (2025)

As presented in **Table 7**, the land use composition within the impact zone is dominated by residential areas, which occupy the most extensive area at 164.874 ha. This is succeeded by vacant/bare land (36.5255 ha) and rice fields (25.9284 ha). Additional affected land uses encompass buildings, dryland agriculture, plantations, and public amenities, including educational and religious facilities.

Spatial identification shows that districts like Gedebage, Kiaracondong, and Coblong, have a high concentration of dense settlements and diverse land functions, including social facilities, educational areas, and informal business units. The presence of informal (non-legal) settlements is also a particular concern, as it has the potential to trigger social and legal dynamics during the land acquisition process.

Land impact estimation involves not only physical-geographical factors but also socio-economic aspects. The potential for mass relocation in dense areas like Cibeunying Kidul and Kiaracondong requires mitigation focused on social justice and protecting vulnerable groups. Moreover, public facilities (schools, places of worship, markets) in the zone must be identified to ensure public services remain uninterrupted.

In terms of land value, areas with high property prices and economic activity, such as Coblong and Cibeunying Kaler, may lead to compensation cost overruns. Thus, precise budget calculations and inclusive communication with the affected community are essential.

Table 6. Estimated land acquisition costs by subdistrict

No	District	Compensation Price (Rp)
1	Antapani	1,247,492,320,000
2	Arcamanik	5,038,545,020,000
3	Bandung Wetan	4,186,046,000,000
4	Cibeunying Kaler	8,317,364,243,192
5	Cibeunying Kidul	8,673,618,269,800
6	Cicendo	4,900,583,320,196
7	Cinambo	11,212,557,737,524
8	Coblong	4,181,967,243,600
9	Gedebage	5,421,992,645,080
10	Kiaracondong	1,281,215,046,000
11	Mandalajati	6,096,623,540,190
12	Panyileukan	667,008,143,604
13	Sukajadi	5,849,114,300,400
14	Ujungberung	2,999,304,748,050
QUANTITY		70,073,432,577,636

Source: Author Analysis (2025)

From an economic standpoint, Table 8 shows that Cinambo District yields the highest estimated compensation (IDR 11.21 trillion), while Panyileukan District is the lowest (IDR 667.01 billion). The aggregate compensation estimate for all districts amounts to IDR 70.07 trillion.

High compensation costs ike Cibeunying Kaler and Coblong are driven by high land prices and intense economic activity. Thus, rigorous budget planning and inclusive communication are crucial to prevent social conflict.

In conclusion, the spatial analysis reveals that the BIUTR project necessitates more than just a technical focus on alignment and engineering; it demands a multidimensional perspective that integrates geospatial, socio-economic, and land policy factors. While the 60-meter buffer zone serves as a vital initial indicator for delineating affected territories, it must be validated through ground truth verification and community participation.

3.2. Estimated Number of Residents Affected by BIUTR Development

BIUTR construction impacts local communities, particularly through settlement displacement within the 60-meter radius. The affected population was estimated by dividing the settlement area by 9.6 m² (referencing SNI 03-1733-2004). This spatial standard is adjusted to meet the basic needs of an adult human, including sleeping, cooking, eating, bathing, sitting, and the requirement for fresh air.

Table 7. Estimated Number of Affected Population

District	Area (m^2)	Population Estimates (Soul)
Antapani	7,060.26	735
Arcamanik	45,563.9	4,746
Bandung Wetan	45,577.4	4,748
Cibeunying Kaler	74,002.1	7,709
Cibeunying Kidul	80,197.9	8,354
Cicendo	53,448.4	5,568
Cinambo	64,901.8	6,761
Coblong	39,113.3	4,074
Gedebage	71,31.89	743
Kiaracondong	15,914.5	1,658
Mandalajati	65,729.1	6,847
Sukajadi	55,223.5	5,752
Ujungberung	33,076.1	3,445
QUANTITY	**586,940**	**61,140**

Source: Author Analysis (2025)

A total of 586,940 m^2 of residential land is projected to undergo functional conversion for the toll road infrastructure. This necessitates the relocation of 61,140 inhabitants from 13 districts to predetermined resettlement sites.

Cibeunying Kidul District has the largest affected residential area and population. Other districts with high relocation numbers include Cibeunying Kaler, Mandalajati, and Cinambo, followed by Antapani, Gedebage, and Kiaracondong.

Given the substantial number of affected residents, the government must handle relocation carefully. The process should avoid forced evictions and adopt a humane approach. The project is designed to solve Bandung's problems, and care must be taken to prevent the creation of new issues during its construction.

3.3. Suitability of Residential Land for Residents Affected by BIUTR Development

After estimating the displaced population and land, it is ethically necessary for Author to propose viable resettlement solutions. Figure 4 illustrates the Residential Land Suitability Map for relocation within Bandung City.

Class I, indicated in green, represents 'Highly Suitable' areas. This class has both advantages and disadvantages. The main advantage is the potential to develop settlements without displacing existing communities, coupled with good accessibility, especially given the current development focus on East Bandung. However, the disadvantage lies in the challenges of building in North Bandung (Sukasari, Cidadap, Coblong, Cibeunying Kaler). Despite being classified as suitable in the model, this area faces seismic threats from the Lembang Fault and functions as a critical water catchment area, making it unadvisable for relocation. Additionally, relocation to East Bandung requires further study due to flood susceptibility. Suitable districts for relocation include Arcamanik, Antapani, Panyileukan, Gedebage, Rancasari, Buahbatu, among others. Class II, symbolized in yellow, represents 'Suitable' areas and dominates the map. The advantage here is the availability of existing supporting facilities, reducing the need for new infrastructure investment. However, the drawback is that the government would need to clear existing settlements or acquire land from current residents before redevelopment can occur. Class III represents 'Not Suitable', meaning these areas are not recommended for residential relocation.

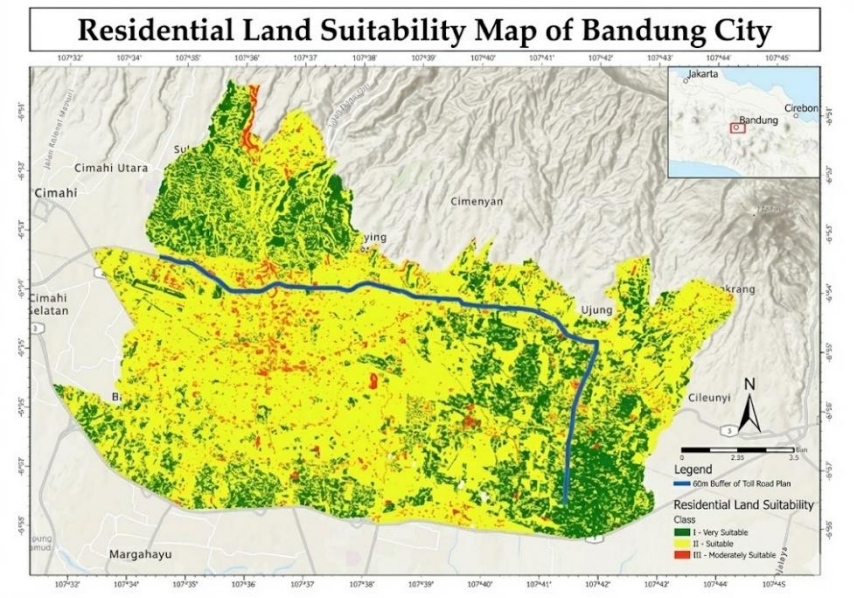

Figure 4. Map of suitable land for residential areas in Bandung
Source: Author (2025)

4. CONCLUSIONS SUGGESTIONS

The development of the BIUTR serves as a beacon of hope for resolving Bandung's persistent traffic congestion. Nevertheless, the project entails substantial challenges, most notably the acquisition of land across 14 districts, encompassing a total affected area of 3.5 million m^2 and a projected compensation value exceeding IDR 70 trillion. Critical zones such as Cinambo, Cibeunying Kidul, and Cibeunying Kaler require special attention due to high land valuation and population density, which amplify socio-economic risks. This process extends beyond quantitative data, directly affecting the displacement of families and the potential interruption of public services. In terms of resettlement planning, Class I zones are identified as optimal for relocation, subject to the mitigation of natural risks like seismic activity and flooding. Class II zones present the advantage of existing infrastructure but require careful management of incumbent population displacement. Class III zones, however, are deemed unsuitable and should be excluded from settlement development to safeguard public safety and ecological integrity. Therefore, this research advocates for a human-centric framework, prioritizing ground-truth verification, open communication, and participatory planning. This approach aims to ensure that the BIUTR project yields sustainable long-term benefits without precipitating new social crises. Ultimately, the utilization of GIS technology demonstrates high efficacy in delivering a comprehensive spatial analysis to facilitate strategic decision-making in urban infrastructure development.

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