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Article

Assessing Public Transport Convenience for Achieving SDG 11.2 in Tangerang Municipality

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Abstract

A reliable urban transport system is essential for achieving sustainable cities and communities. The United Nations' Sustainable Development Goal (SDG) 11.2 targets universal access to safe, affordable, accessible, and sustainable transport systems by 2030. This study evaluates SDG 11.2 performance in Tangerang Municipality, examining progress toward this target. Using spatial analysis methods—such as buffer analysis, network and isochrone analysis, and spatial autocorrelation in GIS—this research assesses transit quality and accessibility. Data were collected through purposive sampling, analyzed using an online field survey, and assessed via a Likert scale. The findings reveal that only 13.85% to 22.47% of Tangerang's population has convenient access to public transport, with coverage limited to 17.56% of the city's area. A dispersed yet positive spatial autocorrelation exists between public transport patterns and population density, with a Moran's I value of 0.076. However, 36 out of 104 subdistricts remain underserved. Pedestrian convenience scored the lowest due to inadequate pedestrian infrastructure and sidewalk encroachment by street vendors. If no action is taken to address these issues, accessibility could decline from 22.4% to 16.51% by 2032, assuming a 2.6% annual population growth rate. Achieving an 85% public transport share by 2032 would require an annual improvement rate of 5.6% from 2020 onward. The study recommends an integrated public transport service expansion, enhanced transit quality, improved transport data collection, and public awareness campaigns to accelerate SDG 11.2 progress in Tangerang.

Keywords: SDG 11.2; sustainable; urban transport; spatial analysis; evaluation.

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1. Introduction

Achieving inclusive, safe, resilient, and sustainable cities is a core objective of the 2030 Sustainable Development Agenda. Among the ten targets within SDG 11, one specifically addresses urban transport: Target 11.2 aims to provide universal access to safe, affordable, accessible, and sustainable transport systems by 2030. This includes enhancing road safety and prioritizing public transport expansion, especially for vulnerable groups such as women, children, persons with disabilities, and the elderly (UN-Habitat, 2021).

A robust public transport system is essential for advancing sustainable urban development. Studies underscore the importance of sustainable transport as a key enabler of development frameworks. Petersen and Schafer (2002) define sustainable transport as one in which the technical, social, and economic dimensions of the system do not impose irreversible harm on future generations. Schipper (2002) outlines three principal components: accessibility (integrated networks with varied mode options), equality (fair and affordable access for all), and reduced negative impacts (green technology and prioritization of safety). In addition, Turner (2017) emphasizes the social dimension through a people-centered approach that positions public transport as a tool for addressing social exclusion and inequality. Key elements—such as intermodality, technology integration, pedestrian and cyclist infrastructure, transit quality, and mixed-use development—are essential for creating more equitable, livable urban neighborhoods.

Tangerang Municipality, part of the Jakarta Metropolitan Region (JMR), serves as a crucial hub for air transport, industry, trade, services, and socio-cultural exchanges, as defined in Presidential Regulation No. 60/2020 regarding the Spatial Plan of JMR (Jabodetabekjur KSN) (2020). As an integral part of Greater JMR, Tangerang experiences a high level of interaction with Jakarta, evidenced by substantial intercity commuting flows within the metropolitan region (**Figure 1**).

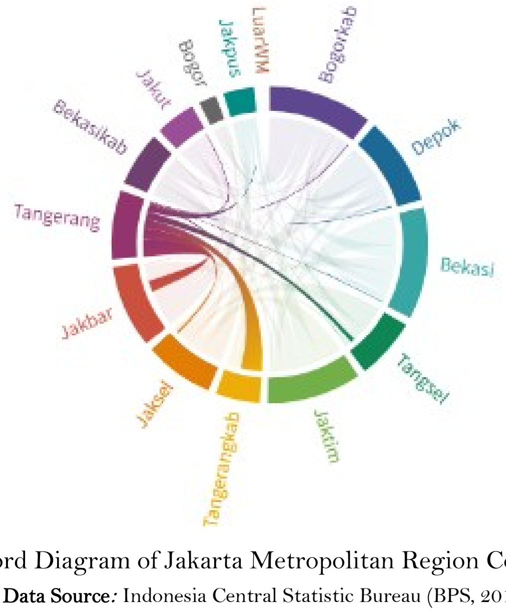

Figure 1 Chord Diagram of Jakarta Metropolitan Region Commuters Flow
Data Source: Indonesia Central Statistic Bureau (BPS, 2019)

According to commuter survey data from the Statistics Bureau (BPS, 2019), 12.4% of Tangerang City's population, or approximately 234,137 people, commutes outside the city, while Tangerang is a destination for 211,819 commuters from nearby cities and districts. At the metropolitan scale, the total commuter population reaches 3.2 million, or 11.1% of the Jakarta Metropolitan Region (JMR) population. Of these, 72%, or around 2.3 million commuters, rely on private vehicles—a figure that highlights the limitations of public transport services in the area. Commuters cite various reasons for not switching to public transport, with 36.6% pointing to long travel times, 34.9% citing impracticality, and 8.4% indicating limited access to public transport (**Figure 2**). Other deterrents include feelings of insecurity, drivers' disregard for safe driving practices, poor vehicle conditions, and relatively high ticket prices. If Tangerang Municipality follows the metropolitan trend, with around 72% of commuters using private vehicles, the city's transport system will face a significant burden. With ongoing population growth, traffic congestion is likely to worsen, driven by both internal and inter-city mobility demands.

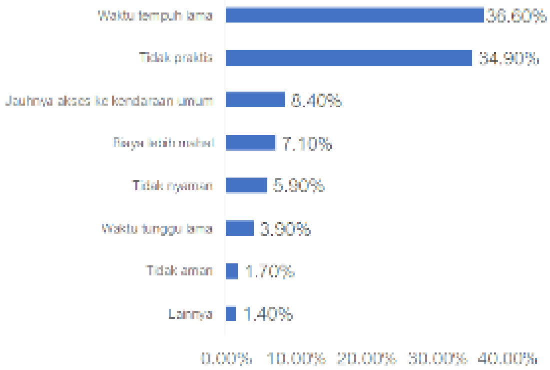

Figure 2 Commuter's unwillingness to shift into commuting with public transport
Data Source*:* Indonesia Central Statistic Bureau (BPS, 2019)

When recognizing the essential role of public transport in sustainable urban development, the next question becomes: how do we measure the quality of a sustainable transport system? A 2018 report by McKinsey evaluated transport systems across 24 global cities, drawing insights from both experts and citizens. The findings identified six key dimensions and corresponding indicators essential for sustainable transport systems: availability, affordability, efficiency, convenience, sustainability, and public perception (Knupfer, Pokotilo, & Woetzel, 2018). A summary of these findings from prior studies is presented in **Table 1**.

The primary indicator for measuring SDG 11.2 is the proportion of the population with convenient access to public transport. The concept of "convenience" includes four criteria: accessibility within a 500-meter walking distance from reference points; inclusivity for people with disabilities, the elderly, children, and low-income households; frequent services, especially during rush hours; and a safe, comfortable environment at transit stops. This study focuses on two core indicators of convenience: accessibility within 500 meters of public transit stops and quality assessments of selected transit hubs.

Table 1. Sustainable transport dimension and indicators

Dimension	Indicators
Availability	Availability of public transport services, road infrastructure quality, pedestrian and bike lane availability
Affordability	Affordable transport and parking fees, transport subsidy
Efficiency	Effective speed in rush hour, average waiting time, dedicated bus lane, travel time, public transport coverage
Conveniency	Vehicle condition, difable accessibility, electronic payment, wifi availability, real time information, headway, seamless transfer
Sustainability	Eco-friendly fuel/energy, fatality/accident in road, emission due to vehicle condition/age
Public Perception	Satisfaction level, public perception on transport services

Source: (Knupfer, Pokotilo, & Woetzel, 2018).

Evaluating SDG 11.2 performance provides a quantified overview of the current conditions, establishes a baseline for future policies, identifies gaps, and aids Tangerang Municipality in assessing progress toward the 2030 SDG targets. Additionally, the findings can inform budget discussions between the local government and local parliament, highlighting the efforts required to improve public transport performance. Given the background and importance of this study, the following research questions are proposed:

1. What is the performance of public transport services in Tangerang Municipality in terms of accessibility to public transit stops?
2. How do public transport services in Tangerang Municipality perform in terms of convenience of access and infrastructure quality at selected transit hubs?
3. What strategies can enhance the convenience and sustainability of public transport services in Tangerang Municipality?

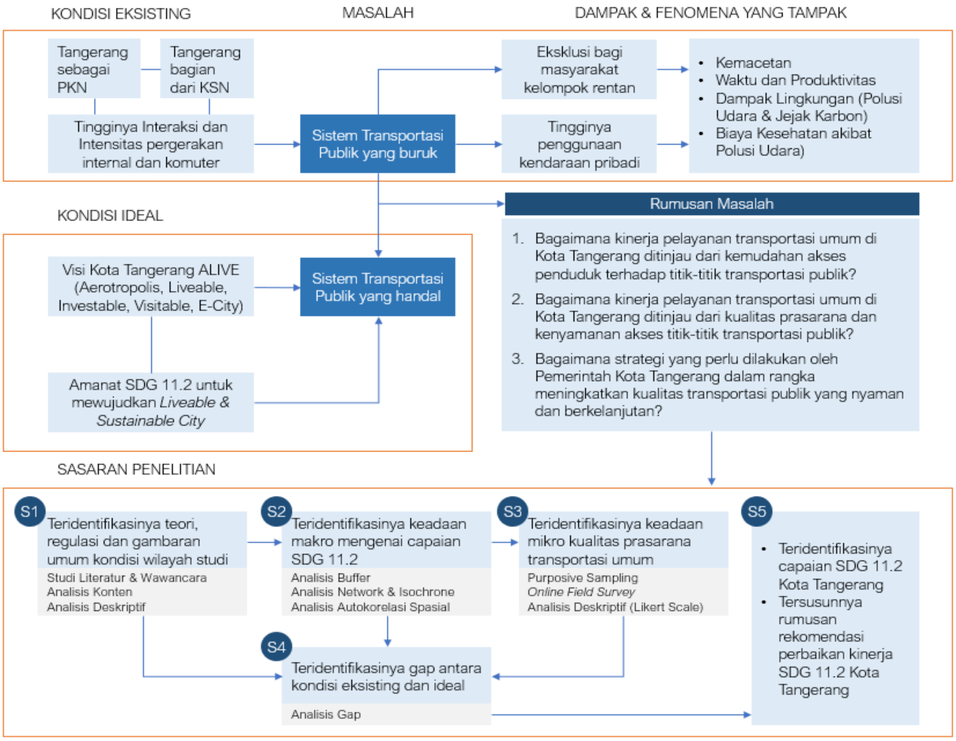

Figure 3 Logical Framework

2. Method

This section outlines the study scope, data types and sources, and the methods applied in this study, detailed in the subsections below.

2.1. Scopes of study and Limitations

The study focuses on Tangerang Municipality, assessing public transport service parameters limited to accessibility and transit stop quality. To evaluate transit stop quality, purposive sampling was conducted in three selected areas representing diverse land-use characteristics:

1. **Batu Ceper Station and Poris Plawad Terminal** – representing transit-oriented development (TOD) in the city core, where trade and services are the dominant land uses.
2. **Jatiuwung District** – representing industrial areas.
3. **Ciledug District** – representing residential areas.

Spatial analysis is constrained by the availability of data on Tangerang's geospatial platform (maps.tangerangkota.go.id). The analysis excludes the Tangerang Bus Rapid Transit (BRT) network's third corridor due to the lack of available data on BRT stops and routes. Feeder services and paratransit options, such as angkot (minibuses) and ojek (motorbike taxis), are also excluded due to insufficient data.

2.2. Materials and Tools

This study uses both primary and secondary data. Primary data was obtained from interviews with the Tangerang Municipality Planning Office. Secondary data was sourced from literature reviews, Tangerang Municipality's website, its geospatial server, and online surveys via Google Street View (**See Table 2**). The tools utilized in this study include QGIS Desktop 3.14.16, which was used for spatial analysis, and GeoDa software for performing spatial autocorrelation analysis. Google Street View provided visual assessments of transit stop quality, allowing for a detailed review of on-site conditions. Data visualization was conducted using Flourish, while Microsoft Office Excel and PowerPoint facilitated data processing and presentation, supporting both analytical and visual aspects of the study.

Table 2. Types and Sources of Data

Activities	Type of Data	Sources of Data	Methods
Understanding local context and issues of Tangerang City	Primary	Deputy Head of Public Works, Spatial Planning, and Transport Affair, Tangerang City Planning Office (Bappeda)	Interview
	Secondary	Law information and documentation network (JDIH) of Tangerang City	Literature Review (Content Analysis)
Transport coverage analysis	Secondary	Geospatial server (maps.tangerangkota.go.id) Openstreetmap (road network)	Spatial analysis (Buffer, Network, Isochrone, LISA & BiLISA)
Transit stops quality analysis	Secondary	Geospatial server (maps.tangerangkota.go.id) Google streetview	Qualitative descriptive analysis (Likert scale)
Recommendation formulation	Secondary	Analysis result	Gap analysis

2.3. Research Methods

This study uses a mixed-method approach, combining spatial analysis with qualitative description. A literature review was conducted to reference relevant theories, policies, and plans, along with interview results, to understand the local context and issues related to public transport services. To evaluate transport service coverage, spatial analyses were applied, including buffer analysis, overlay (clip and union), network analysis, isochrone analysis, and spatial autocorrelation using Local Indicators of Spatial Autocorrelation (LISA) and Bivariate Local Indicators of Spatial Autocorrelation (BiLISA). An online field survey was conducted using Google Street View, and transit quality was assessed using Likert scale methods. Recommendations were developed through gap analysis, comparing the research findings to SDG 11.2 targets and Tangerang's vision as outlined in the Local Spatial Plan (RTRW) 2012-2032.

3. Results, Analysis, and Discussions

This section presents and discusses the results of the analysis, focusing on the understanding of issues and geographical context of the case study location, public transport service coverage analysis, transit quality analysis, and gap analysis. Each of these aspects will be elaborated upon in the subsequent subsections.

3.1 Issues & Context: Tangerang Municipality

Tangerang is a metropolitan city with a population of approximately 1,771,092 people and an area of about 178.35 square kilometers. Administratively, it consists of 13 districts and 104 subdistricts (kelurahan) and is bordered by Tangerang District to the north and west, South Tangerang City to the south, and West and North Jakarta to the east. The urban economic structure of Tangerang has been dominated by three main sectors—industry and manufacturing, trade, and transportation and warehousing—which together accounted for up to 70% of the economy from 2013 to 2017. However, there has been a notable shift from industrial and manufacturing activities towards transportation and warehousing.

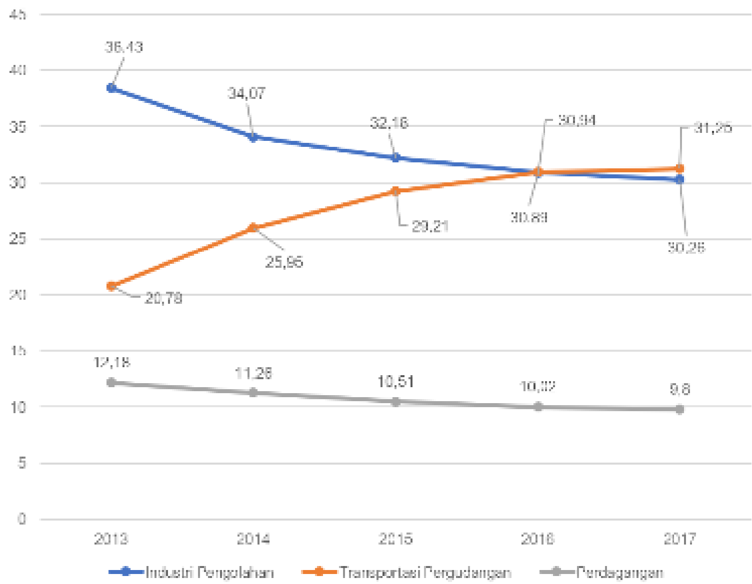

Figure 4 Economic sector shift in Tangerang Municipality 2013-2017

Data Source: Tangerang Statistic Bureau (BPS Kota Tangerang, 2019)

From a regional constellation perspective, traffic congestion is a strategic issue within the Jabodetabek Metropolitan Region (JMR), where land transport movements alone reach 59 million trips per day. Policymakers are directing efforts to address metropolitan traffic issues through the integration of transport network systems and land-use/spatial patterns, focusing on three key strategies::

1. **Functional and Role Division**: Establishing a clear distinction between core cities and satellite cities to serve as counter-magnets.
2. **Infrastructure Development**: Enhancing connections between core and satellite cities to improve transport linkages.

3. **Transit-Oriented Development (TOD):** Prioritizing the suitability of spatial patterns and structural plans in development efforts.

Poris Plawad has been identified as a priority location for TOD development within the Jakarta Metropolitan Region (2020). Additionally, several national strategic projects (PSN) have been established in Tangerang Municipality (2018), including:

1. **Cengkareng-Batuceper-Kunciran Toll Road**: A 14.2-kilometer route.
2. **Express Airport Train**: Connecting Soekarno Hatta International Airport to Sudirman.
3. **Waste-to-Energy Facility:** Selected as one of 12 large cities, including Jakarta, Tangerang, Bandung, Semarang, Surabaya, Denpasar, and Makassar.

From the perspective of the internal urban system, Tangerang City envisions itself as an Aerotropolis, forming part of the Jabodetabekpunjur National Strategic Area. This vision is influenced by the presence of Soekarno Hatta International Airport (SHIA), Indonesia's largest international airport hub, highlighted in red on the accompanying maps (a). The significance of this hub has reshaped Tangerang's identity, driving a shift in the economy from industrial and manufacturing sectors towards transportation and warehousing, particularly related to cargo and airport logistics. As illustrated in **Figure 5** below, industrial areas have expanded westward near the airport, while residential functions and trade and service corridors remain concentrated in the central business district (CBD).

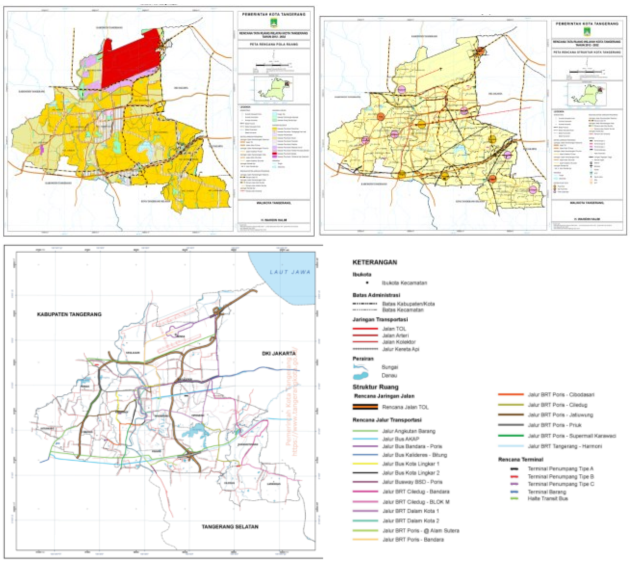

Figure 5 (a.) Spatial Pattern Plan (above left), (b) Spatial Structure Plan (above right), and (c) Transport Infrastructure Plan (below) 2012-2032

Source*:* Tangerang Local Spatial Plan 2012-2032 (2019)

In the Mid-Term Local Development Plan (RPJMD) 2019-2023, Tangerang City envisions becoming a welfare-oriented, character-driven, and competitive city (2019). A key mission related to improving transport infrastructure is outlined in the second mission: to collaboratively enhance sustainable and eco-friendly urban infrastructure development, highlighted by the flagship program “Our City” (Kota Kita). Two primary objectives of this program are to:

1. **Reduce Congestion**: Implement traffic engineering measures and decrease the number of level crossings by constructing underpasses and/or flyovers.
2. **Expand Mass Transport**: Develop a Bus Rapid Transit (BRT) system and integrate public transport services, along with the development and management of Cisadane Waterways.

The strategic transport issues identified in the Local Mid-Term Development Plan (2019-2023) are summarized in **Figure 6**.

Figure 6 Problem Tree Analysis on Congestion and PublicTransport Service Issues in Tangerang Municipality

Source: Tangerang City Local Mid-Term Development Plan 2019-2023 (2019)

To validate the issues identified in the preliminary findings from the literature review, we conducted an interview on Tuesday, August 26, 2020, with the Deputy Head of the Public Works, Spatial Planning, and Transport Sub-Department at the Local Planning Office (Bappeda) of Tangerang Municipality (**Figure 7**). From the interview, we obtained additional information regarding six core government strategies to address congestion issues. One strategy involves integrating transport management into locally-owned enterprises (BUMD). Currently, angkots (minibus paratransit) are managed individually or by small cooperatives. By implementing this integration, drivers will receive regular payments, eliminating the need to wait for passengers and thus reducing congestion.

Another strategy includes the development of five new bus terminals (one type A, two type B, and three type C) and the expansion of a new corridor, specifically the sixth corridor for road-based mass transit/Bus Rapid Transit (BRT). Furthermore, there are plans for the development of 14 railway infrastructure projects, which will encompass the extension of the Mass Rapid Transit East-West Line, the Tangerang-Serpong railway, the Merak-Jakarta regional train, Pasar Anyar station, and other light rail projects.

Additionally, six corridors for waterways will be developed, serving both to manage traffic and to create new attractions for Tangerang City, with a budget allocated for developing piers and revitalizing waterways in 2020. The strategies also emphasize the creation of pedestrian networks, bike lanes, and parking lots to enhance order and reduce irregularities and congestion in the central business district, along with better management of informal areas for small businesses. Finally, the development of Transit-Oriented

Development (TOD) is planned near Soekarno Hatta International Airport, at the Poris Plawad-Batu Ceper transit hub (terminal and station), in the TOD Ciledug sub-city, and around both the Tangerang Station and the TOD Palem Semi Cibodas.

Figure 7 Interview session with Tangerang Municipality Planning Office

3.2. Public Transport Service Coverage

This section presents the results, analysis, and discussion concerning public transport service coverage, utilizing buffer analysis, network analysis, and isochrone analysis. To investigate the distribution patterns, we also conducted a univariate and bivariate local indicator analysis for spatial autocorrelation, employing Moran's I.

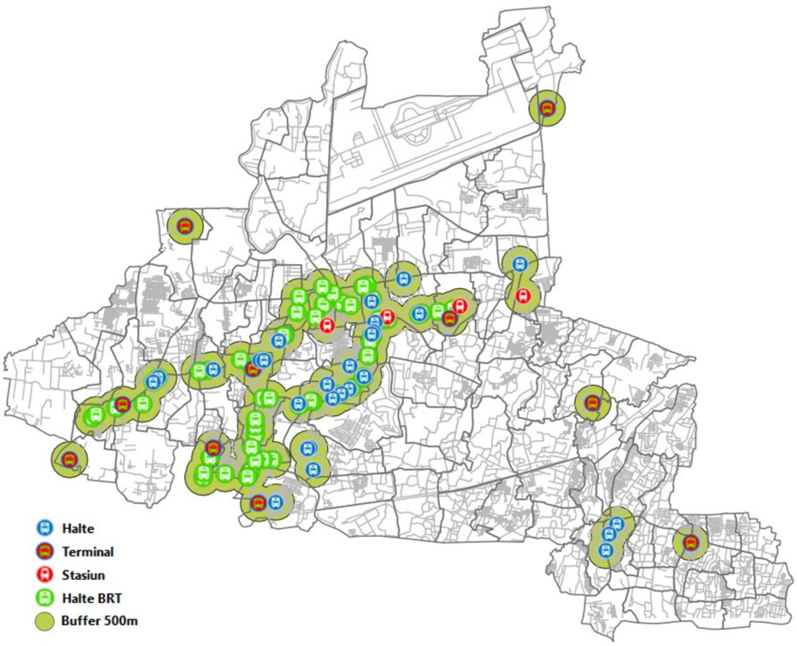

Figure 8 Buffer analysis result with 500 meter radius in Tangerang city

The buffer analysis utilized transportation data from the Tangerang City geospatial server (maps.tangerangkota.go.id), which included information on bus stops, BRT stops, commuter train stations, and bus terminals. Additionally, we incorporated the road network and subdistrict administrative divisions from similar sources. We created a 500-meter buffer around the transit stops and then unioned the resulting polygons (**Figure 8**). Subsequently, we overlaid the results of the buffer analysis with demographic data, specifically population density, assuming a homogeneous population distribution within each subdistrict (**Figure 9**). The findings revealed that the buffer covers 17.65% of the city area, approximately 31.314 square kilometers, encompassing 68 subdistricts. However, there are still 36 subdistricts that remain underserved by public transport.

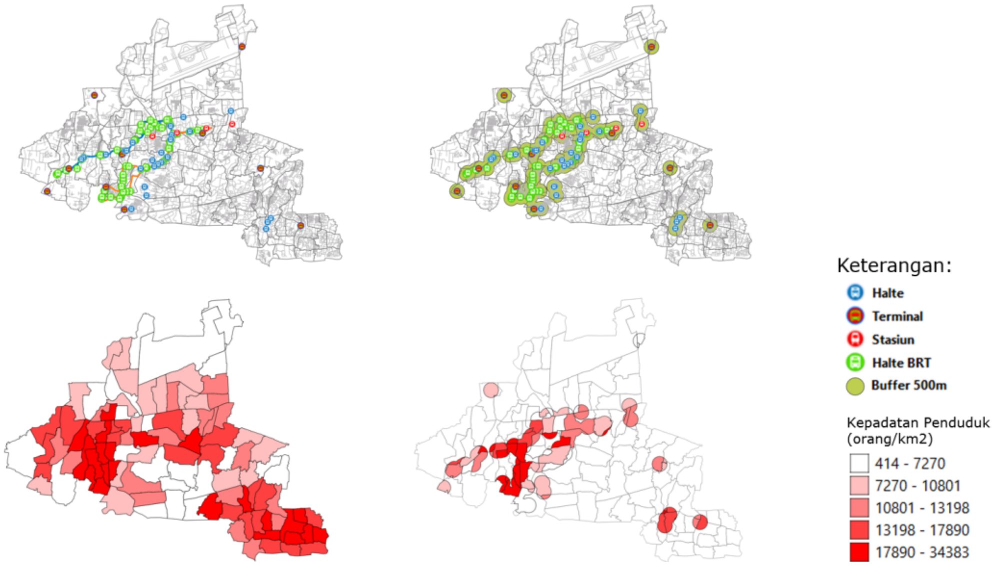

Figure 9 Buffer analysis result with 500 meter radius weighted by population density

After overlaying the 500-meter buffer analysis results with population density, it was found that approximately 397,892 people out of a total population of 1,771,092, or only 22.47%, are located within the buffer area. As illustrated in the accompanying map, the southwestern part of Tangerang City, particularly the Ciledug district, exhibits relatively high population density yet is served by only a few transit stops. These findings indicate that public transit services are predominantly concentrated in central and core city areas, especially within three districts: Tangerang, Cibodas, and Karawaci (**Figure 10**).

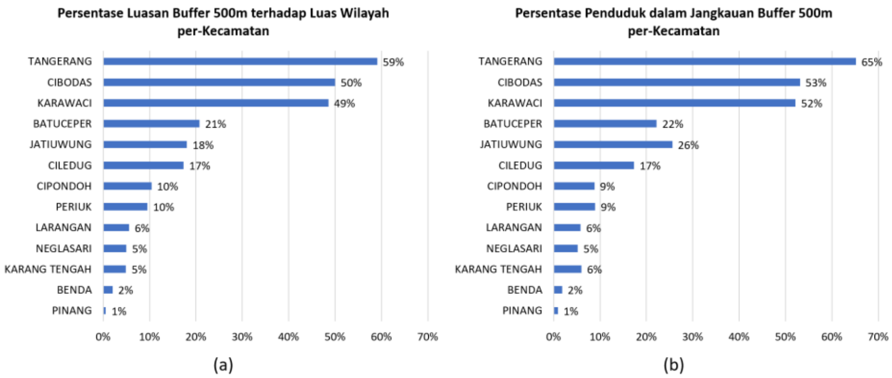

Figure 10 Coverage of area within 500-m buffer by district (a), and percentage of population within 500-m buffer by district (b).

To achieve a more detailed analysis, we employed network analysis and isochrone analysis (**Figure 11**). Using road network data from OpenStreetMap and transit stop information from maps.tangerangkota.go.id, we investigated the diversity of urban transport services within a 500-meter walking distance, rather than relying on air distance. By executing a multilayer overlay, the illustration below reveals that Central Tangerang is served by a greater variety of transport mode options within the 500-meter walking distance compared to other districts in Tangerang.

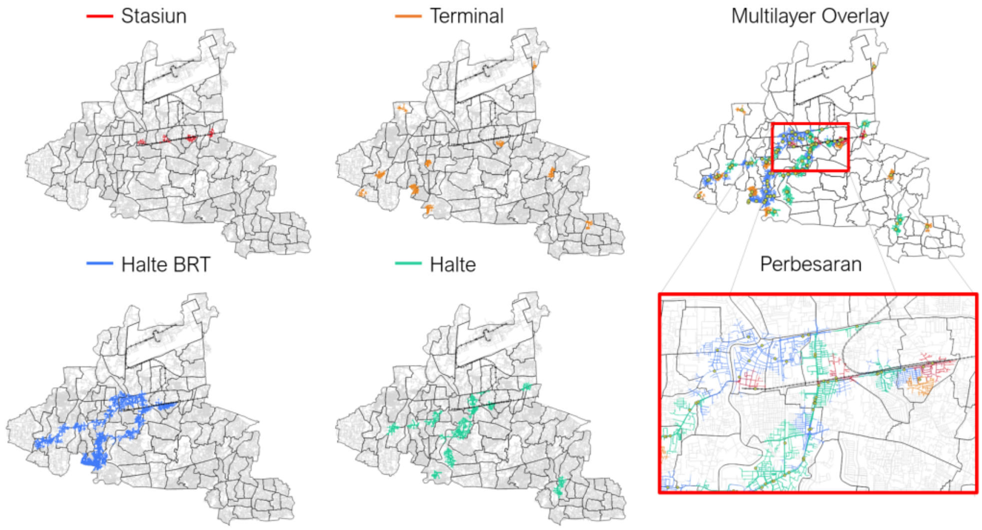

Figure 11 Network Analysis result of transit stops within 500-m walking distance by types of transit stops

We sought to examine the differences between the buffer analysis results (500-meter radius, measured as air distance) and the network analysis results (500-meter walking distance) by overlaying both datasets at four commuter train stations in Tangerang City. The findings indicate that the existing road structure and pattern significantly influence population access to the transit stops. For instance, Tangerang Station and Tanah Tinggi Station exhibit limited accessibility from the southern side, while Batuceper Station is less accessible from the northern side, and Poris Station is less accessible from the eastern side. These discrepancies can lead to varying results in both area and population coverage. Hypothetically, we anticipate that the results from the network analysis will yield lower coverage figures than those from the buffer analysis (**Figure 12**).

Figure 12 Comparisons of Buffer Analysis and Network Analysis results of 4 train station in Tangerang City

To calculate the area and population coverage from the network analysis, we created an isochrone map illustrating the service polygon based on the road network within a 500-meter walking distance. The results from the isochrone analysis reveal that the area covered is only 20.48 square kilometers, which is lower than the buffer analysis result of 31.314 square kilometers, accounting for only 11.48 percent of Tangerang City. After overlaying the new isochrone polygon with population density data, we estimate that only 245,295 people—approximately 13.85 percent of the total Tangerang City population—are within a 500-meter walking distance to public transport services, which is lower than the buffer result of 22.47 percent. This suggests that the street design surrounding the transit stops significantly influences accessibility, reflecting an almost 8 percent difference.

We aimed to determine whether the distribution of transit stops and population exhibits a pattern and whether the distribution of transit stops correlates with population distribution. To answer these questions, we conducted a spatial autocorrelation analysis (**Figure 13**). The results from the univariate local Moran's I analysis, using queen contiguity for the population density variable, yielded a Moran's I value of 0.518, indicating positive autocorrelation and clustering. High-high clusters were identified in the Cibodas-Karawaci (central) districts and the Ciledug-Larangan (southwest) districts, while low-low clusters were found in the Neglasari-Benda area in the northern part of the city and the Pinang districts in the southern part.

For the transit stops variable, the Local Indicator of Spatial Autocorrelation also showed positive and relatively clustered results, with a Moran's I value of 0.292. High-high and low-high clusters were observed in the southern part of the Cisadane River (Cibodas-Karawaci district), with two outliers; a low-low cluster was located in the Cipondoh Lake area, and a high-low cluster was identified in the Ciledug district.

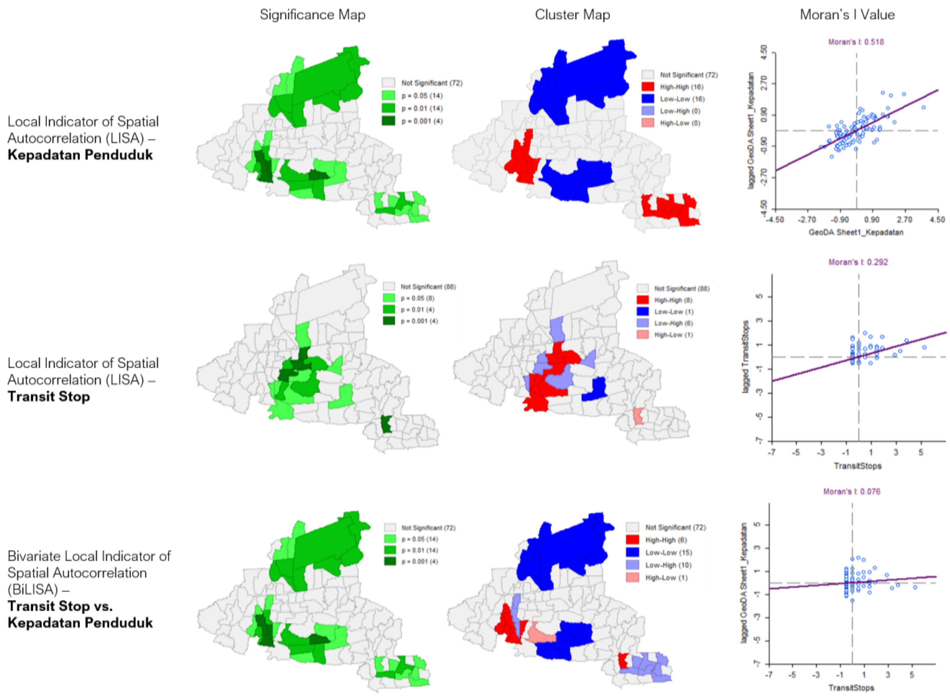

Figure 13 Spatial Autocorrelation Analysis Result (a) LISA population density; (b) LISA transit stops; (c) BiLISA transit stops vs. population density

To further investigate the spatial correlation between the two variables—transit stops and population density—we conducted a bivariate local Moran's I test, which resulted in a positive but dispersed Moran's I value of 0.076. High-high clusters appeared in Cibodas-Karawaci and Ciledug, surrounded by low-high clusters in Karawaci and Larangan, with high-low outliers in Cikokol and low-low clusters in Neglasari-Benda and Pinang.

3.3. Transit Quality Analysis

This section presents the results, analysis, and discussion regarding the assessment of transit quality. The quality evaluation was conducted through online observations of transit stops, utilizing five key parameters outlined in the **Table 3**.

Table 3. Quality of Transit assessment indicators

No	Dimension	Indicators
1	Accessibility	Easiness to access public transit stop from any directions
2	Pedestrian conveniency	Availability of convenient pedestrian path, good quality and undisturbed by another activities/functional use
3	Disabled friendly facilities	Accessibility infrastructure for disabled persons such as ramp with acceptable slopes etc.
4	Intermodal connectivity	Seamless transfer between transport modes, multi-modality
5	Supporting facilities (*parking/bus bay*)	Parking facilities such bike racks, transit bay/dedicated curbside for public transit to stop, to avoid congestion

The transit quality analysis was conducted in three sample locations: Batuceper, representing the central city area; Jatiuwung, representing an industrial area; and Ciledug, characterized by the highest population density and primarily residential zones. Due to the risks associated with COVID-19, the observations were carried out online using Google Street View. It is important to note that this method has limitations, as it does not reflect real-time conditions. For this study, the range of images utilized from Google Street View was captured between April and September 2019.

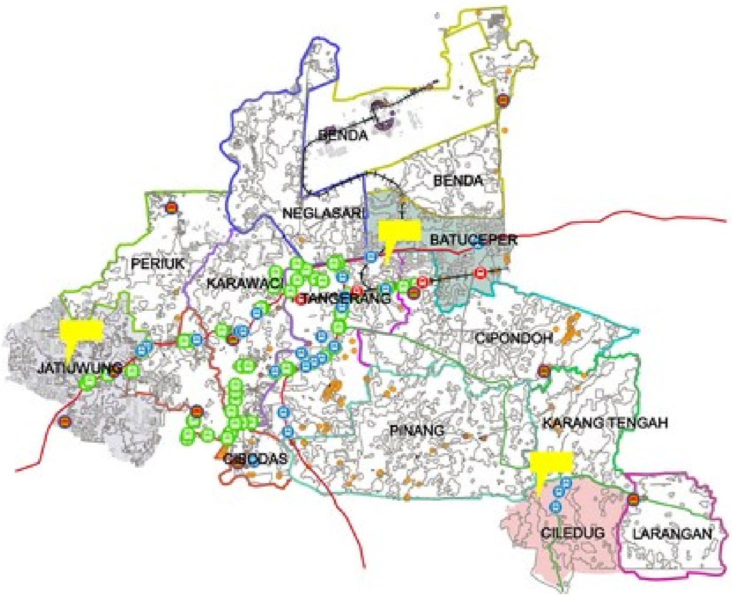

Figure 14 Distribution of transit stops samples (marked in yellow callouts)

The online observation results indicate that the transit stops in Batuceper exhibit relatively weak convenience and accessibility. Batu Ceper Station has primary access from the north side, while the south side features a fenced pedestrian path with only a small gate for entry and exit. At the Poris Plawad BRT stop, the bus stop is located within the terminal, also fenced off with a single gate for access, requiring passengers to walk along the fence to reach the bus stop. In terms of pedestrian convenience, there is a noticeable lack of well-maintained pedestrian pathways. Additionally, the intermodality aspect reveals that there are no safe transfer connections between the station and the BRT stop. Neither transit stop has a bike rack available. However, it is worth noting that Batu Ceper Station is equipped with a ramp for individuals with physical disabilities, and the Poris Plawad BRT stop includes a bus bay with acceleration and deceleration lanes (**Figure 15**).

Figure 15 Observation of Transit Quality in Batuceper and Poris Plawad Transit Stop
Source*:* Google streetview, 2020

In Jatiuwung district, the transportation system is served by a single corridor of the Bus Rapid Transit (BRT), specifically the 1st Corridor: Poris Plawad-Jatake, which includes five bus stops along with several stops for feeder services like angkot (minibus) and ojek (motorcycle taxis), as well as two terminals for passenger and cargo transport. However, the observation revealed that the cargo terminal could not be located, while numerous trucks were parked along the street.

For the passenger terminal, some stops featured ramps for accessibility, but this was not consistent across all stops. Interlinkage between different modes of transport was notably lacking, and informal business activities along the streetside further complicated matters, forcing pedestrians to walk on the road and posing safety risks for passengers accessing public transport. According to previous research by Adeliani (2017), the headway time for the 1st Corridor BRT ranges from 40 to 50 minutes, which is relatively longer compared to the 10-minute headway time of the MRT Jakarta (**Figure 16**).

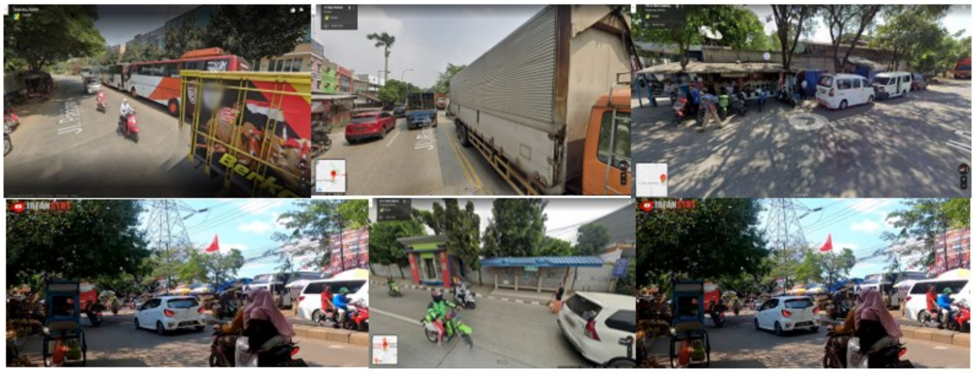

Figure 16 Observation of Transit Quality in Jatiuwung Transit Stops
Source: Google streetview, 2020

In Ciledug district, there are three bus stops serving both bus and angkot services, along with one shadow terminal for intercity and interprovincial buses (AKAP), one border terminal, and eight lines of the Transjakarta bus network. However, the observation revealed a lack of safe pedestrian crossings and a concerning trend of bus stops being repurposed for informal business activities. While the Transjakarta terminal features a ramp with an appropriate slope for individuals with disabilities, it lacks dedicated bus lines or bus bays, unlike those found in Jakarta. This absence contributes to traffic congestion when buses stop to pick up or drop off passengers. Additionally, an intercity and interprovincial bus terminal was identified that is not included in the Tangerang Municipality plan. Located at the center of Lembang market, this terminal suffers from inadequate supporting transport infrastructure and flow management, exacerbating issues for the surrounding area (**Figure 17**).

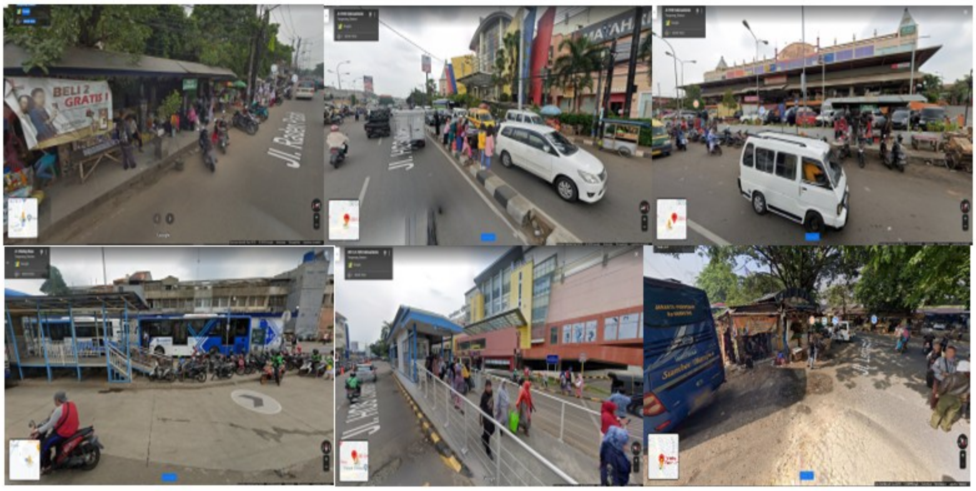

Figure 17 Observation of Transit Quality in Ciledug Transit Stops
Source: Google streetview, 2020

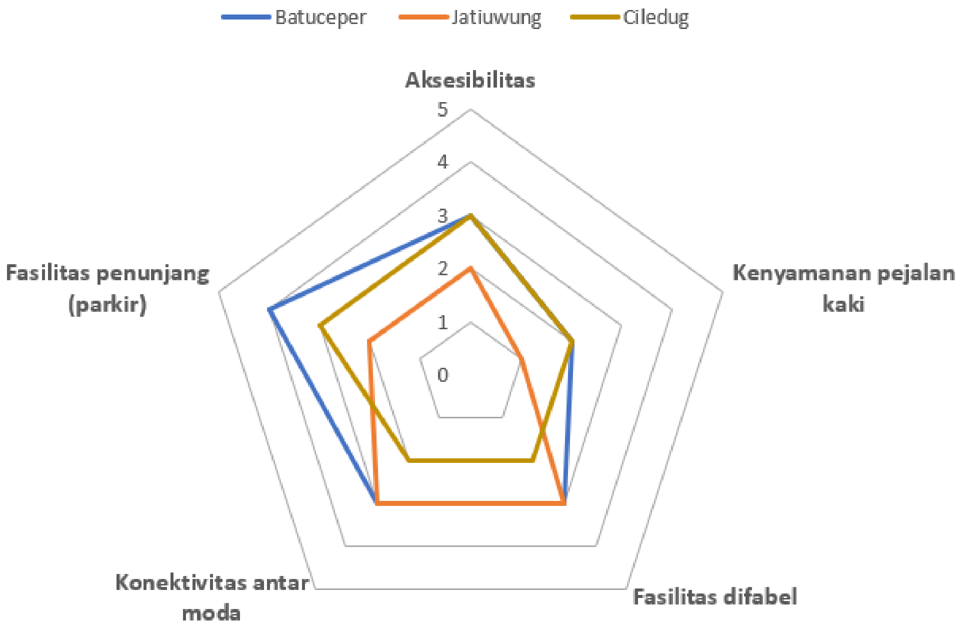

Figure 18 Radar Diagram of Transit Quality in Tangerang Municipality

We quantified the observation results using a Likert scale ranging from 1 to 5. The analysis yielded several key findings.

1. **Pedestrian Convenience**: The lowest score was recorded for pedestrian convenience, with an average of 1.67 out of 5. This low rating is attributed to the scarcity of sidewalks or pedestrian paths at the observed transit stops. Where such paths do exist, they are often obstructed by street hawkers or informal business activities.
2. **Accessibility, Intermodality, and Disability-Friendly Facilities**: These aspects received a score of 2.67 out of 5. Accessibility was hindered in some locations by fenced pedestrian paths, while ramps at various stops exhibited inconsistent quality—some had acceptable slopes, while others were too steep. The intermodality aspect also revealed a lack of safe pedestrian crossings, both at grade and elevated, and bicycle parking facilities were challenging to locate.
3. **Parking Facilities/Bus Stops**: The highest average score was for parking facilities and bus stops, at 3.00 out of 5. Larger terminals generally provided sufficient parking lots and designated bus bays. However, at smaller stops, the absence of dedicated bus bays or parking facilities contributed to congestion issues.

Table 4. Summary of Transit Quality Evaluation

Parameter	Batuceper	Jatiuwung	Ciledug	Average	Description
Accesibility	3	2	3	2.67	1- very limited access 5- easily accessible from any directions
Pedestrian Conveniency	2	1	2	1.67	1- no pedestrian path available 5 – safe and convenient pedestrian path available
Disabled friendly facility	3	3	2	2.67	1- no disabled-friendly facility 5 – disabled-friendly facility is available
Intermodal connectivity	3	3	2	2.67	1- lack of intermodality transfer facilities 5 – safe and convenient intermodal transfer facility is available
Supporting facilities (park and ride)	4	2	3	3.00	1- no dedicated lanes or bus bay/curbside for stop 5 – public transport can stop or park without causing congestion
Average	3.00	2.20	2.40		

3.4. Gap Analysis

This section presents the results, analysis, and discussion regarding the gap analysis conducted between the existing conditions and the local plans (RTRW and RPJMD). It also compares the findings from the buffer analysis with those from the isochrone analysis, incorporating estimated future projection scenarios.

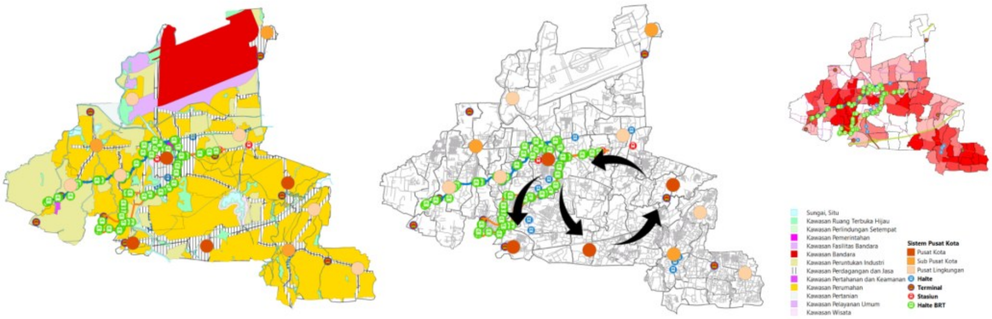

Figure 19 Overlaying Transport Network with (a) Spatial Pattern Plan, (b) Spatial Structure Plan, (c) Population Density

By overlaying the transport network and transit points with the spatial pattern plan, we observe that public transport transit points are concentrated in the city center, which is dominated by trade and service functions (**Figure 19**). However, when comparing the transport networks and transit points to the spatial structure plan, it becomes evident that the current transport network lacks strong connectivity between the city center and several sub-city centers.

The scatterplots below (**Figure 20**) illustrate three outliers (represented by the blue dashed cluster) with high public transport area coverage (more than 75% of the total subdistrict area) but with low population shares (below 10,000 residents): Sukarasa, Babakan, and Sukaasih. In contrast, four subdistricts (represented by the orange dashed cluster) exhibit both high coverage and high population shares: Cibodasari, Karawaci Baru, Nusa Jaya, and Cimone Jaya, with Cimone Jaya having the highest population share, exceeding 13,000 residents. Notably, the orange group is situated in residential areas, while the blue group is located in trade and service areas within the Tangerang CBD.

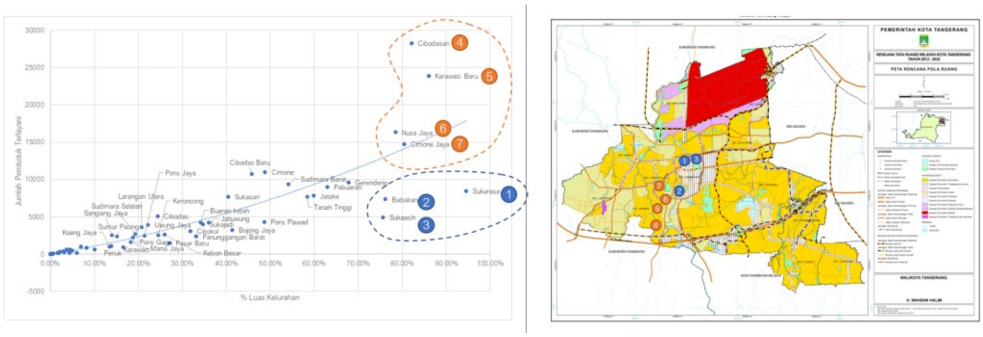

Figure 20 (a) Scatterplot between % area coverage and % population coverage by subdistricts, (b) reference points in Spatial Pattern Local Plan 2012-2032

After comparing the results of the buffer analysis and network-isochrone analysis (**Figure 21**), a significant gap of 8.62% was identified, equating to 152,668 more people being served by the buffer analysis compared to the network-isochrone analysis. This discrepancy highlights the need for a multifaceted approach to improve SDG 11.2, which focuses on sustainable transport systems. It necessitates a combination of strategies that include developing or expanding public transport services, integrating existing networks, and enhancing accessibility. By targeting improvements in pedestrian pathways and bike lanes in residential areas, we can broaden the population catchment, ultimately enhancing both convenience and accessibility.

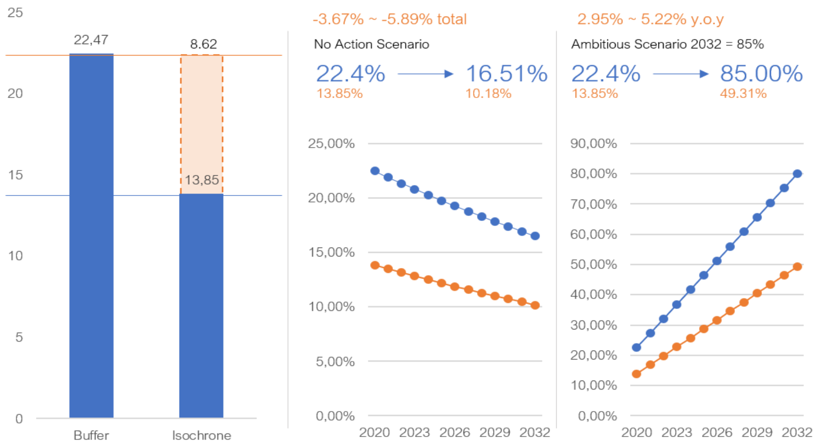

Figure 21 Gap analysis result (a) between buffer and isochrone analysis, (b) no-action scenario projection, (c) ambitious scenario projection

Based on the findings of this study, if no improvement efforts are implemented and assuming a flat population growth rate of 2.6%, the SDG 11.2 score is projected to decline by 5.89% by 2032, decreasing to 16.51% compared to the baseline of 22.4% in 2020. To achieve a target accessibility rate of 85% by 2032, an annual improvement rate of 5.22% starting from 2020 will be necessary. From a policy perspective, the Local Spatial Plan (RTRW) has already outlined strategies aimed at enhancing accessibility to transit stops, revitalizing existing stations and terminals, and developing a non-motorized transport system..

	LOKASI	TAHAP I TAHUN 2013	2014	2015	2016	2017	TAHAP II TAHUN 2022	TAHAP III TAHUN 2027	TAHAP IV TAHUN 2032	SUMBER DANA	PELAKSANA PROGRAM
Penataan stasiun eksisting	Tanah Tinggi, Stasiun Batuceper, Stasiun Poris									APBN	Kementerian Perhubungan

NO			LOKASI	TAHAP I TAHUN 2013	2014	2015	2016	2017	TAHAP II TAHUN 2022	TAHAP III TAHUN 2027	TAHAP IV TAHUN 2032	SUMBER DANA	PELAKSANA PROGRAM
6.	5.	Jalan Pejalan Kaki											
		Penyediaan trotoar	Tersebar di seluruh wilayah									APBD Kota	Dinas PUPR
		Penyediaan penyebrangan sebidang	Tersebar di seluruh wilayah									APBD Kota	Dinas Perhubungan
		Penyediaan penyebrangan tidak sebidang	Tersebar di seluruh wilayah									APBD Kota	Dinas PUPR
		Pengembangan kawasan khusus pejalan kaki	Tersebar di seluruh wilayah									APBD Kota	Dinas PUPR

	LOKASI	TAHAP I TAHUN 2013	2014	2015	2016	2017	TAHAP II TAHUN 2022	TAHAP III TAHUN 2027	TAHAP IV TAHUN 2032	SUMBER DANA	PELAKSANA PROGRAM
Pengembangan konsep park and ride	Di setiap stasiun dan terminal									APBD Kota	Dinas Perhubungan

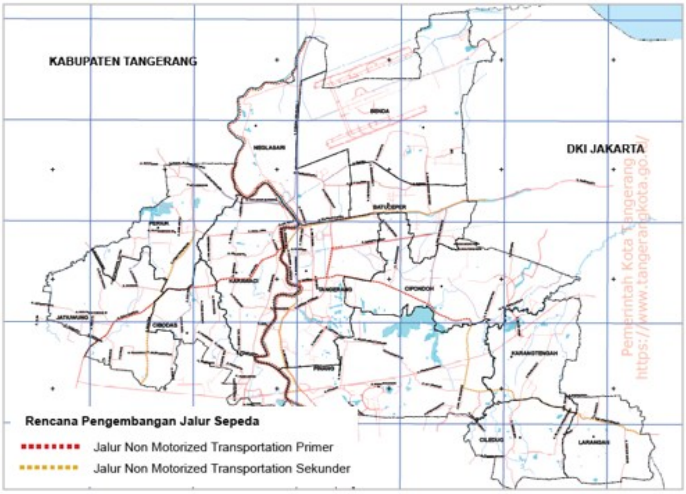

Figure 22 Policy direction and Indicative program in Local Spatial Plan related to improvement of SDG Transport target in Tangerang City

Source*:* Tangerang Local Spatial Plan 2012-2032 (2019)

However, the indicative funding and institutional frameworks outlined in the program annex (**Figure 22**) remain fragmented and lack a holistic, integrated approach. To develop a sustainable transport solution, the government must ensure synergy and adopt an integrative strategy that involves not only the transport sector but also urban design, private sector participation, and social inclusion efforts—particularly emphasizing the involvement of persons with disabilities in planning, implementation, and program/project evaluation.

From our observations, we noted that many informal businesses occupy unused bus stops or pedestrian pathways, highlighting the need to strike a balance between ensuring convenience and preserving the livelihoods and job opportunities of those in the informal sector. Another crucial finding pertains to data quality and availability. The lack of data regarding ojek terminals, pick-up points, and angkot routes may underrepresent the actual conditions. To regularly update SDG transport target performance, it is essential to ensure the availability and quality of reliable transport data.

4. Conclusions and Recommendations

The performance of public transportation services in Tangerang City has been evaluated concerning accessibility within a 500-meter walking distance and quality, focusing on access, pedestrian comfort, availability of facilities for persons with disabilities, intermodal connectivity, and the existence of vehicle stop spaces. Based on literature reviews and field studies, the performance of public transportation accessibility in Tangerang City in achieving the target of SDG 11.2 can be considered quite low. Using two different methods—buffer and network analysis—the effective reach of a 500-meter walking distance to public transit points accommodates only 22.47% and 13.85% of the population, covering less than 17.56% of the city area.

Although the current transportation pattern aligns with the distribution of population density, as indicated by a positive-dispersed spatial autocorrelation between the number of transit points and population density (Moran's I value of 0.076), 36 out of 104 subdistricts remain underserved by public transport. As a city with a manufacturing-based economy, the existing public transportation connections are still centralized and primarily link the city center to industrial areas, without effectively connecting the city center to planned sub-city centers.

The quality of access to transportation transit points in Tangerang City is generally low, assessed across multiple parameters, with pedestrian comfort receiving the lowest score due to the scarcity of available pedestrian pathways. When available, these paths are often occupied by traders or parked vehicles, compromising accessibility.

The identified gaps between existing conditions and the ideal scenarios outlined in the RTRW (Regional Spatial Planning) document highlight significant challenges in realizing the vision of a livable and visitable aerotropolis city. Notably, the northern area surrounding the airport remains underserved by public transportation, indicating a lack of integration between the airport and the city.

If no action is taken, the achievement of SDG 11.2 in Tangerang City is projected to decline from 22.4% to 16.51% by 2032, assuming a population growth rate of 2.6%. To meet the RTRW target of 85% coverage of the population by 2032, an annual improvement rate of 5.6% is necessary from 2020 onwards. The RTRW has proposed several policies aimed at enhancing public transport conditions, including organizing transit areas, improving pedestrian pathways, mainstreaming disability-friendly infrastructure, and providing non-motorized vehicle lanes and park-and-ride facilities. Achieving these improvements will require commitment, collaboration, and coordinated efforts among stakeholders.

Based on these conclusions, several recommendations are proposed to enhance the achievement of SDG 11.2 in Tangerang City:

1. **Hierarchical Expansion of Public Transportation Services**: A staged diversification and integration of transportation modes is crucial to ensure a seamless transportation system from the first mile to the last mile. Concentrating infrastructure investments solely in the city center will not significantly enhance SDG 11.2 in Tangerang City.
2. **Development of Feeder and Non-Motorized Transportation Infrastructure**: To achieve SDG 11.2, combined efforts are essential, including the development of mass public transport systems (MRT, BRT, LRT) and feeder services that extend coverage to residential areas. Good pedestrian access and bicycle lanes must accompany these developments to widen public access to transit points. Enhancing access and improving the road network structure can help bridge the gap identified in the buffer and network-isochrone analysis.
3. **Improving Urban Transport Data and Integrating SDGs 11.2 Indicators into RPJMD 2024-2029**: Regular monitoring and evaluation of reliable transport data are vital. This includes inventorying various transportation modes and routes, such as inner-city buses, inter-city buses, and public bicycle rental points. Comprehensive data will enable better evaluation of public transportation services in supporting SDG 11.2 and fostering a sustainable transportation system. It is critical to incorporate realistic global targets into local contexts to guide transportation development performance.

4. **Urban Culture Development and Behavioral Change through Public Campaigns**: Cultivating a positive urban culture is essential for increasing the convenience of public transport access. The Tangerang City Government should engage stakeholders in social engineering initiatives aimed at changing public behavior regarding transportation use. This includes promoting proper bus stop usage, maintaining pedestrian pathways, orderly queuing, and appropriate waste disposal practices.

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