

Analysis of Urban Infrastructure Carrying Capacity and User Satisfaction Level at the Medan–Deli Serdang Border

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ABSTRACT

The Medan–Deli Serdang border area plays a strategic role as a mobility corridor and a regional movement node that supports social and economic activities. The high intensity of movement and the complexity of activities in this area require adequate infrastructure and accessible public services to meet users' needs. This study aims to examine the interrelationship between infrastructure capacity, service accessibility, and user satisfaction in the Medan–Deli Serdang border area. A descriptive research approach was employed by collecting primary data through questionnaires, field observations, and documentation, complemented by secondary data from official statistical publications and government reports. Quantitative and qualitative analyses were integrated to provide a comprehensive overview of existing conditions. The results indicate that both infrastructure capacity and service accessibility are generally perceived at a moderate level, while user satisfaction also tends to fall within the same category. A stronger interrelationship is observed between service accessibility and user satisfaction compared to the physical capacity of infrastructure. These findings suggest that ease of access, travel efficiency, and the quality of supporting services play a crucial role in shaping user experiences in border areas. The study is expected to contribute to more responsive planning and management of infrastructure and public services based on users' perspectives

Introduction

The border area of Medan City and Deli Serdang Regency is an area with urban dynamics that has developed rapidly in recent years. The Amplas Terminal corridor in Medan City and the Tanjung Morawa area in Deli Serdang Regency function as important nodes for the movement of people and goods that connect the center of Medan City with industrial areas and settlements in the surrounding area. The high intensity of transportation activities and daily mobility makes this area have a strategic role in the regional urban system of North Sumatra (Central Statistics Agency of Medan City, 2025; Central Statistics Agency of Deli Serdang Regency, 2024).

The rapid development of these activities has not been fully balanced with adequate urban infrastructure conditions. The results of initial observations in the field showed that several main roads, especially in the corridor of Jalan Sisingamangaraja and Jalan Medan-Lubuk Pakam, suffered damage to the road surface, limited drainage capacity, and decreased quality of supporting facilities such as bus stops, pedestrian spaces, and parking areas. This condition has a direct impact on the smooth mobility and comfort of infrastructure users in the Medan-Deli Serdang border area.

Regional statistical data shows that the traffic volume on the Medan-Lubuk Pakam corridor has continued to increase since 2021 in line with population growth, economic activity, and daily commuter movements. On the other hand, the increase in capacity and quality of road infrastructure and urban utilities has not shown comparable development, thus putting pressure on the performance of existing infrastructure (Central Statistics Agency of the City of Medan, 2025). This imbalance triggers various problems such as congestion, waterlogging during rain, and a decrease in the level of safety and comfort of road users.

The condition of the infrastructure that is not optimal has a direct impact on the level of public accessibility to public services. Accessibility in regional planning is not only understood as spatial proximity, but also includes travel time, travel costs, availability of transportation modes, and ease of access (Hansen, 1959; Cervero, 2020). In urban border areas, the limited quality of infrastructure and transportation networks causes relatively close geographical distances to turn into functional barriers to access. This is in line with the view of Litman (2022) who emphasizes that low accessibility has implications for increasing social costs and decreasing the effectiveness of public services, especially for people who depend on public transportation.

The problem of accessibility and infrastructure quality is reflected in the level of community satisfaction as a public service user. User satisfaction is a subjective response to a comparison between initial expectations and perceived actual performance of infrastructure, as described in Expectation–Confirmation Theory (Oliver, 1980). In the context of public services, satisfaction is not only determined by the physical condition of the infrastructure, but also by the perception of comfort, security, and ease of access. Parasuraman et al. (1988) through the SERVQUAL model emphasized that service reliability, facility comfort, and physical evidence are important dimensions in shaping user satisfaction, which is then strengthened by the perception of fairness and accountability of service providers (Zeithaml & Berry, 1990).

A number of previous studies have shown a close relationship between infrastructure quality, service accessibility, and community satisfaction in various urban areas. Studies in Medan City and other major cities show that road conditions, utilities, and ease of access to public services have a significant effect on user perception and satisfaction levels (Abdiyanto, 2023; Yuliana, 2024). Other research in urban and peri-urban areas of Indonesia also confirms that the limited carrying capacity of infrastructure and

accessibility of public services are still major problems, especially in suburban and urban border areas (Eboli & Mazzulla, 2007; Lestari & Nugroho, 2022; Pradana & Lestari, 2022; Nuraini et al., 2023; Kurniawan & Sari, 2023).

However, most of the previous research still focused on urban centers or urban areas in general, so studies that specifically examined the relationship between infrastructure carrying capacity, service accessibility, and user satisfaction in cross-regional administrative border areas, especially Medan-Deli Serdang, are still relatively limited. Border areas have different governance characteristics and development priorities, so they often do not fully reflect the actual needs of infrastructure users on the ground.

Based on these conditions, this study analyzes the carrying capacity of urban infrastructure and user satisfaction levels in the Medan-Deli Serdang border area with a focus on the Sandpaper Terminal and Tanjung Morawa. The analysis is carried out by relating the existing condition of infrastructure, service accessibility, and user satisfaction to obtain a comprehensive empirical picture as the basis for discussion in the next section.

Research Method

This study uses a mixed methods approach, which is a combination of quantitative descriptive methods and qualitative analysis based on SWOT (Strengths, Weaknesses, Opportunities, and Threats). This approach was chosen to obtain an empirical picture of the condition of infrastructure carrying capacity and service accessibility, as well as to understand its relationship with the level of user satisfaction in the Medan-Deli Serdang border area. Quantitative descriptive methods are used to measure users' perception and level of satisfaction with infrastructure and public service conditions, while qualitative analysis is used to identify relevant internal and external factors as the basis for the formulation of infrastructure development strategies (Rangkuti, 2019; Nuraini et al., 2023).

The research was carried out in Amplas Village, Medan City, and Tanjung Morawa District, Deli Serdang Regency, which are administrative border areas with high mobility intensity and strategic role as the main corridor for the movement of people and goods through the Amplas Terminal and the Medan-Lubuk Pakam route. The selection of this location is based on the characteristics of the area that reflect the problems of infrastructure and accessibility as described in the introduction. The research period lasts from January to July 2025, including the stage of instrument preparation, primary and secondary data collection, instrument testing, data analysis, and formulation of development strategies.

The research population is a society that actively uses public infrastructure and services in the research area. Based on data from the Central Statistics Agency, the number of people in Amplas Village reached 132,458 people and in Tanjung Morawa District 239,800 people, so that the total population of the study amounted to 372,258 people (Medan City Central Statistics Agency, 2025; Central Statistics Agency of Deli Serdang Regency, 2024). The determination of the number of samples was carried out using the Slovin formula with an error rate of 8%, so that a minimum sample number of 110

respondents was obtained. To anticipate the possibility of non-response, the number of respondents was set at 120 people. The sampling technique uses purposive sampling, with the criteria that respondents are active users of transportation infrastructure, public facilities, or urban services in the research area (Sugiarto & Ramadania, 2024).

The research variables were compiled based on a conceptual framework that was descriptive-analytical, not causal. The variables studied include the carrying capacity of urban infrastructure (X1), service accessibility (X2), and user satisfaction (Y). The carrying capacity of the infrastructure is measured through indicators of road conditions, frequency of repairs, drainage capacity and conditions, availability of public utilities, and the level of infrastructure maintenance. Service accessibility is measured based on distance to public facilities, travel time, transportation costs, availability and frequency of public transportation, and ease of access between regions. User satisfaction is measured through perceptions of service reliability, facility comfort, security, ease of access, service responsiveness, and perception of local government performance.

Primary data was obtained through the distribution of questionnaires to respondents, field observations of the condition of public infrastructure and facilities, and brief interviews to strengthen qualitative understanding. The questionnaire was compiled using a five-level Likert scale to quantitatively capture user perception and satisfaction levels. Secondary data was obtained from official government documents and statistical publications, including the 2022 Medan City Government Agency Performance Report, Medan City in Figures 2025, and Tanjung Morawa District in Figures 2024 published by the Central Statistics Agency.

The research instruments are tested before being used in the main data collection. The validity test was carried out using Pearson Product Moment correlation to ensure that each statement item was able to measure the indicator in question, while the reliability test was carried out using the Cronbach Alpha method with a minimum limit value of 0.70 (Ghozali, 2018; Sekaran & Bougie, 2020). Instruments that meet valid and reliable criteria are used in the data collection process.

Data analysis was carried out in stages according to the research flow. Quantitative analysis was carried out using descriptive statistics to describe the characteristics of respondents and the conditions of each research variable, and correlation tests to see the relationship between infrastructure carrying capacity and user satisfaction, as well as between service accessibility and user satisfaction. Qualitative analysis is carried out through a SWOT approach by identifying strengths, weaknesses, opportunities, and threats related to the development of infrastructure and public services in the research area. The results of the SWOT analysis are used as the basis for formulating an infrastructure development strategy that is applicable and in accordance with local conditions.

The validity of the data is maintained through the application of validity and reliability tests on quantitative data as well as triangulation of sources and methods on qualitative data. Triangulation was carried out by comparing the results of questionnaires,

field observations, interviews, and official documents to ensure the consistency and objectivity of the findings (Nuraini et al., 2023). The entire research process is carried out by paying attention to the principles of research ethics, including respondent consent, data confidentiality, non-discrimination, and transparency.

The conceptual framework of the study was prepared to describe the relationship between variables studied in the context of the Medan-Deli Serdang border area. This framework is not intended to test cause-and-effect relationships or causal influences, but rather to demonstrate the conceptual relationship between urban infrastructure carrying capacity (X1), service accessibility (X2), and user satisfaction (Y) based on empirical conditions and relevant literature review. The carrying capacity of infrastructure and service accessibility are positioned as factors related to the level of user satisfaction as a beneficiary of public services. This conceptual framework is presented in the form of a diagram showing the relationship between variables X1 and X2 and variable Y, as shown in Figure 1.

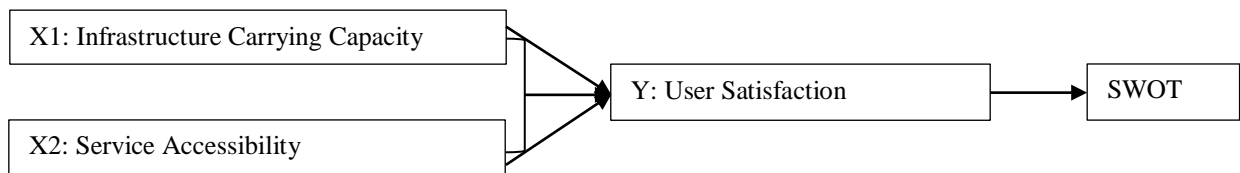


Figure 1. Research Conceptual Framework

Source : Researcher, 2025

The conceptual framework in Figure 1 is used as a reference in the preparation of variables, indicators, and research analysis flows. This framework describes the relationship between infrastructure carrying capacity, service accessibility, and user satisfaction in the context of the Medan–Deli Serdang border area.

Results and Discussion

Current Conditions of Research Locations

The research area is located on the administrative border corridor between Medan City and Deli Serdang Regency, which includes the Medan Amplas area and Tanjung Morawa District. This corridor is one of the main routes for the movement of people and goods that connects the center of Medan City with industrial and residential areas in the hinterland area. The existence of the Sandpaper Terminal as a regional transportation node makes this area have a relatively high intensity of activity and functions as a meeting point for various land transportation modes.

Spatially, the research location is located on the section of Jalan Sisingamangaraja to Jalan Medan-Lubuk Pakam which is known as a strategic corridor with a large traffic load. This area is passed by private vehicles, public transportation, and logistics vehicles that support economic activities in the Medan and Deli Serdang areas. This condition causes significant pressure on the road infrastructure and surrounding supporting facilities, especially during peak hours.

To clarify the scope of the research area and the strategic position of the area studied, a map of the research location is presented in Figure 2. The map shows the boundaries of the research area, the existence of the Sandpaper Terminal, large intersections that function as public facilities, and the Medan-Lubuk Pakam Road corridor as the main connecting route between regions. This visualization provides a spatial overview of the complexity of movement and the interconnectedness of the functions of the Medan-Deli Serdang border area.



Figure 2. Map of the research location in the Medan Amplas–Tanjung Morawa border area

Source: ArcGIS Online, processed by the author.

Based on the map of the research location, this area is at the junction of regional and local traffic flows. This position makes the research area not only function as a transit area, but also as a space for social and economic activities of the surrounding community. This condition has implications for the increasing need for adequate road infrastructure, transportation facilities, and public services to support mobility and user comfort.

The picture of the existing conditions is reflected in the publication of official statistics. Medan Amplas District has a population of more than 130,000 people with a relatively high density level compared to several other sub-districts in Medan City, which contributes to the high intensity of daily movements in this area (Central Statistics Agency of Medan City, 2025). Meanwhile, Tanjung Morawa District is known as one of the areas with rapidly growing industrial and trade activities in Deli Serdang Regency, resulting in significant commuter movement flows to and from Medan City (Central Statistics Agency of Deli Serdang Regency, 2024).

This condition is in line with the evaluation of the performance of the local government which places the problem of transportation infrastructure and public services as a priority issue in urban areas with high activity intensity and cross-regional functions. The problems identified include the condition of the road network, the limitations of transportation support facilities, and the lack of optimal comfort and safety aspects of public service users (Government of Medan City, 2022).

The combination of the strategic position of the region, high movement activity, and limited infrastructure capacity shows that the Medan–Deli Serdang border area faces complex challenges in the provision of infrastructure and public services. This existing condition is an important foundation in analyzing the carrying capacity of infrastructure, service accessibility, and user satisfaction level in the next parts of this study.

Respondent Characteristics

The characteristics of the respondents are presented to provide an overview of the profile of the people involved in this study. The presentation of respondent profiles is important to ensure that the results of the assessment of infrastructure conditions, service accessibility, and user satisfaction come from relevant user groups and have direct involvement with the research area. A total of 120 respondents participated in filling out questionnaires spread across the Medan Amplas and Tanjung Morawa areas.

To show the composition of the respondents in a concise and easy to understand manner, the characteristics of the respondents are presented in Table 1.

Table 1. Characteristics of Research Respondents

Characteristics	Categories	Number (people)	Percentage (%)
Gender	Male	59	49,2
	Women	61	50,8
Age	< 20 years old	22	18,3
	20–29 years old	27	22,5
	30–39 years old	42	35,0
	40–49 years old	14	11,7
	≥ 50 years old	15	12,5
Final Education	High School/Vocational School	76	63,3
	Diploma	10	8,3
	Bachelor (S1)	34	28,3
Jobs	Private Employees	34	28,3
	Student/Student	29	24,2
	Civil Servant/TNI/Polri	16	13,3
	Self-employed	11	9,2
	Informal Workers	10	8,3
	Housewives	10	8,3

	Others	10	8,3
Domicile	Sandpaper Field	53	44,2
	Cape Morawa	67	55,8
Frequency of Infrastructure Usage	Daily	100	83,3
	Weekly	11	9,2
	Monthly	9	7,5

Source: Results of primary data analysis, 2025.

Based on Table 1, the respondents in this study showed a relatively balanced gender composition between males and females. This condition indicates that the perceptions obtained reflect the views of infrastructure users of both gender groups proportionally, so that the potential for assessment bias based on gender can be minimized.

In terms of age, the majority of respondents are in the productive age group, especially the range of 30-39 years. This age group generally has a high mobility intensity, both for work, education, and other social activities. The dominance of productive age shows that the assessment of infrastructure conditions and service accessibility comes from community groups that actively utilize public facilities in the research area. Based on education level, respondents were dominated by high school/vocational school graduates, followed by respondents with a bachelor's education background (S1). This composition reflects the social characteristics of heterogeneous urban and border communities, with diverse educational backgrounds. This diversity contributes to the variation of respondents' experiences and perceptions in using public infrastructure and services. Judging from the type of work, the most respondents came from the private sector and students/students, who generally have relatively high daily mobility needs. In addition, the involvement of respondents from civil servants/TNI/Polri, self-employed, informal workers, and housewives showed that the research area was used by various economic and social activity groups with diverse movement patterns. In terms of domicile, there are slightly more respondents who live in Tanjung Morawa compared to respondents who live in Medan Amplas. This condition shows that the border area not only functions as a transit area, but also as the main activity space for people who live and work around it. The dominance of respondents from Tanjung Morawa and the high frequency of daily infrastructure use are in line with the character of the area as an area with intensive industrial activities and commuter movements towards Medan City, as reflected in regional statistics publications (Central Statistics Agency of Deli Serdang Regency, 2024). The frequency of infrastructure usage shows that most respondents use infrastructure and public services on a daily basis. This high frequency of use indicates that respondents have direct and continuous experience of the condition of infrastructure and service accessibility in the research area. Thus, the assessment given can be considered representative to describe the existing conditions from the point of view of the active user.

Overall, the characteristics of the respondents in this study show that the data obtained come from relevant community groups and have a direct relationship with the Medan-Deli Serdang border area. The respondent profile is a strong basis for interpreting

the results of the analysis of infrastructure carrying capacity, service accessibility, and user satisfaction level in the next subsection.

Results of Infrastructure Carrying Capacity Analysis

The carrying capacity of the infrastructure was analyzed to describe the extent to which the physical infrastructure conditions in the research area were able to support mobility activities and public services of the community. The assessment of the carrying capacity of the infrastructure is based on the perception of the respondents as direct users, so that the results obtained represent the existing conditions as felt in daily activities in the Medan-Deli Serdang border area.

The results of the respondents' assessment of the infrastructure carrying capacity indicators are presented in Table 2, which contains the average value of each indicator as well as an overview of the infrastructure condition in the research area.

Table 2. Results of Infrastructure Carrying Capacity Assessment

Indicator	Average Score	Remarks
Road conditions support mobility	4,02	Good
Road repairs are carried out effectively	3,68	Enough
The drainage system works well	3,53	Enough
Public utilities are adequately available	3,53	Enough
Street lighting works well	3,11	Enough
Adequate supporting facilities (bus stops, parking, waiting rooms)	3,32	Enough

Source: Results of primary data analysis, 2025.

Based on Table 2, in general, the carrying capacity of the infrastructure in the research area is in the sufficient category, with variations in assessments between indicators. Indicators related to the condition of the main road and the availability of supporting facilities showed relatively lower values than other indicators, indicating the limitations of capacity and infrastructure quality in supporting the high intensity of activities in the area. Meanwhile, indicators related to the availability of basic utilities are still considered quite adequate by some respondents, although they do not fully meet the needs of users.

The respondents' assessment shows that the road conditions on the Medan-Tanjung Morawa main corridor have not fully supported smooth mobility, especially during peak hours. This is related to the high volume of traffic, the existence of heavy vehicles, and the condition of road pavements that require periodic maintenance. In addition, the limitation of supporting facilities such as parking areas, bus stops, and waiting rooms also affects the comfort of users in utilizing the available infrastructure.

The findings of the questionnaire results were strengthened by field documentation describing the physical condition of the infrastructure in the research area. Documentation shows the existence of roads with high levels of traffic density, the existence of surface utilities that have the potential to interfere with user comfort, and the condition of facilities inside the terminal that are not fully optimal. Visual documentation of these conditions is presented in Figure 4.



Figure 4. The condition of public infrastructure and facilities in the research area: (a) the condition of the main road with high traffic flow and surface utilities, (b) public facilities in the form of bus stops that have not functioned optimally, (c) access to the environment around the Sandstone Terminal with high movement activity, (d) the condition of facilities in the terminal that show the limitations of supporting utilities.

Source: Field documentation, 2025.

The infrastructure condition depicted in the documentation shows that the carrying capacity of the infrastructure in the Medan-Deli Serdang border area faces considerable pressure due to the intensity of daily activities and movements. Limited capacity and quality of physical infrastructure has the potential to reduce the level of comfort and safety of users, especially for people who rely on this infrastructure regularly.

The results of this analysis show that although the infrastructure in the research area is still able to perform its basic functions, improving the quality and maintenance of infrastructure is still needed to adapt to the ever-evolving level of activity and user needs. The findings regarding the carrying capacity of this infrastructure are an important foundation in understanding the condition of service accessibility and user satisfaction level discussed in the next subsection.

Service Accessibility Analysis Results

The accessibility of services is analyzed to illustrate the level of ease of the community in reaching public facilities and urban services in the Medan-Deli Serdang border area. This analysis includes aspects of distance and ease of access, travel time efficiency, affordability of transportation costs, and availability of transportation support facilities. The assessment is based on the perception of respondents as direct users of the

service, so that the results reflect the conditions of accessibility as perceived in daily activities.

The results of respondents' assessment of service accessibility indicators are presented in Table 3, which contains the average value of each indicator.

Table 3. Service Accessibility Assessment Results

Indicator	Average Score	Remarks
Access to public facilities is relatively easy	3,40	Enough
Travel time to public facilities is relatively efficient	3,92	Enough
Transportation costs to affordable public facilities	3,20	Enough
Adequate availability of public transportation	4,03	Good
Adequate condition of bus stops and pedestrian paths	3,06	Enough
Access between Medan-Deli Serdang areas runs smoothly	3,68	Enough

Source: Primary data (questionnaire), 2025.

Based on Table 3, the level of service accessibility in the research area is generally in the category of adequate, with several indicators showing relatively good values. The indicator of public transportation availability obtained the highest average value, which shows that respondents assessed that the existence of public transportation modes in the study area was still able to support community mobility.

The efficiency of travel time was also considered quite good by respondents, which indicated that distance and connectivity between regions still allowed people to reach public facilities in a relatively reasonable time. This condition is related to the role of the research area as the main connecting corridor between the City of Medan and Deli Serdang Regency.

However, some accessibility indicators show lower average values, especially in the aspect of affordability of transportation costs and the condition of bus stops and pedestrian paths. This value indicates that although modes of transportation are available, the quality of supporting facilities and the convenience of access for users, especially pedestrians, are not fully optimal.

Access between the Medan-Deli Serdang areas was considered quite smooth by the respondents, although there were still obstacles at certain times due to high traffic density and regional activities. This condition shows that the accessibility of the area is greatly influenced by the intensity of daily movements and the limited capacity of available infrastructure.

The results of the service accessibility analysis are in line with the findings of field documentation that show the limitations of bus stop facilities, pedestrian paths, and the complexity of access around the Sandpaper Terminal. Overall, these findings show that the accessibility of services in the research area still needs improvement, especially in the aspects of supporting facilities and affordability of services, in order to improve the comfort and ease of community mobility. These findings are the basis for analyzing user satisfaction levels in the next subsection.

User Satisfaction Level Analysis Results

The user satisfaction level analysis was conducted to describe how the public assessed their experience in using public infrastructure and services in the Medan–Deli Serdang border area. User satisfaction is understood as a response to the physical condition of the infrastructure, comfort, sense of security, and performance of public services felt in daily activities.

The results of respondents' assessments of the user satisfaction indicators are presented in Table 4, which contains the average scores and rating categories for each indicator.

Table 4. User Satisfaction Level Assessment Results

Indicator	Average Score	Remarks
Satisfaction with infrastructure conditions	3,42	Enough
Infrastructure comfort in use	3,18	Enough
Sense of security in using infrastructure	3,28	Enough
Access services according to needs	3,32	Enough
Government responsiveness to problems	2,78	Less
Quality of public services in general	3,41	Enough

Source: Primary data (questionnaire), 2025.

Based on Table 4, the level of user satisfaction with infrastructure and public services in the research area is generally in the category of adequate. Respondents assessed that the infrastructure conditions, comfort of use, and access to services were relatively acceptable, although they did not fully meet user expectations.

The indicators of satisfaction with the condition of infrastructure and the quality of public services in general obtained a relatively higher average value than other indicators, which shows that the basic functions of infrastructure and public services are still felt by the community. However, the level of comfort and sense of security in using infrastructure has not reached the good category, so there is still room for improvement in terms of quality and supporting facilities.

The indicator with the lowest value is in the aspect of government responsiveness to infrastructure and public service problems, which is in the category of lacking. These findings indicate that the community still feels limitations in the speed and effectiveness of handling problems in the field, especially related to infrastructure and public facilities.

Overall, the results of the analysis of user satisfaction levels show that although infrastructure and public services in the Medan-Deli Serdang border area are still able to meet the basic needs of the community, improving service quality and responsiveness of infrastructure management is still needed. These findings are an important foothold in analyzing the relationship between infrastructure conditions, service accessibility, and user satisfaction in the next subsection.

Results of the Analysis of the Relationship between Infrastructure Carrying Capacity, Service Accessibility, and User Satisfaction

An analysis of the relationship between variables was carried out to understand the relationship between infrastructure carrying capacity (X1), service accessibility (X2), and user satisfaction level (Y) in the Medan-Deli Serdang border area. This analysis is not intended to test cause-and-effect relationships, but rather to describe the tendency of relationships between variables based on respondents' perceptions as users of infrastructure and public services.

To provide an overview of the relationship between variables quantitatively, a correlation analysis was carried out between variables X1 and Y, as well as between variables X2 and Y. The results of correlation analysis are presented in Table 5.

Table 5. Results of Intervariable Linkage Analysis

Variable Relationships	Correlation Coefficient (r)	Remarks
Infrastructure carrying capacity (X1) – User satisfaction (Y)	0,14	Weak
Service accessibility (X2) – User satisfaction (Y)	0,84	Strong

Source: Primary data (questionnaire), 2025.

Based on Table 5, the correlation between infrastructure carrying capacity (X1) and user satisfaction (Y) shows a weak correlation value. These findings indicate that the physical condition of infrastructure, such as roads, drainage, and utilities, has not been directly reflected in user satisfaction levels. Although the infrastructure is still functioning on a basic basis, the limited quality of support and maintenance facilities can cause the perception of satisfaction not to increase significantly.

In contrast, the correlation between service accessibility (X2) and user satisfaction (Y) shows strong correlation values. This indicates that ease of access, efficiency of travel time, availability of public transportation, and smooth access between regions have a close relationship with the level of community satisfaction. These findings show that functional aspects and ease of use of public services are important factors in shaping the perception of user satisfaction in the research area.

These quantitative findings are strengthened by the empirical conditions of the research area shown through secondary data. Based on *the City of Medan in the 2025 Figures*, Medan Amplas District has a relatively high population density, with a population of more than 130,000 people, which has implications for the high intensity of daily movements and the need for efficient transportation services (Medan City Central Statistics Agency, 2025). On the other hand, *Tanjung Morawa District in Figures 2024* notes that Tanjung Morawa District is one of the centers of industrial activity in Deli Serdang Regency, which generates a significant daily commuter flow to Medan City (Central Statistics Agency of Deli Serdang Regency, 2024).

This condition shows that even though the physical quality of infrastructure is not fully optimal, the community is still highly dependent on smooth access and availability of transportation services in carrying out daily activities. This explains why service accessibility has a stronger correlation with user satisfaction than with the physical condition of the infrastructure alone.

In addition, the 2022 Medan City Government Agency Performance Report (LKjIP) also noted that the main problems with public services in urban areas are related to aspects of service affordability, congestion, and responsiveness of infrastructure management. This condition is in line with research findings that show that ease of access and service efficiency are more dominant factors in shaping user satisfaction compared to the physical condition of infrastructure separately (Government of Medan City, 2022).

Overall, the results of the analysis of the relationship between variables show that the increase in user satisfaction in the Medan-Deli Serdang border area is more closely related to the aspect of service accessibility compared to the physical improvement of infrastructure alone. These findings provide an important overview of the priorities of regional management, especially in formulating infrastructure and public service development strategies that are responsive to user needs.

SWOT Analysis Results

SWOT analysis is used to summarize internal and external conditions that affect the management of infrastructure and public services in the Medan–Deli Serdang border area. This analysis is compiled based on the synthesis of questionnaire results, field documentation, and official secondary data, so as to comprehensively reflect the existing conditions of the area from the perspective of users and regional contexts.

The results of the identification of SWOT factors in the research area are presented briefly in Table 6, which contains strengths, weaknesses, opportunities, and threats in one analysis.

Table 6. Identification of SWOT Factors of the Research Area

Categories	Description of Factors
Strengths	The availability of public transportation is relatively adequate; the basic functions of the road network are still running; the existence of the Sandpaper Terminal as a regional transportation node.
Weaknesses	The quality of bus stops and pedestrian paths is not optimal; street lighting and surface utilities are still limited; low perception of the responsiveness of infrastructure management.
Opportunities	The growth of industrial and trade activities in Tanjung Morawa; the high daily commuter flow of Medan-Deli Serdang; support for urban service improvement policies.
Threats	Traffic density during peak hours; potential decline in infrastructure quality due to high activity load; limited capacity of street space and public facilities.

Source: Results of primary data analysis, field documentation, and secondary data (BPS; LKjIP), 2025.

The identification of SWOT factors shows that the Medan-Deli Serdang border area has the main strength in its strategic role as a connecting corridor between regions and transportation nodes. However, weaknesses in the quality of supporting facilities and management responsiveness are still issues that are directly felt by users. On the other hand, the opportunities for regional development are quite large in line with the growth of industrial activities and commuter movements, although accompanied by threats in the form of traffic pressure and infrastructure degradation.

Based on the synthesis of these factors, the strategy for developing infrastructure and public services is formulated as presented in Table 7.

Table 7. Development Strategy Formulation Based on SWOT Analysis

Types of Strategies	Strategy Formulation
SO (Strengths–Opportunities)	Optimizing the role of the Sandpaper Terminal and the availability of public transportation to support the mobility of Medan–Deli Serdang commuters.
WO (Weaknesses–Opportunities)	Improving the quality of bus stops, pedestrian paths, and supporting facilities to take advantage of the growth of regional activities.
ST (Strengths–Threats)	Manage traffic and carry out infrastructure maintenance on an ongoing basis to reduce the impact of congestion and degradation.
WT (Weaknesses–Threats)	Strengthening cross-regional coordination and increasing responsiveness in infrastructure and public service management.

Source: SWOT analysis results, 2025.

The results of this SWOT analysis show that the development of the Medan-Deli Serdang border area needs to be directed at improving the quality and accessibility of public services by utilizing the strategic role of the region as a link between regions, while anticipating the pressure of activities and the limitations of existing infrastructure.

Discussion

This section of the discussion interprets the research findings by linking the results of quantitative measurements through questionnaires, qualitative findings from field observations and documentation, and supporting relevant secondary data. The discussion was directed to understand how the condition of infrastructure capacity, service accessibility level, and user satisfaction are interrelated in shaping the community's experience as users of infrastructure and public services in the Medan-Deli Serdang border area. This approach is used to provide a comprehensive interpretation of the research results, without placing the relationship between variables as a cause-and-effect relationship, but as a series of interconnected conditions in the context of area utilization.

The results of the study show that the condition of infrastructure and public services in the Medan-Deli Serdang border area is still able to carry out its basic function as a mobility corridor, but the quality of service felt by users is not fully optimal. The quantitative findings of the questionnaire show that most indicators of infrastructure capacity and service accessibility are in the *adequate* category, while user satisfaction levels also tend to be in the same category. This pattern indicates a gap between the technical functioning of the infrastructure and the quality of the user experience in utilizing the service.

In terms of infrastructure capacity (X1), respondents assessed that the road network, basic utilities, and supporting facilities in general can still be used to support daily mobility. However, the average value that has not reached the *good category* indicates that the physical condition of the infrastructure has not fully met user expectations. These findings are in line with the view that the quality of infrastructure is not only measured by

its physical existence, but also by the level of comfort, order, and sustainability of its maintenance (Parasuraman et al., 1988). In the context of a border area with a high movement intensity, a small limitation on the physical element can have a significant impact on user perception.

The results of field observations and documentation reinforce these quantitative findings. The condition of unsustainable pedestrian paths, limited bus stop facilities, and the existence of poorly organized surface utilities indicate that the infrastructure capacity has not been fully designed to support overall user comfort. These findings are in line with the research of Abdiyanto (2019) and Abdiyanto (2021) which emphasized that the quality of urban infrastructure needs to be seen as a single system, not just a partial fulfillment of physical elements.

In the aspect of service accessibility (X2), the results of the study show a stronger relationship with user satisfaction than with infrastructure capacity. Respondents assessed that ease of service access, travel time efficiency, and availability of public transportation are important factors in shaping the experience of using public services. These findings are in line with the concept of accessibility that places convenience, affordability, and connectivity as the main dimensions in urban transportation and service systems (Geurs & Van Wee, 2004).

The strong relationship between service accessibility and user satisfaction in this study corroborates the results of a study by Abdi Sugiarto (2018) and Abdi Sugiarto (2020), which concluded that public perception of public services is more influenced by the ease of access and clarity of services than the physical condition of infrastructure alone. In the context of the Medan-Deli Serdang area, the high daily commuter flow causes users to be more sensitive to the aspects of travel time, readability of facilities, and ease of changing modes.

The quantitative findings also show that the government responsiveness indicator obtained the lowest score on the user satisfaction variable (Y). This indicates that the community still feels limitations in handling infrastructure and public service problems. This condition is in line with the results of research by Cut Nuraini (2020) and Cut Nuraini (2022), which show that the satisfaction of public service users is greatly influenced by the perception of the speed and accuracy of managers' responses, especially in urban areas with high activity dynamics.

In terms of secondary data, this condition can be understood by looking at the characteristics of the research area. The Medan Amplas area has a high population density and functions as a gateway for movement to Deli Serdang Regency, while Tanjung Morawa is developing as an industrial and residential area that produces a large number of daily commuters. This combination of functions causes high pressure on infrastructure systems and public services. A similar situation was also found in previous studies that examined border areas and urban buffer areas, where the imbalance between activity growth and service quality improvement was the main problem (Cervero, 2013; Litman, 2017).

When compared to relevant previous research, the results of this study are consistent with the findings of Abdiyanto (2018), Abdiyanto (2020), and Abdi Sugiarto (2019) who stated that increasing user satisfaction cannot be achieved only through physical infrastructure development, but requires improving service quality, accessibility, and governance. Meanwhile, other research that is less relevant in the context of the region, but

is conceptually relevant, also shows that improvements to supporting facilities such as pedestrian paths and bus stops have a significant contribution to the user experience in various cities (Ewing & Handy, 2009; Pucher & Buehler, 2012).

The SWOT analysis conducted in this study strengthens these findings. The region's strength as a transportation node and connecting corridor provides great opportunities for service development, but weaknesses in supporting facilities and management responsiveness have the potential to hinder increased user satisfaction. The strategy formulated shows that the focus of development should be directed to improving the quality of accessibility and services, in line with the research findings of Abdiyanto (2021) and Abdi Sugiarto (2021) which emphasized the importance of an integrated approach in urban infrastructure management.

Overall, this discussion shows that the user experience in the Medan-Deli Serdang border area is shaped by the relationship between infrastructure capacity, service accessibility, and management quality. When accessibility and service are not optimal, user satisfaction tends to be held back even though basic infrastructure is available. These findings reinforce the argument that improving the quality of public services in border areas needs to be directed towards aspects that are directly felt by users, with the support of responsive policies and management.

Conclusion

Based on the results of the research, it can be concluded that the Medan-Deli Serdang border area is still able to carry out its basic function as a mobility corridor and regional movement node, but the quality of infrastructure and public services felt by users is not fully optimal. Infrastructure capacity is generally at a level sufficient to support people's daily activities, but limitations on supporting facilities, such as bus stops, pedestrian walkways, and surface utility arrangements, suggest that physical functionality has not been fully accompanied by comfort and ease of use. Service accessibility is more strongly related to user satisfaction levels than infrastructure capacity alone, indicating that ease of service access, travel time efficiency, and inter-regional connectivity are important factors in shaping user experience in the research area. The level of user satisfaction that tends to be in the adequate category, as well as the low assessment of management responsiveness, reflects the need for improved service quality and infrastructure governance that is more adaptive to the dynamics of border areas.

Based on these conclusions, recommendations that can be implemented are practically directed at several main aspects. First, improving the quality of transportation supporting facilities needs to be done through physical improvements to bus stops, the provision of sustainable and user-friendly pedestrian paths, and the arrangement of surface utilities to improve safety and comfort. Second, optimization of traffic management and public transportation services during peak hours can be done by adjusting routes, setting operating hours, and providing clearer travel information to reduce user uncertainty. Third, strengthening cross-regional coordination between the Medan City Government and the Deli Serdang Regency Government needs to be focused on handling border areas as a

unified service system, especially in infrastructure maintenance and management of public facilities. Fourth, increasing the responsiveness of infrastructure and public service managers can be done through easily accessible reporting mechanisms, scheduled follow-up improvements, and periodic evaluations based on user feedback. With the implementation of these recommendations, it is hoped that the quality of service accessibility and user satisfaction level in the Medan-Deli Serdang border area can increase gradually and sustainably.

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