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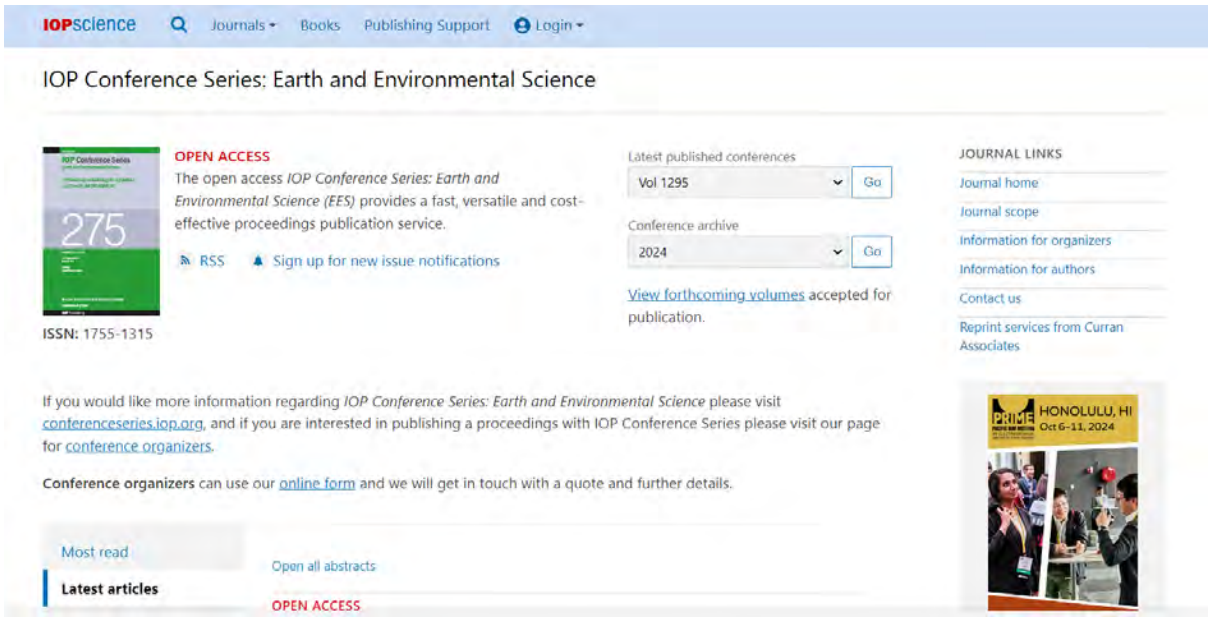
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The 6th International Symposium on Sustainable Urban Development (The 6th ISoSUD) 2023

The 6th INTERNATIONAL SYMPOSIUM ON SUSTAINABLE URBAN DEVELOPMENT (The 6th ISoSUD) 2023

The International Symposium on Sustainable Urban Development (ISoSUD) is a series of international activities organized by the Faculty of Landscape Architecture and Environmental Technology, Universitas Trisakti, Jakarta. The event is held once every 3 (three) years with themes related to current issues regarding sustainable urban development, in particular related to urban environmental management and environmental technologies. The activity aims to facilitate academics to publish their research results in order to enhance their scientific expertise as researchers.

The 6th ISoSUD in 2023 carried the theme "**From Recovery To Resilience: Building A Sustainable Future For A Better Life**" which means this symposium will focus on how we can recover from the difficult times caused by the COVID-19 pandemic and build a better future and sustainable. This theme also shows the importance of building resilience in facing future challenges, whether related to climate change, economic policies, or other social problems.

The COVID-19 pandemic that swept the world in the last four years has had a significant impact on human health, the global economy, and the daily lives of people around the world. It will take the concerted efforts of all countries and peoples to overcome this pandemic and rebuild the world after it. This pandemic underscores the need for global efforts to strengthen health systems, enhance societal resilience, strengthen international cooperation, and accelerate action to achieve sustainable development goals and combat climate change. This crisis provides an opportunity to make significant changes in the way we view and manage our economic and social activities and to create a world that is more sustainable and fairer for all people and our planet. Now is the time to make a difference, to make a profound systemic shift towards a more sustainable economy for the benefit of our people and our planet. In other words, now is the right time to undertake significant transformations in existing economic and social systems, which can help sustainably achieve the SDGs and fight climate change to ensure a better future for people and our planet. Overall, post-pandemic recovery must be based on the principles of sustainable development contained in the SDGs. By integrating the SDG goals into our recovery policies and actions, we can create a more sustainable, inclusive, and resilient future for our people and the world.

The 6th ISoSUD was held in the hybrid conference:

a. Day 1, on Wednesday, August 2nd, 2023, at Building M, 12th floor, Universitas Trisakti, Jakarta, Indonesia. There were 130 participants offline and 170 participants on the Zoom platform in the plenary session.

b. On day 2, on Thursday, August 3rd, 2023, using the Zoom meeting facility, 270 participants attended virtually on Day 2.

In this two-day International Symposium, experts, researchers, and academician shared their valuable insights and research findings. These esteemed presenters hail from 58 universities and institutions in Filipina, India, Indonesia, Iraq, Japan, Malaysia, Netherlands, Singapura, and Taiwan, reflecting the symposium's diverse and inclusive nature. The call paper system that has been used since the first ISoSUD in 2008 succeeded in inviting 165 manuscripts (more than 400 authors) that were presented offline and virtually. Then, 136 from 165 papers were selected further to be published in IOP Proceedings Indexed by Scopus. After another review process, 106 manuscripts were published in IOP EES. To improve the quality of the manuscripts, the organizing committee held a Coaching Clinic for Scientific Paper Writing on June 24th, 2023. Prof. Mohamad Ali Fulazzaky, Ph.D, delivered the coaching clinic.

The 6th ISoSUD 2023 involved co-host universities consisting of five from within the country and four from abroad: Universitas Jember (UNEJ), Jember, Indonesia; Universitas Islam Indonesia (UII), Yogyakarta, Indonesia; Universitas Pasundan (UNPAS), Bandung, Indonesia; Institut Teknologi Sepuluh November (ITS), Surabaya, Indonesia; Universitas Indonesia (UI), Jakarta, Indonesia; Universiti Teknologi Malaysia (UTM), Malaysia; Universiti Tun Hussein Onn Malaysia (UTHM), Malaysia; The University of Kitakyushu, Japan; Chung Yuan Christian University (CYCU), Taiwan. During the class presentation session, a presentation from the participants representing the 6th ISoSUD co-host was carried out. Besides that, The 6th ISoSUD 2023 was supported as well by the Indonesian Society of Sanitary and Environment Engineers (IATPI), which has continuously supported our symposium since 2008. And sponsored by PT Enviro Cipta Lestari.

In the plenary session, some main speakers delivered more focused seminar themes; they were:

Welcoming Speech:

Prof. Dr. Kadarsah Suryadi DEA – Rector of Universitas Trisakti

Opening Speech:

Ir. Diana Kusumastuti, MT. - Director General of Human Settlements, Ministry of Public Works and Public Housing Indonesia

Plenary Speakers:

Day-1

1. Prof. Lin Chi Wang - Chung Yuan Christian University (CYCU), Taiwan
2. Prof. Ir. Joni Hermana M.Sc.ES., Ph.D – Institut Teknologi Sepuluh November (ITS), Indonesia

Day 2

3. Prof. Ts. Dr. Azmi Bin Aris - Universiti Teknologi Malaysia (UTM), Malaysia
4. Prof. Dr. Eng. Toru Matsumoto - University of Kitakyushu, Japan
5. Associate Prof. Victor R Savage – Nanyang Technological University (NTU), Singapore

We believe that this event will be able to facilitate good networking among researchers, scientists, engineers, and practitioners with common interests, especially in sharing the latest research results, ideas, development, and applications in Sustainable Urban Development. Hopefully, all participants enjoyed the seminar and found this experience inspiring and helpful in their professional field. Thank you for choosing the 6th ISoSUD as your symposium reference. Let us embrace the spirit of collaboration and innovation as we strive towards a sustainable future for a better life. We hope to have your pleasant support and participation in the next three years on The 7th ISoSUD 2026.

Sincerely,
Assoc. Prof. Ariani Dwi Astuti, ST., MT., PhD
Chairperson of The 6th International Symposium on Sustainable Urban Development (ISoSUD) 2023

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Study of Trans Siginjai shelter coverage on corridor I and II in Jambi City of Indonesia

Study of Trans Siginjai shelter coverage on corridor I and II in Jambi City of Indonesia

M A Setiawan, M C Adriana* and A Sitawati

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*martina.cecilia@trisakti.ac.id

Abstract. In order to meet mobility needs and prevent congestion, the government introduced and began operating Trans Siginjai Jambi in 2017. The low load factor value, however, indicates that its utilization is currently not optimal in supporting the mobility of people in Jambi City. Bus Rapid Transit (BRT) is a closed transportation system, which bus shelters is become one of the main infrastructures to support its operation. The lack of bus shelters will influence the bus accessibility and the number of passengers. Therefore, the aim of this study is to examine how bus stop services of Trans Siginjai have served community movements in Jambi City's Corridor I and Corridor II. Comparative descriptive analysis and geographical analysis are utilized in this study to perform coverage analysis. The findings of this investigation demonstrate that up to 8 stops in Corridor I and up to 10 stops in Corridor II fail to adhere to the distance requirements. Trans Siginjai only cover 16.99% of the area and only 21.18% of residential areas along the both corridors. In order to improve the accessibility, more bus stops are required, especially in the dense settlement area.

1. Introduction

Jambi City is a developing city with a population density of 604,738 people and a density per km of 3,561 people/km^2 [2]. As the Capital City of the Province, Jambi City plays a role as the center of government, trade, and services, as well as an economic center that attracts urbanization flows of residents to live and work in Jambi City [3]. However, the city of Jambi is inseparable from transportation problems. Ade [4] stated that in its development, Jambi City has experienced a significant increase in traffic volume. They can be proven by the increase private vehicle ownership in Jambi City. In 2018, private vehicle ownership totaled 511,316 units; in 2020, it rose to 779,749 units. These conditions emerge the urgency of providing public transportation in Jambi City as an effort to reduce congestion. Responding to this issue, the Jambi City Government, through Jambi Governor Decree No. 341 of 2017, implements Bus Rapid Transit (BRT) in Jambi urban area.

BRT (Bus Rapid Transit) is a form of high-quality bus system which adopt the performance and amenity of rail-transit system (high capacity, faster speed, more comfort, time efficiency) with relatively lower cost [5]. The provision of public transportation in the form of BRT by the Jambi City government, widely known as Trans Siginjai. Trans Siginjai expected to accommodate the needs of the communities and solve the congestion. Trans Siginjai Jambi had inaugurate on December 14th, 2017. Until now, Trans Siginjai Jambi has served two corridors with an available fleet of 10 units. Each corridor has five units of fleets. Corridor I was operating in early 2018, while Corridor II has been operating since 2019.

Corridor I (17.3 km) connect Sijenjang Terminal - Simpang Rimbo. Meanwhile, Corridor II (17.05 km) connects the Jambi Provincial DPRD Office - Jambi Sultan Thaha Airport.

However, its operation has not been optimal because of the low load factor. Based on data from the Jambi Provincial Transportation Office, the load factor value for the Trans Siginjai on Corridor I (2019) was only 25-30% and only 21 – 26% on Corridor II (2020). It means that Trans Siginjai is not optimal in accommodating community mobilization by referring to standard provisions in Certificate of Director General 687 of 2002 by 70%.

Many factors influence the low load factor value of the Trans Siginjai. Based on the previous studies, there were problems with its services, such as uncertainty of departure schedules, inadequate bus stop facilities, the friendliness of the driver, bus management, route information, and the lack of bus fleets [4, 6-8]. Moreover, a perception study by Makarim [9] revealed that the lack of bus stops and improper locations made people reluctant to use Trans Siginjai. Bus stops in the BRT system are one of the main infrastructures; because it is the only access point for the passenger to use the bus. The lack of bus stops and the improper locations will make it difficult for people to access, which may also will the factors affecting the low load factor. Therefore, this study aims to examine the coverage of Trans Siginjai Jambi in serving community needs in Corridor I and Corridor II Jambi City.

2. Methods

2.1. Data Collection

Data is an important instrument in conducting research. The data used in this study was secondary. In general secondary data is in the form of historical records or reports. The data has been compile in published and unpublished archives (documentary data). The data in this research was obtained by visiting agencies issuing related data, such as the Jambi Province Transportation Service, which has data on the Distribution of Routes and Bus Stops and the Jambi City Regional Development Planning Agency (BAPPEDA), which has regional administration data and land use.

2.2. Data Analysis

The data analysis techniques used in this study are as follows:

a. Comparative Descriptive Analysis is an analytical method that is a combination of description, analysis, and comparison by Ratna [10]. This method is used to describe and analyze the availability of the number of Trans Siginjai Jambi BRT shelters on Corridor I and Corridor II in Jambi City. The results compared with the standard provisions set by the 2016 BRT Standard.
b. The percentage of area and location of settlements served by the two Trans Siginjai Jambi BRT corridors was assessed based on the distribution of the stop points. In this case, the scope of the Trans Siginjai service was based on the range of bus stops. Service range Analysis of the bus stop used the buffer method to measure the service radius of the Trans Siginjai stops. In determining the radius of the bus stop service, the assumption is that the optimal distance that can be tolerated by a person walking to a bus stop is 500 meters [11].

3. Results and Discussions

3.1. Availability of Trans Siginjai Jambi BRT Stops Corridor I and Corridor II in Jambi City

The availability of bus stops can be seen from the distance between bus stops. According to data obtained from the Jambi Province Department of Transportation (DISHUB), the Trans Siginjai Jambi BRT is currently operating on 2 corridors in Jambi City. Corridor I consist of 12 bus stops with the route towards Terminal Sejinjang – Simp. Rimbo and vice versa. While Corridor II consists of 14 bus stops with the route to the Jambi Governor's Office - Jambi Sultan Thaha Airport and vice versa. In the BRT system, the distance between stops is determined for optimal operations. So that the analysis regarding the availability of these stops also takes into account the distances between available stops which were then compared with the standard distances between stops based on the 2016 BRT Standard. According to the

2016 BRT Standard, the effective distance between stops is in the range of 300 – 800 m. The suitability of the distance between the bus stops as the stopping points of the Trans Siginjai Jambi BRT on Corridors I and II with the 2016 BRT Standard is presented in Table 1 and Table 2.

Table 1 shows that there are only 4 of the 12 stops in Corridor I meet the shelter distance standard according to the 2016 BRT Standard, including:

1. Unja Telenai Bus Stop – UIN Telanai Bus Stop;
2. Lrg. H. Ibrahim Bus Stop – LP Kelas II Jambi Bus Stop;
3. Simp. Rimbo Bus Stop – Simp. Rimbo Gas Station Stop;
4. UIN Telanai Bus Stop – Unja Telanai Bus Stop.

Meanwhile, there are 8 bus stops in Corridor I that do not meet the shelter distance standard according to the 2016 BRT Standard (300 – 800 m). The distance between bus stops that are not in accordance with the 2016 BRT Standard varies, starting from the Inspectorate Bus Stop – Unja Telanai Bus Stop with a distance of 1,033 m and the Unja Telanai Bus Stop – Sejinjang Terminal Bus Stop with the furthest distance between the 8 bus stops which is not in accordance with BRT The 2016 standard, which reaches 11,515 m.

Table 1. Suitability of Bus Stops Distance on Corridor I

Between Bus Stops	Distance between Bus Stops (m)		Suitability
	Standard	Existing	
Sejinjang Terminal – Simp. Rimbo Directions			
Sejinjang Terminal - Inspektorat	300-800	10,567	Not suitable
Inspektorat– Unja Telanai	300-800	1,033	Not suitable
Unja Telanai– UIN Telanai	300-800	568	Suitable
UIN Telanai– Lrg. H. Ibrahim	300-800	1,645	Not suitable
Lrg. H. Ibrahim– LP Kelas II Jambi	300-800	428	Suitable
LP Kelas II Jambi– Damri Simp. Rimbo	300-800	2,460	Not suitable
Simp. Rimbo – Sejinjang Terminal Directions			
Simp. Rimbo– Simp. Rimbo Gas Station	300-800	428	Suitable
Simp. Rimbo Gas Station – LP Kelas II Jambi	300-800	2,011	Not suitable
LP Kelas II Jambi - UIN Telanai	300-800	2,132	Not suitable
UIN Telanai – Unja Telanai	300-800	639	Suitable
Unja Telanai– Sejinjang Terminal	300-800	11,515	Not suitable

Moreover, there are total 14 bus stops on Corridor II with route length of 17.95 Km. Table 2 shows that there are 10 of the 14 stops in Corridor II don't meet the distance criteria with distances varies from 1,170 m to 4,566 m. There are only 4 other stops have met bus stop standard distances according to the 2016 BRT Standard such as:

1. Jambi Educational Quality Assurance Council (LPMP) Bus Stop - Taman Jaksa Bus Stop;
2. Jambi Prima Mall Bus Stop – Bakeuda Prov. Jambi Bus Stop;
3. Taman Makam Pahlawan Bus Stop – Jambi Prima Mall Bus Stop;
4. Taman Jaksa Bus Stop – Grapari Telkomsel Bus Stop

Table 2. Suitability of Bus Stops Distance on Corridor II

Between Bus Stops	Distance between Bus Stops (m) Standard	Existing	Conformity
Jambi Governor's Office – Jambi Sultan Thaha Airport Directions			
Jambi DPRD - Jambi Educational Quality Assurance Council (LPMP)	300-800	1,490	Not suitable
Jambi Educational Quality Assurance Council (LPMP) - Taman Jaksa	300-800	750	Suitable
Taman Jaksa – Pasar Angso Duo	300-800	2,742	Not suitable
Pasar Angso Duo – Jambi Prima Mall	300-800	2,059	Not suitable
Jambi Prima Mall – Bakeuda Prov. Jambi	300-800	510	Suitable
Bakeuda Prov. Jambi – Taman PKK Tehok	300-800	1,170	Not suitable
Taman PKK Tehok – Simp. Candra	300-800	1,727	Not suitable
Simp. Candra – Jambi Airport	300-800	1,621	Not suitable
Jambi Sultan Thaha Airport – Jambi Governor's Office Directions			
Jambi Airport – Taman Makam Pahlawan	300-800	4,566	Not suitable
Taman Makam Pahlawan– Jambi Prima Mall	300-800	455	Suitable
Jambi Prima Mall – Simp. Sungai Maram	300-800	1,731	Not suitable
Simp. Sungai Maram – Taman Jaksa	300-800	3,019	Not suitable
Taman Jaksa – Grapari Telkomsel	300-800	735	Suitable
Grapari Telkomsel - Jambi DPRD	300-800	1,563	Not suitable

Based on the discrepancies in the distances between bus stops in Corridor I and Corridor II, it is necessary to identify the distance between bus stops based on land use. The land use analysis shows that the Trans Siginjai shelters don't adequately serve the public attractions in Jambi City. Many residential areas, education facilities, health facilities, tourism areas, and trade and services areas are not covered by the bus stops, both in corridor I and II. The land use map is illustrated in Figure 1.

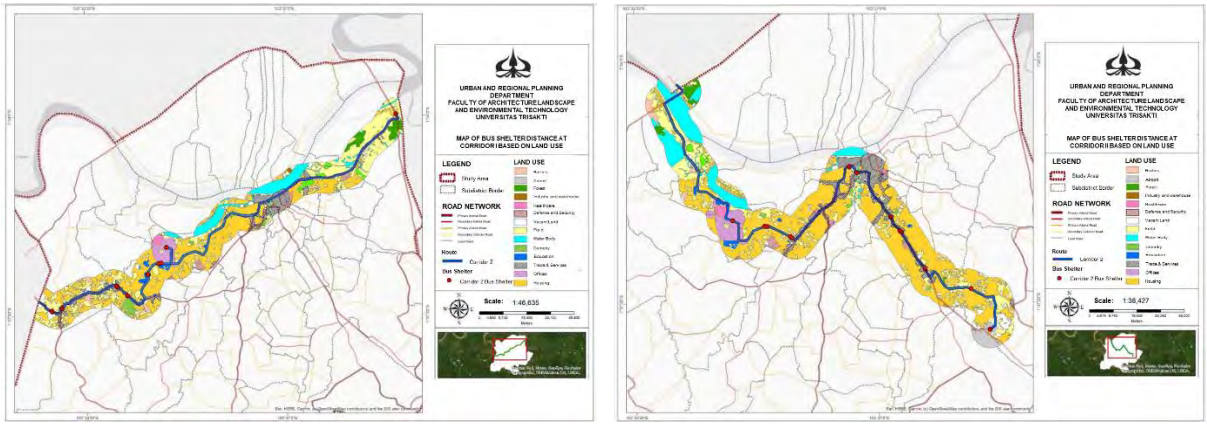

Figure 1. Distance map between corridor I and II bus stops based on land use

3.2. Service Coverage of the Trans Siginjai Jambi BRT Stop

Service coverage is one of the factors that must be considered in determining the location of the bus stop. In this study, the service coverage radius used is 500 m. This distance represents the optimal

distance that can tolerated by someone to walk to the bus stop [11]. Based on spatial buffer analysis using ArcMap 10.5 software, they are only 30 sub-districts or 48% of the 62 sub-districts within the service coverage area. The highest percentage of service coverage of 81.25% located in Talang Jauh Village, and the lowest service coverage of 0.002% is in Buluran Kenali Village. It can be seen that the service coverage of the Trans Siginjai Jambi BRT in Corridor I and Corridor II is 16.99% or with a serviced area of 10.96 km^2, as shown in Table 3. The coverage area of the Trans Siginjai is illustrated in Figure 2.

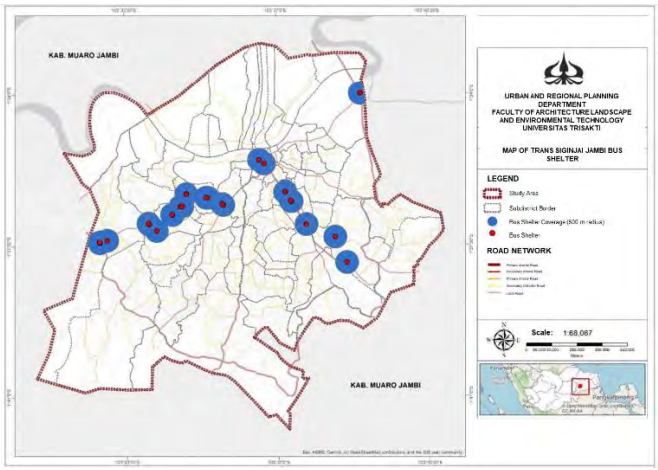

Figure 2. Map of Trans Siginjai Jambi BRT service coverage based on area

Table 3. Service Coverage of Jambi Trans Siginjai BRT Stops Based on Land Area

Sub-District	Area (Km^2)	Serviced Area	
		Area (Km^2)	%
Kenali Besar	12.48	1.40	11.24%
Rawa Sari	2.58	0.42	16.48%
Selamat	1.16	0.14	12.09%
Sungai Putri	1.52	1.24	81.08%
Legok	2.93	0.05	1.64%
Murni	0.28	0.0001	0.03%
Solok Sipin	0.80	0.08	9.65%
Pasir Putih	7.03	1.49	21.23%
Wijaya Putra	0.85	0.10	11.42%
Pakuan Baru	0.76	0.39	51.14%
Tambak Sari	0.86	0.67	77.73%
The Hok	2.78	0.23	8.11%
Budiman	0.13	0.04	32.82%
Talang Banjar	1.98	0.0003	0.02%
Sijinjang	6.76	0.55	8.15%

Table 3. Service Coverage of Jambi Trans Siginjai BRT Stops Based on Land Area (cont.)

Sub-District	Area (Km^2)	Serviced Area	
		Area (Km^2)	Area (Km^2)
Jelutung	1.73	0.006	0.36%
Payo Lebar	0.88	0.16	18.08%
Cempaka Putih	0.74	0.10	13.06%
Talang Jauh	0.51	0.42	81.25%
Paal Merah	4.63	0.16	3.37%
Beringin	1.12	0.69	62.07%
Sungai Asam	0.63	0.19	30.97%
Orang Kayo Hitam	0.17	0.13	75.29%
Pasar Jambi	0.26	0.02	8.05%
Jelmu	1.15	0.0008	0.07%
Mudung Laut	1.67	0.009	0.54%
Telanaipura	1.25	0.95	75.74%
Simpang IV Sipin	199	1.17	58.94 %
Buluran Kenali	1.92	0.00004	0.002 %
Pematang Sulur	2.95	0.16	5.49 %
Total	64.50	10.96	16.99 %

Furthermore, the settlement area covered by Trans Siginjai is only around 5.10 km^2 or only 21.18% of residential areas along corridor I and II in Jambi City (Table 4). The settlements that have not been reached by the Trans Siginjai shelter are in the sub-districts of Bagan Pete, Beliung, Mayang Mangurai, Pasir Panjang, Tanjung Raden, Tanjung Pasir, Olak Kemang, Ulu Gedong, Sulanjana, Tanjung Sari, Tanjung Pinang, Rajawali, Kebon Handil, Handil Jaya, Simpang III Sipin, Suka Karya, Kenali Asam Bawah, Kenali Asam Atas, Paal Lima, Talang Bakung, Lingkar Selatan, Eka Jaya, Payo Selincah, Pasar Jambi, Tengah, Jelmu, Mudung Laut, Arab Melayu, Tahtul Yaman, Tanjung Johor, dan Penyengat Rendah as well as several sub-districts that are part of the Trans Siginjai Jambi BRT route such as the sub-districts of Kasang, Kasang Jaya, Lebak Bandung, Buluran Kenali, dan Teluk Kenali. In areas that have not been serve, some areas have the highest residential area, such as the Tanjung Pinang Sub-Districts, with a settlement area of 96% of the total area. It is followed by the Sub-Districts of Beliung, Sulanjana, Tanjung Sari, Rajawali, Kebon Handil, Lebak Bandung, Handil Jaya, dan Simpang III Sipin, with a settlement area of more than 50% of the area of each of these areas. The illustrated map residential coverage is shows in Figure 3.

Table 4. Residential Area Coverage of the Trans Siginjai Jambi BRT Stop

Sub-District	Area (Km^2)	Residential Land Use	
		Area (Km^2)	Served
Kenali Besar	3.18	0.47	14.71%
Rawa Sari	1.38	0.12	8.85%
Selamat	0.62	0.10	15.52%

Table 4. Residential Area Coverage of the Trans Siginjai Jambi BRT Stop (cont.)

Sub-District	Area (Km^2)	Residential Land Use	
		Area (Km^2)	Area (Km^2)
Sungai Putri	0.90	0.79	88.41%
Legok	0.46	0.03	6.20%
Murni	0.20	0.00002	0.01%
Solok Sipin	0.63	0.05	8.33%
Pasir Putih	3.55	0.83	23.29%
Wijaya Pura	0.64	0.09	14.14%
Pakuan Baru	0.64	0.33	52.53%
Tambak Sari	0.63	0.46	73.03%
The Hok	1.93	0.13	6.73%
Budiman	0.07	0.03	39.17%
Talang Banjar	1.23	0.0003	0.03%
Sijinjang	0.43	0.09	19.85%
Jelutung	1.07	0.01	0.59%
Payo Lebar	0.59	0.10	16.63%
Cempaka Putih	0.46	0.07	15.16%
Talang Jauh	0.26	0.21	79.82%
Paal Merah	1.39	0.003	0.19%
Beringin	0.39	0.18	47.17%
Sungai Asam	0.25	0.01	5.95%
Telanaipura	0.28	0.16	55.61%
Simpang IV Sipin	1.28	0.72	56.19%
Pematang Sulur	1.62	0.12	7.42%
Total	24.08	5.10	21.18%

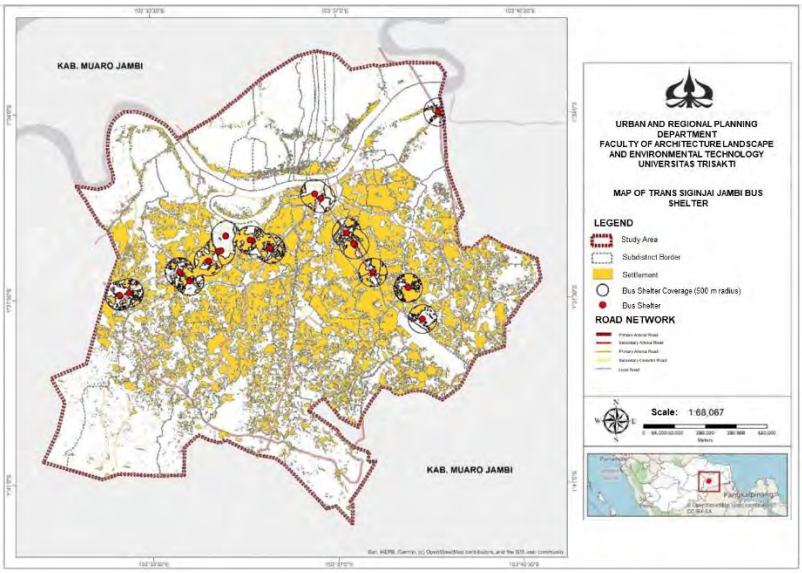

Figure 3. Service coverage map of the Trans Siginjai Jambi BRT stop based on residential areas

The coverage analysis of Trans Siginjai shelter indicate the inadequate bus stops according to its distance and area served. The lack of availability causing the low accessibility of Trans Siginjai may affecting the low-load factor. The results of this study support the previous research by Makarim [9] that stated the lack of bus stops, and the location are reasons people become reluctant to use Trans Siginjai. Accessibility is the most important service attribute [12], as stated by Sung et al. [13] that the accessibility of a BRT bus stop plays an important role in increasing the number of users. It is due to the fact that public transportation services with a high level of bus stop accessibility will be very easy to reach by the community, so the opportunity to get more enthusiasts and the number of users is very likely to increase.

Optimizing the service areas of the Trans Siginjai Jambi BRT service is highly dependent on the ease of access. As stated by Riawan et al. [14] that the important thing in terms of accessibility is how public transport can ensure that the services provided can reach as many urban areas as possible. Especially in residential areas, considering the settlements are one part of land use which is the most important aspect in creating the largest movement within cities. One of the ways to increase the accessibility of the Trans Siginjai Jambi BRT is by providing more bus stops. The more bus stops available, the more residential areas will be reached, especially for movement attraction areas and facilities such as offices, education, health, tourism, and trade and services. If the service coverage is high for these areas, the users may also be higher. Many bus stops should be placed in these areas, because they have a great opportunity to attract potential users.

4. Conclusion

To meet mobility needs and prevent congestion, the government introduced and began operating Trans Siginjai Jambi in 2017. The low load factor value, however, indicates that its utilization is currently not optimal in supporting the mobility of people in Jambi City. Comparative descriptive analysis and geographical analysis are utilized in this study to perform coverage analysis. Based on the coverage of the services of the Trans Siginjai Jambi BRT Shelters in Corridor I and II in Jambi City, known that 8 out of 12 available shelters in Corridor I and 10 out of 14 stops in Corridor II do not meet the standards according to the BRT Standard. The lack of bus stops resulted in low service coverage, which only served 16.99% with an area of 10.96 km^2. It is causing the serviced settlement area to be only 21.18% or with a serviced area of 5.10 km^2 along both corridors. To improve accessibility, more bus stops are required, especially in the dense settlement area.

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Study of Trans Siginjai Shelter Coverage on Corridor I and II in Jambi City of Indonesia

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Abstract. In order to meet mobility needs and prevent congestion, the government introduced and began operating Trans Siginjai Jambi in 2017. The low load factor value, however, indicates that its utilization is currently not optimal in supporting the mobility of people in Jambi City. Bus Rapid Transit (BRT) is a closed transportation system, which bus shelters is become one of the main infrastructures to support its operation. The lack of bus shelters will influence the bus accessibility and the number of passengers. Therefore, the aim of this study is to examine how bus stop services of Trans Siginjai have served community movements in Jambi City's Corridor I and Corridor II. Comparative descriptive analysis and geographical analysis are utilized in this study to perform coverage analysis. The findings of this investigation demonstrate that up to 8 stops in Corridor I and up to 10 stops in Corridor II fail to adhere to the distance requirements. Trans Siginjai only cover 16.99% of the area and only 21.18% of residential areas along the both corridors. In order to improve the accessibility, more bus stops are required, especially in the dense settlement area.

Keywords: Shelter Coverage, Bus Rapid Transit, Trans Siginjai, Jambi City, Bus Shelter

1. Introduction

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However, its operation has not been optimal because of the low load factor. Based on data from the Jambi Provincial Transportation Office, the load factor value for the Trans Siginjai on Corridor I (2019) was only 25-30% and only 21 – 26% on Corridor II (2020). It means that Trans Siginjai is not optimal in accommodating community mobilization by referring to standard provisions in Certificate of Director General 687 of 2002 by 70%.

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3. Result and Discussion

3.1. Availability of Trans Siginjai Jambi BRT Stops Corridor I and Corridor II in Jambi City

The availability of bus stops can be seen from the distance between bus stops. According to data obtained from the Jambi Province Department of Transportation (DISHUB), the Trans Siginjai Jambi BRT is currently operating on 2 corridors in Jambi City. Corridor I consist of 12 bus stops with the route towards Terminal Sejinjang – Simp. Rimbo and vice versa. While Corridor II consists of 14 bus stops with the route to the Jambi Governor's Office - Jambi Sultan Thaha Airport and vice versa. In the BRT system, the distance between stops is determined for optimal operations. So that the analysis regarding the

availability of these stops also takes into account the distances between available stops which were then compared with the standard distances between stops based on the 2016 BRT Standard. According to the 2016 BRT Standard, the effective distance between stops is in the range of 300 – 800 m. The suitability of the distance between the bus stops as the stopping points of the Trans Siginjai Jambi BRT on Corridors I and II with the 2016 BRT Standard is presented in Table 1 and Table 2.

Table 1 shows that there are only 4 of the 12 stops in Corridor I meet the shelter distance standard according to the 2016 BRT Standard, including:

1. Unja Telenai Bus Stop – UIN Telanai Bus Stop;
2. Lrg. H. Ibrahim Bus Stop – LP Kelas II Jambi Bus Stop;
3. Simp. Rimbo Bus Stop – Simp. Rimbo Gas Station Stop;
4. UIN Telanai Bus Stop – Unja Telanai Bus Stop.

Meanwhile, there are 8 bus stops in Corridor I that do not meet the shelter distance standard according to the 2016 BRT Standard (300 – 800 m). The distance between bus stops that are not in accordance with the 2016 BRT Standard varies, starting from the Inspectorate Bus Stop – Unja Telanai Bus Stop with a distance of 1,033 m and the Unja Telanai Bus Stop – Sejinjang Terminal Bus Stop with the furthest distance between the 8 bus stops which is not in accordance with BRT The 2016 standard, which reaches 11,515 m.

Table 1. Suitability of Bus Stops Distance on Corridor I

Between Bus Stops	Distance between Bus Stops (m)		Suitability
	Standard	Existing	
Sejinjang Terminal – Simp. Rimbo Directions			
Sejinjang Terminal - Inspektorat	300-800	10,567	Not suitable
Inspektorat– Unja Telanai	300-800	1,033	Not suitable
Unja Telanai– UIN Telanai	300-800	568	Suitable
UIN Telanai– Lrg. H. Ibrahim	300-800	1,645	Not suitable
Lrg. H. Ibrahim– LP Kelas II Jambi	300-800	428	Suitable
LP Kelas II Jambi– Damri Simp. Rimbo	300-800	2,460	Not suitable
Simp. Rimbo – Sejinjang Terminal Directions			
Simp. Rimbo– Simp. Rimbo Gas Station	300-800	428	Suitable
Simp. Rimbo Gas Station – LP Kelas II Jambi	300-800	2,011	Not suitable
LP Kelas II Jambi - UIN Telanai	300-800	2,132	Not suitable
UIN Telanai – Unja Telanai	300-800	639	Suitable
Unja Telanai– Sejinjang Terminal	300-800	11,515	Not suitable

Moreover, there are total 14 bus stops on Corridor II with route length of 17.95 Km. Table 2 shows that there are 10 of the 14 stops in Corridor II don't meet the distance criteria with distances varies from 1,170 m to 4,566 m. There are only 4 other stops have met bus stop standard distances according to the 2016 BRT Standard such as:

1. Jambi Educational Quality Assurance Council (LPMP) Bus Stop - Taman Jaksa Bus Stop;
2. Jambi Prima Mall Bus Stop – Bakeuda Prov. Jambi Bus Stop;
3. Taman Makam Pahlawan Bus Stop – Jambi Prima Mall Bus Stop;
4. Taman Jaksa Bus Stop – Grapari Telkomsel Bus Sto

Table 2. Suitability of Bus Stops Distance on Corridor II

Between Bus Stops	Distance between Bus Stops (m)		Conformity
	Standard	Existing	

Jambi Governor's Office – Jambi Sultan Thaha Airport Directions			
Jambi DPRD - Jambi Educational Quality Assurance Council (LPMP)	300-800	1,490	Not suitable
Jambi Educational Quality Assurance Council (LPMP) - Taman Jaksa	300-800	750	Suitable
Taman Jaksa – Pasar Angso Duo	300-800	2,742	Not suitable
Pasar Angso Duo – Jambi Prima Mall	300-800	2,059	Not suitable
Jambi Prima Mall – Bakeuda Prov. Jambi	300-800	510	Suitable
Bakeuda Prov. Jambi – Taman PKK Tehok	300-800	1,170	Not suitable
Taman PKK Tehok – Simp. Candra	300-800	1,727	Not suitable
Simp. Candra – Jambi Airport	300-800	1,621	Not suitable
Jambi Sultan Thaha Airport – Jambi Governor's Office Directions			
Jambi Airport – Taman Makam Pahlawan	300-800	4,566	Not suitable
Taman Makam Pahlawan– Jambi Prima Mall	300-800	455	Suitable
Jambi Prima Mall – Simp. Sungai Maram	300-800	1,731	Not suitable
Simp. Sungai Maram – Taman Jaksa	300-800	3,019	Not suitable
Taman Jaksa – Grapari Telkomsel	300-800	735	Suitable
Grapari Telkomsel - Jambi DPRD	300-800	1,563	Not suitable

Based on the discrepancies in the distances between bus stops in Corridor I and Corridor II, it is necessary to identify the distance between bus stops based on land use. The land use analysis shows that the Trans Siginjai shelters don't adequately serve the public attractions in Jambi City. Many residential areas, education facilities, health facilities, tourism areas, and trade and services areas are not covered by the bus stops, both in corridor I and II. The land use map is illustrated in Figure 1.

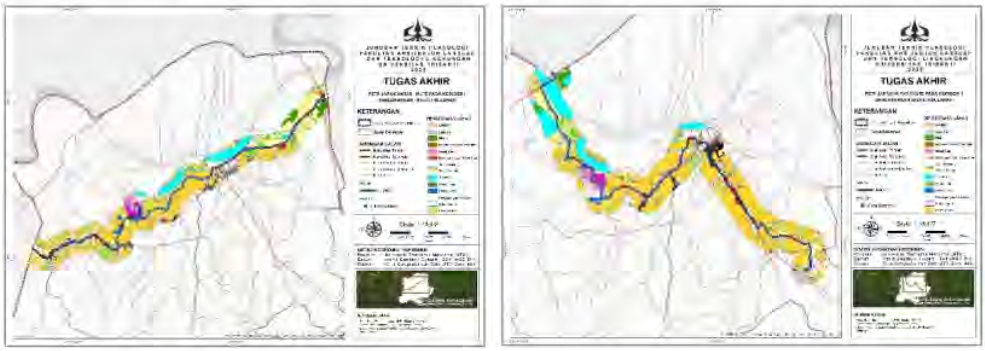

Figure 1. Distance Map between Corridor I and II Bus Stops Based on Land Use

3.2. Service Coverage of the Trans Siginjai Jambi BRT Stop

Service coverage is one of the factors that must be considered in determining the location of the bus stop. In this study, the service coverage radius used is 500 m. This distance represents the optimal distance that can tolerated by someone to walk to the bus stop [11]. Based on spatial buffer analysis using ArcMap 10.5 software, they are only 30 sub-districts or 48% of the 62 sub-districts within the service coverage area. The highest percentage of service coverage of 81.25% located in Talang Jauh Village, and the lowest service coverage of 0.002% is in Buluran Kenali Village. It can be seen that the service coverage of the Trans Siginjai Jambi BRT in Corridor I and Corridor II is 16.99% or with a serviced area of 10.96 km^2, as shown in table 3. The coverage area of the Trans Siginjai is illustrated in Figure 2.

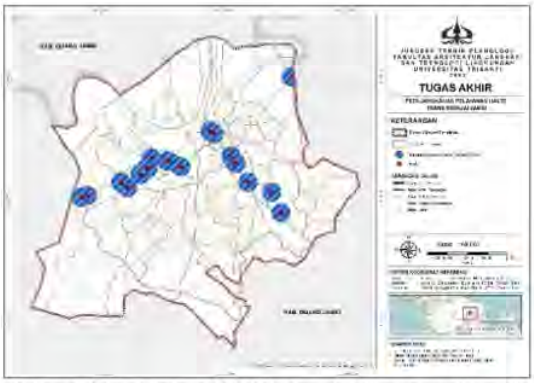

Figure 2. Map of Trans Siginjai Jambi BRT Service Coverage Based on Area

Table 3. Service Coverage of Jambi Trans Siginjai BRT Stops Based on Land Area

Sub-District	Area (Km^2)	Serviced Area	
		Area (Km^2)	%
Kenali Besar	12.48	1.40	11.24%
Rawa Sari	2.58	0.42	16.48%
Selamat	1.16	0.14	12.09%
Sungai Putri	1.52	1.24	81.08%
Legok	2.93	0.05	1.64%
Murni	0.28	0.0001	0.03%
Solok Sipin	0.80	0.08	9.65%
Pasir Putih	7.03	1.49	21.23%
Wijaya Putra	0.85	0.10	11.42%
Pakuan Baru	0.76	0.39	51.14%
Tambak Sari	0.86	0.67	77.73%
The Hok	2.78	0.23	8.11%
Budiman	0.13	0.04	32.82%
Talang Banjar	1.98	0.0003	0.02%
Sijinjang	6.76	0.55	8.15%
Jelutung	1.73	0.006	0.36%
Payo Lebar	0.88	0.16	18.08%
Cempaka Putih	0.74	0.10	13.06%
Talang Jauh	0.51	0.42	81.25%
Paal Merah	4.63	0.16	3.37%
Beringin	1.12	0.69	62.07%
Sungai Asam	0.63	0.19	30.97%

Sub-District	Area (Km^2)	Serviced Area	
		Area (Km^2)	%
Orang Kayo Hitam	0.17	0.13	75.29%
Pasar Jambi	0.26	0.02	8.05%
Jelmu	1.15	0.0008	0.07%
Mudung Laut	1.67	0.009	0.54%
Telanaipura	1.25	0.95	75.74%
Simpang IV Sipin	199	1.17	58.94 %
Buluran Kenali	1.92	0.00004	0.002 %
Pematang Sulur	2.95	0.16	5.49 %
Total	64.50	10.96	16.99 %

Furthermore, the settlement area covered by Trans Siginjai is only around 5.10 km^2 or only 21.18% of residential areas along corridor I and II in Jambi City (see table 4). The settlements that have not been reached by the Trans Siginjai shelter are in the sub-districts of Bagan Pete, Beliung, Mayang Mangurai, Pasir Panjang, Tanjung Raden, Tanjung Pasir, Olak Kemang, Ulu Gedong, Sulanjana, Tanjung Sari, Tanjung Pinang, Rajawali, Kebon Handil, Handil Jaya, Simpang III Sipin, Suka Karya, Kenali Asam Bawah, Kenali Asam Atas, Paal Lima, Talang Bakung, Lingkar Selatan, Eka Jaya, Payo Selincah, Pasar Jambi, Tengah, Jelmu, Mudung Laut, Arab Melayu, Tahtul Yaman, Tanjung Johor, dan Penyengat Rendah as well as several sub-districts that are part of the Trans Siginjai Jambi BRT route such as the sub-districts of Kasang, Kasang Jaya, Lebak Bandung, Buluran Kenali, dan Teluk Kenali. In areas that have not been serve, some areas have the highest residential area, such as the Tanjung Pinang Sub-Districts, with a settlement area of 96% of the total area. It is followed by the Sub-Districts of Beliung, Sulanjana, Tanjung Sari, Rajawali, Kebon Handil, Lebak Bandung, Handil Jaya, dan Simpang III Sipin, with a settlement area of more than 50% of the area of each of these areas. The illustrated map residential coverage is shows in Figure 3.

Table 4. Residential Area Coverage of the Trans Siginjai Jambi BRT Stop

Sub-District	Area (Km^2)	Residential Land Use	
		Area (Km^2)	Served
Kenali Besar	3.18	0.47	14.71%
Rawa Sari	1.38	0.12	8.85%
Selamat	0.62	0.10	15.52%
Sungai Putri	0.90	0.79	88.41%
Legok	0.46	0.03	6.20%
Murni	0.20	0.00002	0.01%
Solok Sipin	0.63	0.05	8.33%
Pasir Putih	3.55	0.83	23.29%
Wijaya Pura	0.64	0.09	14.14%
Pakuan Baru	0.64	0.33	52.53%
Tambak Sari	0.63	0.46	73.03%
The Hok	1.93	0.13	6.73%

Sub-District	Area (Km^2)	Residential Land Use	
		Area (Km^2)	Served
Budiman	0.07	0.03	39.17%
Talang Banjar	1.23	0.0003	0.03%
Sijinjang	0.43	0.09	19.85%
Jelutung	1.07	0.01	0.59%
Payo Lebar	0.59	0.10	16.63%
Cempaka Putih	0.46	0.07	15.16%
Talang Jauh	0.26	0.21	79.82%
Paal Merah	1.39	0.003	0.19%
Beringin	0.39	0.18	47.17%
Sungai Asam	0.25	0.01	5.95%
Telanaipura	0.28	0.16	55.61%
Simpang IV Sipin	1.28	0.72	56.19%
Pematang Sulur	1.62	0.12	7.42%
Total	24.08	5.10	21.18%

Figure 3. Service Coverage Map of the Trans Siginjai Jambi BRT Stop Based on Residential Areas

The coverage analysis of Trans Siginjai shelter indicate the inadequate bus stops according to its distance and area served. The lack of availability causing the low accessibility of Trans Siginjai may affecting the low-load factor. The results of this study support the previous research by Makarim [9] that stated the lack of bus stops, and the location are reasons people become reluctant to use Trans Siginjai. Accessibility is the most important service attribute [12], as stated by Sung et al. [13] that the accessibility of a BRT bus stop plays an important role in increasing the number of users. It is due to the fact that public transportation services with a high level of bus stop accessibility will be very easy to reach by the community, so the opportunity to get more enthusiasts and the number of users is very likely to increase.

Optimizing the service areas of the Trans Siginjai Jambi BRT service is highly dependent on the ease of access. As stated by Riawan et al. [14] that the important thing in terms of accessibility is how public transport can ensure that the services provided can reach as many urban areas as possible. Especially in residential areas, considering the settlements are one part of land use which is the most important aspect

in creating the largest movement within cities. One of the ways to increase the accessibility of the Trans Siginjai Jambi BRT is by providing more bus stops. The more bus stops available, the more residential areas will be reached, especially for movement attraction areas and facilities such as offices, education, health, tourism, and trade and services. If the service coverage is high for these areas, the users may also be higher. Many bus stops should be placed in these areas, because they have a great opportunity to attract potential users.

4. Conclusion

To meet mobility needs and prevent congestion, the government introduced and began operating Trans Siginjai Jambi in 2017. The low load factor value, however, indicates that its utilization is currently not optimal in supporting the mobility of people in Jambi City. Comparative descriptive analysis and geographical analysis are utilized in this study to perform coverage analysis. Based on the coverage of the services of the Trans Siginjai Jambi BRT Shelters in Corridor I and II in Jambi City, known that 8 out of 12 available shelters in Corridor I and 10 out of 14 stops in Corridor II do not meet the standards according to the BRT Standard. The lack of bus stops resulted in low service coverage, which only served 16.99% with an area of 10.96 km^2. It is causing the serviced settlement area to be only 21.18% or with a serviced area of 5.10 km^2 along both corridors. To improve accessibility, more bus stops are required, especially in the dense settlement area.

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