

Needs Assessment and Design of Trans Palu Bus Stops (Case Study: Corridor 2 and Corridor 4)

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ABSTRACT

The City of Palu has established a transportation policy by introducing *Bus Trans Palu* as a form of mass public transport. However, the implementation of this policy has not yet been fully supported by adequate supporting facilities, particularly bus stops and shelters. This study aims to assess the existing conditions, determine the number of *halte* needed, and identify suitable locations and shelter designs along Corridor 2 and Corridor 4. Based on a survey of 400 respondents, the average willingness-to-walk distance was found to be 200 meters. Using this data, the placement of shelters is determined at intervals of 400 meters. The identification of potential *halte* locations was carried out using the buffer analysis method. Additionally, the selection of *halte* locations and layout design refers to the classification of shelter types as specified in *SK Dirjen Hubdat No. 271/HK.105/DRJD/96*. The results of the study indicate that there are currently 2 existing shelters in Corridor 2 and 1 in Corridor 4, but none of them meet the minimum standard requirements. Based on the analysis of *halte* needs, Corridor 2 requires a total of 31 shelters, while Corridor 4 needs 71 shelters to optimally serve the public.

Keywords: buffer analysis, Bus Trans Palu, corridor, respondents, shelter.

INTRODUCTION

Transportation refers to the movement of goods and people from one place to another (Ferdiansyah et al., 2021; Morlok, 1985; D. A. Nugroho & Malkhamah, 2018; Priambudi et al., 2021; Tukimun et al., 2022). The primary purpose of transportation is to facilitate mobility and connectivity between locations, which, in turn, allows various economic, social, and cultural activities to occur efficiently. The availability of an effective and efficient transportation system plays a crucial role in enhancing the accessibility and mobility of an area, thereby impacting the overall quality of life for the community (Ajay et al., 2023; Chen et al., 2023; Gholami & Ziaee, 2017; Hiep et al., 2023; Sharma et al., 2018). According to Law No. 22 of 2009 concerning Road Traffic and Transportation, transportation is defined as the movement of people and/or goods from one place to another using vehicles in the road traffic space (Hadi & Malagano, 2021; A. Nugroho et al., 2023; Pratiwi & Sudiro, 2023; Silaban & Pase, 2021; Utary, 2019). This law further explains that road traffic and transportation form a single system consisting of various elements, including networks, infrastructure, vehicles, drivers, and road users. One of the key elements in transportation infrastructure is the bus stop, which serves as a stop for public motor vehicles to pick up and drop off passengers, and is intended to provide comfort according to service standards.

Palu City consists of eight sub-districts and 46 villages, with one of the city's newest mass transportation services being the *Trans Palu Bus*. This service operates under a government subsidy scheme, purchasing services from public transport companies in urban areas. The *Trans Palu* bus officially began operation on October 1,

2024, with four service corridors. Its supporting infrastructure includes *Bus Stops* (TPB) and bus stops, which are critical elements to support the transportation system.

The bus stop facilitates the process of boarding and disembarking passengers at predetermined stopping points. Its role is vital in ensuring the comfort and safety of mass transportation services. In Corridor 2, there are 29 TPBs and two bus stops that connect the city center to Manmanda Market. Meanwhile, Corridor 4 has 35 TPBs and one bus stop that serves the route from Terminal Tupo to MSA Airport. However, observations show that many passenger access points lack TPBs or bus stops, forcing passengers to walk long distances to reach the stopping point. This situation has the potential to reduce public interest in using mass transportation. Based on these conditions, it is important to conduct research related to the needs and design of *Trans Palu Bus* stops in Corridor 2 and Corridor 4. The research questions formulated in this study include: What are the existing conditions of bus stops and TPBs in the two corridors? How many stops are needed? And how can the most effective locations and designs of the bus stops be determined?

The purpose of this study is to examine the existing conditions of the facilities, calculate the need for bus stops, and propose placements and designs in accordance with the needs of the user community.

The benefits of this research are divided into two aspects: academic and practical. From the academic perspective, this research is expected to help students apply the knowledge gained during lectures, particularly in the field of transportation, and contribute to Tadulako University through strategic thinking aimed at the development of urban transportation systems. From the practical side, this research aims to increase awareness and sensitivity regarding transportation facility planning, as well as provide useful recommendations to local governments and relevant agencies in making decisions regarding the location and design of *Trans Palu Bus* stops, especially in Corridor 2 and Corridor 4.

RESEARCH METHOD

The type and source of data are crucial in a study as they determine the validity and relevance of the results. The researcher must understand the origin and type of data used to align with the research objectives. In this study, data sources are divided into two categories: secondary data and primary data, which complement each other in the analysis process.

Secondary data is obtained from relevant agencies and other pre-existing sources. For this study, secondary data includes various documents and maps such as road network maps, land use maps, route network maps, and public transportation and online transportation data. These data are sourced from government agencies responsible for transportation and spatial planning in the Palu City area. The road network map was provided by the Palu City Public Works Office to assist in creating the *Trans Palu Bus* route map. Land use maps were obtained from the Regional Development Planning Agency (BAPPEDA) to identify locations for key destinations and travel attractions. Route network maps and public transportation data came from the Palu City Transportation Office to verify the bus routes' details and legality. Online transportation data was sourced from the Central Sulawesi Provincial Transportation Office to present alternative transportation options operating in the research area.

Primary data is collected directly from the field or research object. Primary data collection was carried out through observation and field surveys to gather factual information about bus stops, land use, loading profiles, travel time, speed, load factors, and the characteristics of Trans Palu Bus passengers' travel behavior in Corridor 2 and Corridor 4. This data is essential for an accurate analysis of the needs and design of bus stops based on actual conditions.

Primary data collection employed a quantitative descriptive approach. Descriptive analysis was used to systematically and accurately describe observed phenomena. This method aims to provide a comprehensive overview of the variables studied and their relationships within the context of public transportation, particularly bus stops along the Trans Palu Bus corridors. Data was collected through field surveys, interviews with users and stakeholders, documentation, and direct measurements at key locations. Data collection methods included visual observation at bus stop locations, interviews with users and stakeholders, and recording the average travel time and speed of vehicles on the Trans Palu Bus routes. These methods helped gather empirical data related to the comfort, efficiency, and effectiveness of bus stop services, as well as the need for improved facilities.

The research was conducted in Palu City, focusing on the two main corridors of the Trans Palu Bus: Corridor 2 and Corridor 4. These corridors were selected due to their limited number of bus stops and their service to strategic areas, including economic zones and densely populated settlements. This makes them representative for studying the needs and design of bus stops more comprehensively. The research period spans from January to May 2025, lasting five months. During this time, research activities include secondary data collection, field surveys for primary data, and data processing and analysis. The results of this study are expected to yield strategic policy recommendations for improving public transportation planning in Palu City to make it more inclusive, efficient, and user-friendly.

RESULT AND DISCUSSION

Existing Conditions of the Study Area

Based on the results of the survey that has been carried out, there are 2 stopping points in Corridor 2 and Corridor 4, namely the Gajah Mada Bus Stop and the Manonda Market Bus Stop. Where the Gajah Mada Bus Stop is passed by Corridor 2 and Corridor 4 while the Pasar Manonda Bus Stop is only Corridor 2 itself, the location of the bus stop is as follows:

Table 1. Bus Stop Locations in Corridor 2 and Corridor 4

No	Bus Stop Name	Bus Stop Location	Land Use Planning	Corridors Served
1	Gajah Mada Bus Stop	Jl. Gajah Mada	Shops	Corridor 2 and Corridor 4
2	Pasar Manonda Bus Stop	Jl. Kunduri	Trade and Shops	Corridor 2

The existence of bus stops in Palu City is still very lacking, with the results of the inventory survey of stopping places obtained as follows:

Gajah Mada Bus Stop

This bus stop is located on Jalan Gajah Mada with a land use area around which is a shop.



Figure 1. Documentation of the Gajah Mada Bus Stop

Gajah Mada Bus Stop is one of the bus stop facilities located in Corridor 2 and Corridor 4 which is located on Jl. Gajah Mada and is a place for passenger transfers between Corridor 2 and Corridor 4. The facilities at the Gajah Mada Bus Stop are signs, seats and garbage cans with all facilities functional. However, this bus stop does not have a bus stop identity, route information board, lighting lights, public telephone, fence and notice board.

Pasar Manonda Bus Stop

This bus stop is located on Kunduri street with land use around it is trade and shops.

Table 2. Inventory of Manonda Market Bus Stops

BUS STOP NAME	FACILITIES	INFORMATION		CONDITION	
		YES	NO	WORK	NOT WORKING
PASAR MANONDA BUS STOP	Identity Stop		√		√
	Signage Instructions	√		√	
	Route Information Board		√		√
	Lighting Description		√		√
	Seating	√		√	
	Public Telephone		√		√
	Trash Can	√		√	
	Pay		√		√
	Billboards/Announcements		√		√

The Pasar Manonda bus stop is one of the bus stop facilities located in Corridor 2 and is located on Jl. Kunduri. The facilities available at the Gatot Subroto Bus Stop are signage and seating with all facilities functioning. However, this bus stop does not have a bus stop identity, route information board, lighting lights, public telephones, garbage cans, fences and notice boards.

Analysis of Public Transportation Dynamic Survey Data and Interviews

Analysis of Public Transport Dynamic Survey Data

Data collection is carried out by following the ritase (full trip) of each corridor, so that it can provide a comprehensive picture of the dynamics of passengers along the bus route. The following are the results of the dynamic survey analysis obtained in Corridor 2 as many as 11 ritases and Corridor 4 as many as 7 ritases then the data from all ritases in each Corridor are averaged as follows:

Table 3. Corridor Segments 2 Directions Go

NO	DEPARTURE SEGMENTS	
Segment 1	Town Hall	T.vatulemo
Segment 2	T.vatulemo	Bappeda sulteng
Segment 3	Bappeda sulteng	Jasa raharja
Segment 4	Jasa raharja	Dinas perkebunan sulteng
Segment 5	Dinas perkebunan sulteng	Smkn 1 palu
Segment 6	Smkn 1 palu	Smpn 2 palu
Segment 7	Smpn 2 palu	Titik 0 km/bank danamon
Segment 8	Titik 0 km/bank danamon	Korem
Segment 9	Korem	Alfa (hj. Hayun)
Segment 10	Alfa (hj. Hayun)	Hokky kw
Segment 11	Hokky kw	Alfa (wahid hasyim)
Segment 12	Alfa (wahid hasyim)	Posko sahur gratis
Segment 13	Posko sahur gratis	Kantor kesbangpol
Segment 14	Kantor kesbangpol	Pengadaian (wr. Supratman)
Segment 15	Pengadaian (wr. Supratman)	Rs. Anutapura
Segment 16	Rs. Anutapura	Halte pasar manonda

Tabel 4. Segmen Koridor 2 Arah Pulang

NO	RETURN SEGMENTS	
Segment 1	Halte pasar manonda	Museum sulteng
Segment 2	Museum sulteng	Smpn 3 palu
Segment 3	Smpn 3 palu	Rs. Alkhairat
Segment 4	Rs. Alkhairat	Masjid alkhairat
Segment 5	Masjid alkhairat	Halte gajah mada
Segment 6	Halte gajah mada	Hotel gajah mada
Segment 7	Hotel gajah mada	Kfc hasanuddin
Segment 8	Kfc hasanuddin	Taman gor
Segment 9	Taman gor	Bank bca
Segment 10	Bank bca	Telkom
Segment 11	Telkom	Bellrock café
Segment 12	Bellrock café	Makassar raya motor
Segment 13	Makassar raya motor	Balai kota

From the table above, we can find out the division of the Corridor 2 segment for the outbound direction, which is as many as 16 segments, and the return direction, which is as many as 13 segments. The division of this segment is based on the location of the Palu

trans bus stop along Corridor 2. The division of this segment starts from the starting point of departure, namely City Hall with the end point of Manonda Market, while the beginning of return is Manonda Market with the end point of City Hall.

Table 3. Corridor Segments 4 Directions Go

NO	RETURN SEGMENTS	
Segment 1	Terminal tipo	Pt.surya setia sejahtera
Segment 2	Pt.surya setia sejahtera	Masjid nurul huda silae
Segment 3	Masjid nurul huda silae	Caf� coklat silae
Segment 4	Caf� coklat silae	Hotel swissbell
Segment 5	Hotel swissbell	Masjid mujahidin
Segment 6	Masjid mujahidin	Palu grand mall
Segment 7	Palu grand mall	Uin datokarama
Segment 8	Uin datokarama	Kompleks ruko
Segment 9	Kompleks ruko	Unisa
Segment 10	Unisa	Dealer hasrat
Segment 11	Dealer hasrat	Puskesmas kamonji
Segment 12	Puskesmas kamonji	Bank mandiri (imam bonjol)
Segment 13	Bank mandiri (imam bonjol)	Halte gajah mada
Segment 14	Halte gajah mada	Palu plaza
Segment 15	Palu plaza	Masjid alkhairat
Segment 16	Masjid alkhairat	Rs. Alkhairat
Segment 17	Rs. Alkhairat	Rocket chicken
Segment 18	Rocket chicken	Klinik az-zahra
Segment 19	Klinik az-zahra	Mr. Diy (pue bongo)
Segment 20	Mr. Diy (pue bongo)	Pengadaian (pue bongo)
Segment 21	Pengadaian (pue bongo)	Toko besi palu putra steel
Segment 22	Toko besi palu putra steel	Bank sulteng (i gusti)
Segment 23	Bank sulteng (i gusti)	Alfa super (i gusti)
Segment 24	Alfa super (i gusti)	Indomaret (i gusti)
Segment 25	Indomaret (i gusti)	Ruko radit store
Segment 26	Ruko radit store	Bns mart (i gusti)
Segment 27	Bns mart (i gusti)	Puskesmas mabelopura
Segment 28	Puskesmas mabelopura	Sogogi (basuki rahmat)
Segment 29	Sogogi (basuki rahmat)	Erafone (basuki rahmat)
Segment 30	Erafone (basuki rahmat)	Hotel best western
Segment 31	Hotel best western	Doctor's caf�
Segment 32	Doctor's caf�	Puskesmas birobuli
Segment 33	Puskesmas birobuli	Sutan raja
Segment 34	Sutan raja	Bandara mutiara sis aljufri

Tabel 4. Corridor Segments 4 Return Directions

NO	RETURN SEGMENTS	
Segment 1	Bandara mutiara sis aljufri	Sutan raja
Segment 2	Sutan raja	Puskesmas birobuli
Segment 3	Puskesmas birobuli	Doctor's caf�
Segment 4	Doctor's caf�	Hotel best western
Segment 5	Hotel best western	Erafone (basuki rahmat)

NO	RETURN SEGMENTS	
Segment 6	Erafone (basuki rahmat)	Sogogi (basuki rahmat)
Segment 7	Sogogi (basuki rahmat)	Puskesmas mabelopura
Segment 8	Puskesmas mabelopura	Bns mart (i gusti)
Segment 9	Bns mart (i gusti)	Ruko radit store
Segment 10	Ruko radit store	Indomaret (i gusti)
Segment 11	Indomaret (i gusti)	Alfa super (i gusti)
Segment 12	Alfa super (i gusti)	Bank sulteng (i gusti)
Segment 13	Bank sulteng (i gusti)	Toko besi palu putra steel
Segment 14	Halte pasar manonda	Pengadaian (pue bongo)
Segment 15	Pengadaian (pue bongo)	Mr. Diy (pue bongo)
Segment 16	Mr. Diy (pue bongo)	Klinik az-zahra
Segment 17	Klinik az-zahra	Rocket chicken
Segment 18	Rocket chicken	Rs. Alkhairat
Segment 19	Rs. Alkhairat	Masjid alkhairat
Segment 20	Masjid alkhairat	Bank mandiri (imam bonjol)
Segment 21	Bank mandiri (imam bonjol)	Puskesmas kamonji
Segment 22	Puskesmas kamonji	Dealer hasrat
Segment 23	Dealer hasrat	Unisa
Segment 24	Unisa	Kompleks ruko
Segment 25	Kompleks ruko	Uin datokarama
Segment 26	Uin datokarama	Palu grand mall
Segment 27	Palu grand mall	Masjid mujahidin
Segment 28	Masjid mujahidin	Hotel swissbell
Segment 29	Hotel swissbell	Café coklat silae
Segment 30	Café coklat silae	Pt.surya setia sejahtera
Segment 31	Pt.surya setia sejahtera	Terminal tipo

From the table above, we can find out the division of Corridor 4 segments for the outbound direction, which is 34 segments and the return direction, which is 31 segments. The division of this segment is based on the location of the Palu trans bus stop along Corridor 4. The division of this segment starts from the starting point of departure, namely Terminal Tipo with the end point of Mutiara Sis Aljufri Airport, while the beginning of return is Mutiara Sis Aljufri Airport with the end point of Tipo Terminal.

Table 5. Average results of dynamic analysis of public transportation in the Corridor 2 segment (Return)

RETURN					
SEGMENT	PNP ON THE BUS	LOAD FACTOR (%)	TRAVEL TIME (MINUTES)	SEGMENT LENGTH (KM)	SPEED (KM/H)
Segment 1	1	3,3%	1	0,32	19
Segment 2	1	3,3%	1	0,45	29
Segment 3	1	3,3%	1	0,50	30
Segment 4	1	3,3%	1	0,40	21
Segment 5	1	3,3%	1	0,50	35
Segment 6	1	3,3%	1	0,50	49
Segment 7	1	3,3%	2	0,55	19
Segment 8	1	3,3%	1	0,35	17
Segment 9	1	3,3%	2	0,50	20
Segment 10	1	3,3%	2	0,40	17
Segment 11	1	3,3%	2	0,60	29

RETURN					
SEGMENT	PNP ON THE BUS	LOAD FACTOR (%)	TRAVEL TIME (MINUTES)	SEGMENT LENGTH (KM)	SPEED (KM/H)
Segment 12	1	3,3%	1	0,30	28
Segment 13	1	3,3%	2	0,80	44
Segment 14	1	3,3%	1	0,45	22
Segment 15	1	3,3%	1	0,50	25
Segment 16	1	3,3%	2	0,60	21
Average		3,33%			26,6
Total			22	7,72	

Table 6. Average results of dynamic analysis of public transportation in the Corridor 2 segment (Return)

RETURN					
SEGMENT	PNP ON THE BUS	LOAD FACTOR (%)	TRAVEL TIME (MINUTES)	SEGMENT LENGTH (KM)	SPEED (KM/H)
Segment 1	1	3,3%	1	0,35	17
Segment 2	1	3,3%	1	0,30	21
Segment 3	1	3,3%	1	0,30	16
Segment 4	1	3,3%	1	0,45	24
Segment 5	1	3,3%	1	0,40	19
Segment 6	1	3,3%	1	0,35	18
Segment 7	1	3,3%	1	0,50	28
Segment 8	1	3,3%	1	0,50	35
Segment 9	1	3,3%	1	0,40	20
Segment 10	1	3,3%	2	0,45	19
Segment 11	1	3,3%	1	0,50	51
Segment 12	1	3,3%	1	0,25	30
Segment 13	0	0%	3	0,55	10
Average		3,05%			24
Total			16	5,3	

From the table above, the direction of going in Corridor 2 has a total travel time of 22 minutes with a total segment length of 7.72 kilometers. Meanwhile, in the direction of return in Corridor 2, it has a total travel time of 16 minutes with a total segment length of 5.3 kilometers. The table above also explains the average vehicle load factor for the direction of going is 3.33% and the average speed is 26.6 km/h. Meanwhile, in the direction of return, the average vehicle load factor is 3.05% and the average speed is 24 km/h.

Table 7. Average results of dynamic analysis of public transportation in Corridor 4 segment (Outgoing)

RETURN					
SEGMENT	PNP ON THE BUS	LOAD FACTOR (%)	TRAVEL TIME (MINUTES)	SEGMENT LENGTH (KM)	SPEED (KM/H)
Segment 1	1	3,3%	1	0,70	42
Segment 2	1	3,3%	1	0,65	39

RETURN					
SEGMENT	PNP ON THE BUS	LOAD FACTOR (%)	TRAVEL TIME (MINUTES)	SEGMENT LENGTH (KM)	SPEED (KM/H)
Segment 3	1	3,3%	1	0,45	27
Segment 4	1	3,3%	1	0,35	16
Segment 5	1	3,3%	1	0,45	21
Segment 6	1	3,3%	1	0,70	42
Segment 7	1	3,3%	1	0,45	25
Segment 8	2	3,3%	1	0,35	27
Segment 9	2	6,7%	1	0,50	27
Segment 10	2	6,7%	1	0,45	26
Segment 11	2	6,7%	1	0,35	17
Segment 12	2	6,7%	1	0,30	21
Segment 13	2	6,7%	1	0,25	13
Segment 14	2	6,7%	1	0,35	24
Segment 15	2	6,7%	1	0,30	15
Segment 16	2	6,7%	1	0,40	24
Segment 17	2	6,7%	2	0,35	12
Segment 18	2	6,7%	1	0,40	21
Segment 19	2	6,7%	1	0,40	22
Segment 20	2	6,7%	2	0,45	17
Segment 21	2	6,7%	1	0,45	23
Segment 22	1	3,3%	2	0,45	19
Segment 23	1	3,3%	1	0,45	25
Segment 24	1	3,3%	1	0,25	14
Segment 25	1	3,3%	2	0,40	17
Segment 26	1	3,3%	1	0,35	17
Segment 27	1	3,3%	2	0,55	17
Segment 28	2	6,7%	3	0,55	12
Segment 29	2	6,7%	1	0,35	20
Segment 30	2	6,7%	1	0,45	21
Segment 31	2	6,7%	1	0,45	26
Segment 32	2	6,7%	2	0,45	16
Segment 33	1	3,3%	3	0,30	7
Segment 34	0	0%	3	0,50	10
Average		4,99%			21,4
Total			46	14,55	

Table 8. Average results of dynamic analysis of public transportation in the Corridor 4 segment (Return)

RETURN					
SEGMENT	PNP ON THE BUS	LOAD FACTOR (%)	TRAVEL TIME (MINUTES)	SEGMENT LENGTH (KM)	SPEED (KM/H)
Segment 1	1	3,3%	3	0,50	11
Segment 2	1	3,3%	3	0,30	7
Segment 3	1	3,3%	2	0,45	20
Segment 4	1	3,3%	1	0,45	24
Segment 5	1	3,3%	1	0,45	23
Segment 6	1	3,3%	3	0,35	8
Segment 7	1	3,3%	3	0,55	12

RETURN					
SEGMENT	PNP ON THE BUS	LOAD FACTOR (%)	TRAVEL TIME (MINUTES)	SEGMENT LENGTH (KM)	SPEED (KM/H)
Segment 8	1	3,3%	2	0,55	24
Segment 9	1	3,3%	2	0,35	16
Segment 10	1	3,3%	1	0,40	20
Segment 11	1	3,3%	2	0,25	11
Segment 12	1	3,3%	2	0,45	14
Segment 13	1	3,3%	2	0,45	22
Segment 14	1	3,3%	2	0,35	13
Segment 15	1	3,3%	1	0,45	23
Segment 16	1	3,3%	2	0,40	26
Segment 17	1	3,3%	2	0,40	17
Segment 18	1	3,3%	2	0,35	11
Segment 19	1	3,3%	2	0,40	20
Segment 20	1	3,3%	2	0,50	15
Segment 21	1	3,3%	1	0,30	15
Segment 22	1	3,3%	2	0,35	11
Segment 23	1	3,3%	1	0,45	27
Segment 24	1	3,3%	1	0,50	29
Segment 25	1	3,3%	1	0,35	20
Segment 26	1	3,3%	1	0,45	20
Segment 27	1	3,3%	1	0,70	31
Segment 28	1	3,3%	2	0,45	13
Segment 29	1	3,3%	1	0,35	21
Segment 30	1	3,3%	1	0,65	36
Segment 31	0	0%	2	0,70	24
Average		3,23%			19
Total			54	13,60	

From the table above, we can find out that the direction of going in Corridor 4 has a total travel time of 46 minutes with a total segment length of 14.55 kilometers. Meanwhile, in the direction of return in Corridor 4, it has a total travel time of 54 minutes with a total segment length of 13.60 kilometers. The table above also explains the average vehicle load factor for the direction of departure is 4.99% and the average speed is 21.4 km/h. Meanwhile, in the direction of return, the average vehicle load factor is 3.23% and the average speed is 19 km/h.

Bus Stop Needs Analysis

Buffer Analysis

In this bus stop need analysis, the researcher will conduct a buffer analysis to see which is the potential bus stop by paying attention to 2 categories, namely as supporting factors and inhibiting factors.

1. Supporting Factors

The supporting factors referred to in this study are factors that add value to an area for bus stop planning. The higher the supporting value, the more potential the area will be for the placement of bus stops.

a. Close to the Education Area

The education area is one of the factors that affect the planning of the placement of public transportation stops. The educational area needs to be served by a transportation system considering that in Palu City educational activities have a high intensity and the pattern of movement and travel intentions in Palu City are mostly carried out by Students/Students with the goal of going to Schools/Universities.

Corridor 2 and Corridor 4 of the Trans Palu Bus cross the educational area consisting of 43 schools and 3 universities. To analyze the need for bus stops in this area, a buffering technique was carried out as far as 200 meters from educational centers, based on the findings of the survey of the walking distance of the respondents. The results of the analysis show that there are several potential locations for the construction of new bus stops on the two corridors. These locations are prioritized because of the high mobility of students, students, and educators who are potential users of public transportation.

In addition to the education area, the existence of an office area is also one of the determining factors for the location of the bus stop. Offices are the main destination for people's journeys, not only by workers, but also by the general public who access administrative services and services. In this analysis, buffering was carried out as far as 200 meters from 78 points of office areas identified along Corridor 2 and Corridor 4. As a result, strategic locations that have high potential as bus stop construction points are obtained, considering the high intensity of activities in office areas that require the support of adequate public transportation facilities.

Trade and service zones are the next supporting factors. Locations such as Palu Grand Mall, Grand Hero, Ramayana, shopping centers, convenience stores, and restaurants are points with a high concentration of economic activities. A total of 17 trade and service locations spread along the two corridors were analyzed using a buffering method of 200 meters. Based on the respondents' walking distance, these locations have the potential to be used as a point for the construction of bus stops to increase accessibility and support community economic activities.

Furthermore, residential areas are also an important point in bus stop planning because they are the main source of movement of public transportation users. Settlements are not only a place to live, but also a point for the revival of people's daily mobility. Based on the mapping results, residential areas located on the Corridor 2 and Corridor 4 tracks are marked in yellow. Because it is the starting point for community mobility, the existence of bus stops in residential areas is very crucial to improve the comfort and efficiency of travel.

Although there are many supporting factors, there are also inhibiting factors in determining the location of the bus stop. One of them is worship facilities, such as mosques, churches, and other places of worship which are quite numerous in Palu City, especially around the trajectory of the two corridors. In accordance with the provisions of the Ministry of Transportation, bus stops should not be built too close to places of worship—at least 100 meters away—for reasons of comfort and tranquility during worship activities. Therefore, these points are categorized as delimiting zones or reducing the value of the potential construction of bus stops.

Another inhibiting factor is the existence of health facilities such as hospitals and health centers. In the study area, 34 health facility units were identified consisting of 13 hospitals and 21 health centers. Similar to places of worship, the location of health facilities must be protected from noise and high traffic. The closer the bus stop is to a

health facility, the lower its feasibility value as a point for the construction of a bus stop, and conversely, the farther it is located, the higher the potential for development.

The spatial analysis process was carried out to assess the potential location of the construction of the bus stop by subtracting the value of the buffer zone from the value of the supporting zone. The results of this data processing are visualized in a map of potential areas that show the areas with the highest value for the construction of new bus stops in Corridor 2 and Corridor 4. Locations with a large buffer of educational, office, trade, and residential areas, as well as being outside the radius of the barrier zone, are a top priority in the development of ideal new stop points.

In determining the need for bus stops, an approach based on walking distance is also used. Based on the interview survey, respondents stated that they were willing to walk up to 200 meters to the bus stop. Therefore, the ideal distance between stops is set at 400 meters, considering access from both directions. This decree also refers to the Decree of the Director General of Hubdat No. 271/HK.105/DRJD/96 concerning the distance between bus stops and bus stops based on land use. Thus, the calculation of bus stop needs is carried out based on the road sections that the Trans Palu Bus passes, to ensure that the distance between stops is in accordance with user comfort standards.

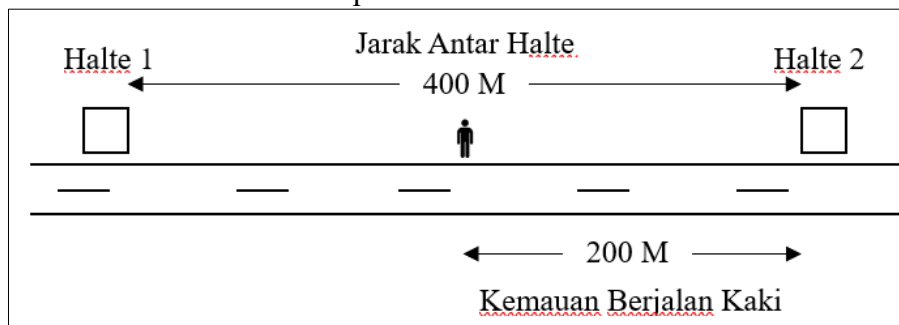


Figure 2. Standard Stop Distance Based on Willingness to Walk

It can be seen from the picture above that the distance from stop 1 to stop 2 with a willingness to walk amounted to 400 m with a willingness to walk 200 m to stop 1 and 200 m to stop 2. Based on the calculation of the need for bus stops above, on Jalan Kartini which is in Corridor 2 gets 4 stops while Jalan Abdurahman Saleh which is in Corridor 4 gets 6 stops.

Table 9. Determination of the Number of Bus Stops in the Corridor 2

NO	SEGMENT NAME	ROAD LENGTH	DISTANCE BETWEEN SERVICE STOPS	LAND USE	TOTAL
1	JL. BALAI KOTA	270	400	PERKANTORAN, KOMERSIL	1
2	JL. MOH YAMIN	523	400	PERKANTORAN, KOMERSIL	1
3	JL. KARTINI	1550	400	PERKANTORAN, SEKOLAH	4
4	JL. MONGINSIDI	350	400	SEKOLAH, KOMERSIL, PERTOKOAN	1
5	JL. HASANUDDIN 2	555	400	PERTOKOAN, KOMERSIL	1
6	JL. SUDIRMAN	545	400	PERTOKOAN, KOMERSIL	2
7	JL. H.HAYUN	365	400	PERTOKOAN, KOMERSIL	1
8	JL. KIMAJA	450	400	PERTOKOAN, KOMERSIL	1
9	JL. WAHID HASYIM	610	400	SEKOLAH, PEMUKIMAN, KOMERSIL	2
10	JL. JAELANGKARA	465	400	PEMUKIMAN, KOMERSIL	1
11	JL. WR. SUPRATMAN	655	400	PERTOKOAN, KOMERSIL	2
12	JL. KANGKUNG	450	400	PEMUKIMAN, KOMERSIL	1

13	JL.KUNDURI	465	400	1	PASAR, PEMUKIMAN, KOMERSIL	1
14	JL. KEMIRI	650	400	1	PASAR, PEMUKIMAN, KOMERSIL	2
15	JL. SIS ALJUFRI	830	400	1	PERTOKOAN, KOMERSIL	2
16	JL.GAJAH MADA	445	400	1	PERTOKOAN, KOMERSIL	1
17	JL. HASANUDDIN 1	540	400	1	PERTOKOAN, KOMERSIL	1
18	JL. MOH. HATTA	925	400	1	PERKANTORAN, SEKOLAH	2
19	JL. JUANDA	1070	400	1	PERKANTORAN, KOMERSIL	3

Tabel 10. Penentuan Jumlah Kebutuhan Halte Pada Koridor 4

NO	SEGMENT NAME	ROAD LENGTH	DISTANCE BETWEEN STOPS	SERVICE	LAND USE	TOTAL
1	JL. ABDURAHMAN SALEH	1215	400	2	PERKANTORAN, KOMERSIL	6
2	JL.BASUKIRAHMAT	1720	400	2	PERKANTORAN, KOMERSIL, PERTOKOAN	8
3	JL.IGUSTINGURAHRAI	2410	400	2	PEMUKIMAN, KOMERSIL, PERTOKOAN	12
4	JL. PUE BONGO	1735	400	2	PEMUKIMAN, KOMERSIL	8
5	JL. SIS AL-JUFRI 1	470	400	2	PERTOKOAN, KOMERSIL	2
6	JL. SIS AL-JUFRI 2	830	400	1	SEKOLAH, KOMERSIL, PERTOKOAN	2
7	JL. IMAMBONJOL	565	400	2	PERTOKOAN, KOMERSIL	4
8	JL. DIPONEGORO	2660	400	2	PERTOKOAN, KOMERSIL	14
9	JL. MALONDA	2230	400	2	PEMUKIMAN, KOMERSIL	12
10	JL. DANAULINDU	285	400	1	PERTOKOAN, KOMERSIL	1
11	JL. DANAUPOSO	190	400	1	PERTOKOAN, KOMERSIL	1
12	JL. GAJAHMADA	160	400	1	PERTOKOAN, KOMERSIL	1

Based on Table 12 and Table 13 above, we can find out the number of needs in Corridor 2 and Corridor 4 determined by the calculation of road length, distance between bus stops, number of services and land use in the segment obtained in Corridor 2 with 30 stops and Corridor 4 with 71 bus stops.

The red circle indicates the bus stop's ideal service zone, which is an area where people can access bus services on foot in less than 10 minutes or within a radius of about 400 meters. This mapping is an important basis in determining the location of the proposed stop points.

Analysis of Location and Design of Stops

Determination of Stopping Points

In determining the location of this bus stop is based on the results of the analysis that has been carried out in the study area which is then adjusted to the standards of the Decree of the Director General of Land Transportation No.271/HK.105/DRJD/96 for traffic space.

Table 11. Proposed Corridor Stop Points²

NO	SEGMENT	BUS STOP NEEDS	PROPOSED COORDINATE POINTS	
			LEFT	RIGHT
1	JL. Balai Kota	1	X: 119°53'24.54"E Y: 0°53'57.67"S	
2	Jl. Moh. Yamin	1	X: 119°53'17.06"E Y: 0°54'0.86"S	

NO	SEGMENT	BUS STOP NEEDS	PROPOSED COORDINATE POINTS	
			LEFT	RIGHT
3	Jl. Kartini	4	X: 119°53'10.72"E Y: 0°54'5.42"S	
			X: 119°52'59.39"E Y: 0°54'5.14"S	
			X: 119°52'50.52"E Y: 0°54'5.11"S	
			X: 119°52'36.22"E Y: 0°54'7.30"S	
4	Jl. Monginsidi	1	X: 119°52'24.40"E Y: 0°54'1.02"S	
5	Jl. Hasanuddin 2	1	X: 119°52'17.62"E Y: 0°53'53.56"S	
6	Jl. Sudirman	2	X: 119°52'8.33"E Y: 0°53'47.27"S	
			X: 119°52'11.72"E Y: 0°53'34.61"S	
7	Jl. H. Hayun	1	X: 119°52'4.77"E Y: 0°53'32.33"S	
8	Jl. Kimaja	1	X: 119°51'52.86"E Y: 0°53'31.75"S	
9	Jl. Wahid Hasyim	2	X: 119°51'32.79"E Y: 0°53'36.81"S	
			X: 119°51'25.32"E Y: 0°53'37.10"S	
10	Jl. Jaelangara	1	X: 119°51'14.51"E Y: 0°53'40.51"S	
11	Jl. Wr. Supratman	2	X: 119°51'6.25"E Y: 0°53'47.07"S	
			X: 119°51'6.58"E Y: 0°53'59.15"S	
12	Jl. Kangkung	1	X: 119°51'0.79"E Y: 0°54'2.81"S	
13	Jl. Kunduri	1	X: 119°50'56.26"E Y: 0°54'6.67"S	
14	Jl. Kemiri	2	X: 119°51'13.71"E Y: 0°54'9.57"S	
			X: 119°51'21.39"E Y: 0°54'12.18"S	
15	Jl. Sis Aljufri	2	X: 119°51'29.23"E Y: 0°54'8.08"S	
			X: 119°51'34.10"E Y: 0°53'53.54"S	
16	Jl. Gajah Mada	1	X: 119°51'47.78"E Y: 0°53'53.62"S	
17	Jl. Hasanuddin 1	1	X: 119°52'2.82"E Y: 0°53'50.39"S	
18	Jl. Moh. Hatta	2	X: 119°52'19.91"E Y: 0°53'46.92"S	
			X: 119°52'32.38"E Y: 0°53'48.35"S	
19	Jl. Juanda	3	X: 119°52'49.85"E Y: 0°53'49.10"S	
			X: 119°53'4.38"E	

NO	SEGMENT	BUS STOP NEEDS	PROPOSED COORDINATE POINTS	
			LEFT	RIGHT
			Y:0°53'49.36"S	
			X:119°53'10.11"E	
			Y:0°53'50.60"S	

Based on the technical standards for determining the facilities for public transportation stops, it is proposed to provide a stop in Corridor 2 of the Trans Palu Bus. The location of the proposed new bus stop is located on Jl. Kartini, precisely in front of Café Fourteen. The proposed stop point in the picture above is illustrated in the form of a red box. The proposed point of this bus stop was chosen based on strategic considerations, namely the high level of community activity where the area at this location is in the office area and commercial area and is included in the ideal service zone with a radius of 400 meters.

Existing Conditions of the Fourteen Café Location

The picture above is the existing condition of the location of the bus stop point that will be built where the proposed bus stop is located in front of Café Fourteen. From the existing conditions seen in the picture, there is sufficient land availability for the construction of the bus stop without disturbing the flow of traffic or pedestrian activities.

shows the location of the proposed new bus stop located on Jl. Kartini, precisely in front of the BP2KB Prov. Central Sulawesi. The proposed stop point in the picture above is illustrated in the form of a red box. The proposed point of this bus stop was chosen based on strategic considerations, namely the high level of community activity where the area at this location is in the office area and commercial area and is included in the ideal service zone with a radius of 400 meters.

the existing condition of the location of the bus stop point that will be built is the location of this proposed bus stop in front of the BP2KB Prov. Central Sulawesi. From the existing conditions seen in the picture, there is sufficient land availability for the construction of the bus stop without disturbing the flow of traffic or pedestrian activities. shows the location of the proposed new bus stop located on Jl. Kartini, precisely in front of Wisma Tani. The proposed stop point in the picture above is illustrated in the form of a red box. The proposed point of this bus stop was chosen based on strategic considerations, namely the high level of community activity where the area at this location is in the office area and is included in the ideal service zone with a radius of 400 meters.

The existing condition of the location of the bus stop point that will be built is located in front of Wisma Tani. From the existing conditions seen in the picture, there is sufficient land availability for the construction of the bus stop without disturbing the flow of traffic or pedestrian activities. The location of the proposed new bus stop is located on Jl. Kartini, precisely in front of SMKN 1 Palu. The proposed stop point in the picture above is illustrated in the form of a red box. The proposed point of this bus stop was chosen based on strategic considerations, namely the high level of community activity where the area at this location is in the office area, school area, residential area and commercial area and is included in the ideal service zone with a radius of 400 meters.

The existing condition of the location of the bus stop point that will be built is the location of this proposed bus stop in front of SMKN 1 Palu. From the existing conditions

seen in the picture, there is sufficient land availability for the construction of the bus stop without disturbing the flow of traffic or pedestrian activities.

Based on the technical standards for determining the facilities for public transportation stops, it is proposed to provide a stop in Corridor 4 of the Trans Palu Bus. existing conditions of the location of the bus stop to be built. The location of the proposed stop point is in front of Faqih Rashid Field. The service on the road has 2 stopover services, the bus stop that is built will be opposite. And at this location, the availability of land for the construction of the proposed bus stop has been seen. existing conditions of the location of the bus stop to be built. The location of this proposed stop point is in front of the Sutan Raja Hotel. The service on the road has 2 stopover services, the bus stop that is built will be opposite. And at this location, the availability of land for the construction of the proposed bus stop can be seen.

The location of the proposed stop point is in front of the Toyota Passion Dealer. The service on the road has 2 stopover services, the bus stop that is built will be opposite. And at this location, the availability of land for the construction of the proposed bus stop has been seen.

Stop Design

The design of this bus stop has a length of 5.5 meters, a width of 1.8 meters, and a height of 3 meters and the flow of pedestrians is in front of the bus stop, and is equipped with the identity of the bus stop, route information board, seats, and canopy. The more complete the bus stop facilities are useful for providing information related to what corridors cross the bus stop, then the bus stop identity board is useful for knowing the name of the bus stop and usually the name of the bus stop depends on the location of the bus stop. Seats are also very important because they will provide comfort to the user, and the canopy serves to protect passengers from the weather (rain, heat, and wind) and create a more comfortable environment while waiting for the bus. Not only that, the canopy also provides better aesthetics for the bus stop and adds a professional impression.

Trans Palu Bus Route Design

The route design is based on the previous Trans Palu Bus route but is added with the analysis that has been carried out so as to provide a design that is easier for the public to understand and can be included in the information board at each bus stop.

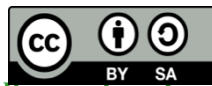
CONCLUSION

Based on the data processing results, it can be concluded that the existing bus stops in Corridor 2 (2 stops) and Corridor 4 (1 stop) do not meet the technical standards outlined in the Decree of the Director General of Hubdat No. 271/HK.105/DRJD/96. While there are 29 signs in Corridor 2 and 35 signs in Corridor 4, the calculated need for bus stops is 31 for Corridor 2 and 71 for Corridor 4, considering the road length and a 200-meter willingness-to-walk distance. Effective bus stop placement should focus on areas with high pedestrian activity, near activity centers or settlements, while maintaining a minimum distance of 50 meters from intersections and 100 meters from hospitals or places of worship. The Palu City Government plans to build bus stops with minimum dimensions of 4 x 2 meters, with a design of 5.5 x 1.8 meters and a height of 3 meters, which complies with existing standards. Future research could focus on evaluating the impact of bus stop placement on commuter behavior and public transport efficiency in Palu City, exploring aspects like pedestrian safety and convenience in relation to bus stop location.

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