

# Level Of Service Pedestrian in Makassar to Support Multimodal Transportation

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**Abstract:- Pedestrian is one of the modes that used in the development of multimodal transportation, especially in the movement of passengers to and from the bus stop. Pedestrian performance can also be calculated to evaluate multimodal transportation. The purpose of this study is to calculate pedestrian performance, especially in the area around the bus stop used by passengers in Makassar City. The analytical method used consist o 5 calculations, namely calculating pedestrian flow, calculating pedestrian speed, calculating pedestrian density, calculating pedestrian space and calculating pedestrian service levels. The results showed that performance was still good between A-C at each bus stop.**

**Keywords:- Halte; Multimodal Transportation; Makassar City; Pedestrian.**

## I. INTRODUCTION

Awareness of the importance of integrating land use with the operational system of mass public transport has resulted in a brilliant idea of developing a city based on Transit Oriented Development (TOD). TOD is a strategy to make cities more efficient in the transportation system for people and goods by developing mixed function areas in urban activity centers around the public transport station, with safe and comfortable areas for pedestrians [1]. This TOD-based urban planning model is a form of livability and the sustainability of the urbanization process related to residence, work, and other urban activities that can be reached on foot that is pleasant, safe, easy and comfortable to and from public transport station, as a substitute for travel which is done by private car to the destination [2]. Travel without a motorized vehicle is closely related to a sustainable transportation system [3].

The intermodal/multimodal transportation service network is realized through integration between routes/cross/road transportation, trains, rivers and lakes, crossings sea and air, by taking into account the advantages of modes and the concept of combining the main modes, feeder modes and intermediate modes. And based on the suitability of technology and characteristics of the service area, and cross-level transportation both in Tatanas, Tatrakil, and Tatrakok [4].

Things that need to be considered in multimodal planning are 2 parties that determine the sustainability of a multimodal network, that is the demand side and the supply side. These two side have a different focus, but will still be interconnected. The demand side sees from the user's point of view because it describes the response from the market,

while the supply side provides the provider's point of view, which illustrates that the level of service can be seen from the system. Calculation of service performance has many purposes and types such as for the planning process, design and policy analysis [5].

The condition of buses that can only stop at official bus stops is considered not as easy and flexible as city transportation, and the condition of the pedestrian path around the bus stop is still poor [6]. The construction of the Pedestrian Path was carried out by the Makassar City Public Works Department on several roads, including Penghibur Road, Ujung Pandang Road, Nusantara Road, and Haji Bau Road. However, the sections that have been constructed of the Pedestrian Path are not traversed by public transport so that the pedestrian path cannot yet become a place for public transport transfers. The newly constructed and existing Pedestrian Paths are not yet integrated into the transportation system. Pedestrian Paths on Gunung Bawakaraeng Road, Gunung Bulusaraung Road, Mesjid Raya Road, Urip Sumoharjo Road and A.P Petarani Road which are the main roads of the city have an uneven distribution of pedestrian paths. Construction and repairs are more often carried out at several points with consideration of the high user density and the function of the building that is directly opposite the sidewalk. [7].

The purpose of this study was to determine the level of service (LoS) of the pedestrian path in Makassar City in an effort to increase multimodal transportation.

## II. THEORY

Rahul D Matariya [8] conducted various surveys on experimental BRT lines which can be classified into several parts, namely volume studies at intersections, queue length and flow, occupancy surveys, parking surveys, speed and delay studies, and total pedestrian volume. Directly, pedestrians are one of the factors that affect BRT services. Vasantha Wicramasinghe and Sunanda Dissanayake [9], the level of pedestrian service has several stages as follows :

- Pedestrian flow rate; Factor the number of pedestrians who pass a certain point on the sidewalk per unit time. This factor is used to design the width of the pedestrian path. Pedestrian flow is the number of pedestrians crossing a point on the sidewalk and is measured in units of pedestrians per meter per minute.
- Pedestrian speed; Average speed factor in walking of pedestrians. In this case related to age, the state of the body of the pedestrian. Directly age and body condition will affect the speed of pedestrians in walking. Speed is the distance pedestrians travel on a sidewalk.

- Pedestrian density; Factor the average number of pedestrians per unit area on the sidewalk. Density is the number of pedestrians per unit area of the sidewalk.
- Pedestrian space; The factor of the area required by each pedestrian to move freely, where this factor is inversely proportional to the pedestrian density factor. walker's room
- Calculating the pedestrian level of service

The level of pedestrian service can be seen from the LOS (Level Of Service) calculation, the pedestrian LOS calculation can be seen in Table 1 below

Pedestrian Space (m <sup>2</sup> /person)	Level of Service (LoS)
> 5,6	A
3,7 - 5,6	B
>2,2 – 3,7	C
>1,1 – 2,2	D
>0,75 – 1,4	E
<0,75	F

Table 1: Location Selection Based on the Road Hierarchy

### III. SCOPE DATA COLLECTION

The location of the pedestrian path in this study follows the determination of the study area. After finding 7 road sections that became the study area, then identification was carried out at the bus stops located on these roads. The types and number of bus stops at the study sites can be seen in Table 2 below

No	Road traversed by BRT Corridor II	City Transport Routes passing by	Hieraki	Number of Bus Stop
1	Jalan Riburane	A	Arteri	1
2	Jalan Ahmad Yani	A	Arteri	1
3	Jalan Gunung Bulusaraung	C, D, E, H, I, S, F1	Arteri	-
4	Jalan Masjid Raya	C, D, E, H, I, S, F1	Arteri	3
5	Jalan Urip Sumoharjo	D, E, H, I, S, F1	Arteri	2
6	Jalan AP Pettarani	E, E1	Arteri	6
7	Jalan Gunung Bawakaraeng	E, H, I, S, F1	Arteri	2

Table 2: Location Selection Based on the Road Hierarchy

The total number of bus stops is 15 bus stops consisting of 13 BRT stops and 2 regular bus stops (city transportation stops). The study area for the pedestrian path is around this stop (Figure 1)

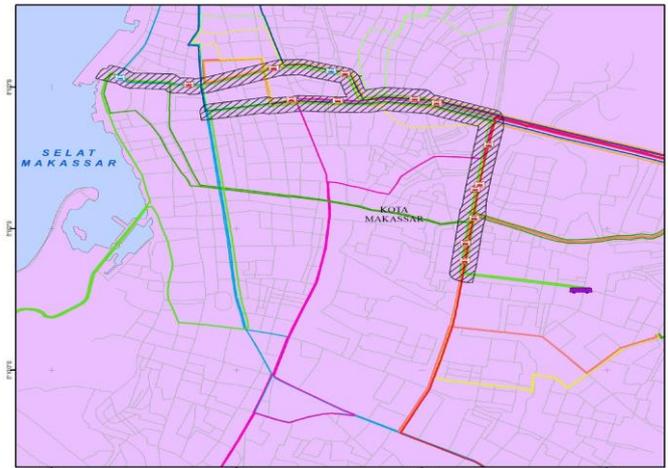


Fig. 1: Location Selection Based On The Road Hierarchy

The variable for calculating pedestrian operational performance is pedestrian space, with sub-variables of space requirements, pedestrian density, pedestrian speed, pedestrian flow and pedestrian volume. Meanwhile, the indicators for the assessment are segment travel time, segment length and number of pedestrians.

### IV. DISCUSSION

The calculation of the operational performance of the pedestrian path consists of at least 5 stages. The stages start from calculating the pedestrian flow, calculating pedestrian speed and density, calculating pedestrian space then the results of the pedestrian space calculation are converted into pedestrian lane service level units (A-F). Prior to performing the service performance analysis, a comparative analysis with standards regarding the characteristics of pedestrian paths in the study area was conducted. The results of the analysis are presented.

The existing condition when compared with the standard, the actual lane width is in accordance with the standard but due to several obstacles in the form of on-street parking and vegetation, the existing width needs to be increased in order to accommodate the standard of at least two people passing each other. Vegetation can also be a concern because on the one hand it can reduce operational performance, namely reducing pedestrian speed and space, but on the other hand it can increase walking comfort because it can protect pedestrians from the hot sun. When viewed from the facilities in the form of barriers and ramps that are not yet available on all roads in the study area. Some surface pavements are also not up to standard because there are holes and damaged concrete pavement.

The dominance of the service level of the pedestrian path in the study area is at service level A, which is very good. There are only a few roads that have service points B and C. Road sections that have service levels B are at the Almarkaz Stop on Mesjid Raya Road and the Allianz Stop on A.P Pettarani Road in each direction. The road sections that have a service level of C are the Karebosi Bus Stop on Ahmad Yani Road, the Terong Market Stop on Mesjid Raya

Road and Gunung Bawakaraeng Road and the SMAN 1 Stop on Gunung Bawakaraeng Road (weekdays). Service Level C means that the pedestrian space still has normal capacity, pedestrians can move with the current in the same direction normally even though in the opposite direction there will be little contact. Pedestrian flow runs normally but is relatively slow due to limited space between pedestrians. In general, the condition of Level of Service C is still in good condition.

The calculation is carried out at 13 bus stops, with 2 times, that is weekdays and weekdays based on the results of pedestrian surveys and pedestrian geometrics. An example of calculating pedestrian calculations can be seen in table 3 below.

Road Name	Bus Stop Name	Direction	Width
Riburane Road	Riburane	East	2
		West	2
Ahmad Yani Road	Karebosi	East	1.5
		West	1.5

Table 3: Pedestrian Level of Service

Road Name	Weekday				
	Number of Pedestrian	Flow	Density	Pedestrian Space	Lo S
Riburane Road	25	1.25	0.09	11.72	A
	25	1.25	0.09	11.72	A
Ahmad Yani Road	80	5.33	0.36	2.75	C
	81	5.40	0.37	2.71	C

**V. CONCLUSION**

In general, the performance of pedestrians in Makassar City can be used as a mode of transfer of passengers who will switch modes. Although in general it is in accordance with the standard, there are still some pedestrian paths that are physically damaged, . Pedestrian service performance is at level A – C which means it is still good, meaning that if there is an increase in public transport passengers, this pedestrian can still accommodate up to 2 times the current passengers.

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