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INTERMODAL CONNECTIVITY AT KAMPUNG RAMBUTAN BUS TERMINAL

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ABSTRACT

Transportation as a means of development is an important and strategic factor in the running of the economy. It can be seen from the high demand for transportation services. Jakarta Capital City, which is a metropolitan area, has a high need for transportation, especially public transportation. The high demand of transportation is because the average population of DKI Jakarta is carry out economic activities as a businessman or office worker, plus people commuting from supporting areas such as Bogor, Depok, Tangerang, and Bekasi to work, study or other activity in Jakarta. As a solution to transportation needs, the Jakarta Provincial Government is currently building several mass transportations, one of which is the Light Rail Transit or LRT from Bogor and Cibubur to Central Jakarta. This LRT line is passing through the Kampung Rambutan Terminal in East Jakarta and is planning to have a station connected to the bus terminal. This development is expected to be a solution to the need for integration of the LRT with the feeder mode in the Terminal. Based on this, this study will discuss the LRT connectivity with integrated modes at the Kampung Rambutan Terminal. The method used is quantitative descriptive study with the support of primary and secondary data. From the results of the analysis, it is known that the level of connectivity in terms of the time required shows quite good results, while the level of connectivity in terms of facilities also shows good results, this can be seen from the acquisition of the highest graph with an adequate value of 57%. In general, it can be concluded that the LRT connectivity with existing modes at the Kampung Rambutan Terminal is quite good.

Keywords: Connectivity, Public Transportation, Inter-Modal, Terminal

1. INTRODUCTION

In the transportation system, connectivity has an important role in the process of organizing transportation, especially in the integration of transportation modes. Initially the concept of connectivity was first used to evaluate connectivity between airports, namely the extent to which airports are connected to other airports in a certain network Zhu et al. (2018). Furthermore, this concept was developed so that it can cover other modes such as trains, public transportation, and other public transportation. In short, connectivity can be interpreted as a unit in a transportation network. There are several theories about connectivity including: a. Connectivity is defined as the degree to which points or nodes in a transportation network are interconnected with one another Mishra et al. (2012). b. Connectivity is described

as a measure of the availability of facilities at certain points on a transportation network Labi et al. (2019). c. Connectivity is the convenience in terms of time, cost, and travel between a different transportation route system or capital system Alstadt et al. (2012).

Metropolitan-scale transportation such as in DKI Jakarta needs to pay attention to one of the supporting aspects to support the mobility of public transportation users, namely the connectivity factor between each mode. With connectivity, a network of transportation systems can be formed that functions to connect every existing mode of transportation. Connectivity is also an indicator of success in integrated transportation development Kuswati and Herawati (2017). In addition, the existence of intermodal connectivity will create more efficient public transportation, especially in terms of time and cost. As time goes by, DKI Jakarta is now reforming transportation and building more efficient transportation, using the latest technology, and being able to connect with other modes. One type of transportation that is planned to meet these needs is Light Rail Transit or abbreviated as LRT. LRT is a system on the line an electric train with a metropolitan scale that has characteristics in the form of the ability to run train cars one by one and pick up and drop passengers along specially made tracks on terraced land, overhanging structures, subways, or on roads Muhammad and Triana (2017). The construction of the LRT is considered a solution to reduce congestion and air pollution which has been a problem in DKI Jakarta. On the other hand, currently the LRT construction has not effectively reached connectivity with feeder modes such as buses and other transportation because there are no LRT stations that are directly connected to the Terminal which is a gathering place for feeder modes.

2. MATERIALS AND METHODS

The place for this research is located at Kampung Rambutan Terminal which is a type A terminal. This terminal is located in Gg. Rambutan, No.11, Ciracas Exit, Cipayung District, East Jakarta City 13850. Kampung Rambutan Terminal has been actively used since October 1, 1992. This terminal was established on an area of 141,000 m2, which makes it one of the largest passenger transport terminals in Indonesia. Since its establishment, this terminal not only serves inter-city transportation between provinces but also serves transportation routes within the city. Kampung Rambutan Terminal is very crowded with passengers, because it functions as a liaison between cities and has fairly easy access because it is located right next to the toll entrance. Apart from being an inter-city and intra-city terminal, the Kampung Rambutan terminal is also used by the DKI Jakarta Provincial Government as a Transjakarta bus terminal. As an effort to organize a better terminal, the Kampung Rambutan terminal has a vision and mission to be achieved. Its vision is to create an integrated and quality transportation system parallel to big cities in developed countries.

This study is conducted a research approach using descriptive quantitative methods. There are several factors that support the integration can be run smoothly. One of the important factors that need to be considered is travel time. Travel time is one of the main factors that need to be considered in transportation, this is because travel time is the main attraction in considering the choice of mode to be used. In public transportation, travel time can be divided into several parts, namely the time when the transportation stops, the waiting time for transportation, the time to change modes of transportation, and the time in transit Sijabat et al. (2013). For some modes of transportation, there are other factors that determine the journey, namely the cost of travel. Travel costs are the costs of moving goods or passengers

or can also be referred to as transit costs. Travel costs have an influence on the operational costs of a mode of transportation because these costs include costs that must be incurred in running this mode of transportation Ritonga et al. (2015).

Figure 1

Figure 1 Location Study: Kampung Rambutan Terminal

In addition, in the integration of modes, there is one main factor that needs to be considered, namely public transportation that is interconnected or what can be referred to as multimodal transportation. The existence of multimodal transportation is considered to be able to increase optimization both in terms of transportation of people and goods Wibowo and Chairuddin (2017).

In multimodal transportation, there are several concepts Chairi et al. (2017), including:

1) Connect Mode

Connecting mode is a mode that is used as a connector either before or after the main mode is used. The previous mode is the mode used from home to transportation stops such as bus stops. While the after mode is the mode used from the place of transit to the destination.

2) Main Mode

The main mode is the mode used in a long journey. This mode usually has a schedule of arrivals and departures.

3) Multimodal Network

Multimodal network can be said to be the most basic thing in the multimodal component. This network is used as a link between several types of transportation modes.

4) Mode Switch Facility

Mode transfer facilities have a role to attract private transport passengers so that they can be integrated into public transport modes. One form of this facility is the availability of sufficient parking space.

5) Mode Switch Facility with Different Network

This facility is used as a connection point between two types of modes with different networks, for example, between the road network and the rail network.

6) Regulation

The existence of regulations in multimodal transportation is intended so that the performance of public transportation can be controlled properly.

Based on those theory, because of limitation of time and budget, the indicator used are the Intermodal Connectivity Level in terms of Time which consists of 3 variables, including:

1) Travel time is the time it takes to travel using this mode of transportation.
2) Queuing time is the time required for passengers to enter the mode of transportation.
3) Waiting time is the time calculated when passengers wait for the mode of transportation to arrive.

The bus trajectories then observed using the help of several applications, namely moovit, trafii, and google maps to obtain data related to travel time, queue time and waiting time required by passengers. Furthermore, the data that has been obtained is classified using the rating scale method to determine the level of time speed of each mode. This method is a method that divides the assessment into five categories, while the factors used must be measurable so that the assessment can run objectively Satria and Agustini (2018). The scale used for this assessment can be seen in the table below. Table 1

Table 1

Table 1 Time Speed Rating Scale

Time Speed	Time	Rating
Very Fast	Travel time: 25 – 50 min Queuing time: 0 – 2,5 min Waiting time: 0 – 5 min	5
Fast	Travel time: 50 – 75 menit Queuing time: 2,5 – 5 menit Waiting time: 5 – 10 menit	4
Moderate	Travel time: 75 – 100 menit Queuing time: 5 – 7,5 menit Waiting time: 10 – 15 menit	3
Slow	Travel time: 100 – 125 menit Queuing time: 7,5 – 10 menit Waiting time: 15 – 20 menit	2
Very Slow	Travel time: > 125 menit Queuing time: > 10 menit Waiting time: >20 menit	1

Intermodal Connectivity Level in terms of Facilities

The physical condition of the connecting facilities can describe the ease of movement for pedestrians. The ease of movement in order to reach the destination point can be referred to as accessibility for pedestrians. The accessibility for pedestrians can be assessed based on 6 types of variables Sisy Tiara et al. (2017), including the following:

1) Mileage is the distance from the place of origin to the transit point that is reached on foot.
2) Connectivity, namely whether or not pedestrian paths are available for pedestrians

3) Ease, judging by the availability of disabled facilities such as guiding blocks and ramps.
4) Convenience can be seen in terms of the presence or absence of functional disturbances on the pedestrian path. In addition, it can be seen from the availability of road shade along the path for pedestrians such as canopies, roofs, or it could be in the form of trees.
5) Friendliness, seen based on the smoothness for pedestrians in walking or what can be called seamless walking, which consists of 4 criteria, namely the availability of ramps on every incline or descent, available flat and consistent pedestrian paths, no disturbances in pedestrian paths, and there are signposts for pedestrians.
6) Visibility, namely the visibility of pedestrians when walking to the transit point, which consists of 4 criteria including the distance to the transit point <200 meters, there is a special building as a transit point can be a bus stop or terminal, there is a signage that directs to the direction of the transit point, and there is signage of the name of the transit point.

The research was conducted by direct observation and using supporting data from the Department of Transportation. The method used is still the same as before, namely using a rating scale where the assessment indicators are seen based on the 6 variables.

Table 2

Table 2 Facility Rating Scale

Connectivity	Ease	Convenience		Friendliness	Visibility	Weight
Defined as a sidewalk	**Facilities for the disabled**	**Malfunctions**	**Road shading**	***Seamless walking***	**Transit point visibility**	
Excellent 100% of the path is defined as sidewalk	**Excellent** 100% of the pathway's available disability facilities	**Excellent** no malfunctions	**Excellent** 100% of the lanes are shaded	**Excellent** meets 4 criteria	**Highly Visible** meets 4 criteria	5
Good 75 - 99% of lanes defined as sidewalks	**Good** 75 - 99% of the lines available for disabled facilities	**Good** slight malfunctions	**Good** 75 - 99% lanes are shaded	**Good** meets 3 out of 4 criteria	**Visible** meets 3 out of 4 criteria	4
Enough 50 - 74% of lanes defined as sidewalks	**Enough** 50 - 74% of the lines available for disabled facilities	**Enough** slight malfunctions	**Enough** 50 - 74% of the lanes there is shade	**Simply** meet 2 out of 4 criteria	**Quite Visible** meets 2 out of 4 criteria	3
Less 25 - 49% of lanes defined as sidewalksr	**Less** 25 - 49% of pathways available for disabled facilities	**Less** many malfunctions	**Kurang** 25 - 49% lanes are shaded	**Less** meets 1 of 4 criteria	**Less Visible** meets 1 of 4 criteria	2
Bad 0 - 24% of lanes defined as sidewalks	**Bad** 0 - 24% of pathways available for disabled facilities	**Bad** very much impaired functioning	**Bad** 0 - 24% lanes there is shade	**Bad** does not meet the criteria	**Invisible** does not meet the criteria	1

3. RESULTS AND DISCUSSIONS

Public transportation route data which the origin and/or destination from Kampung Rambutan consists of several types of transportation, namely:

1) Transjakarta Bus Rapid Transit: 9 routes
2) Small Bus: 12 routes
3) Reguler Bus: 8 routes

The results of the survey to measure travel time, queue time and waiting time of each routes are described in Figure 2, Figure 3 and Figure 4.

Figure 2

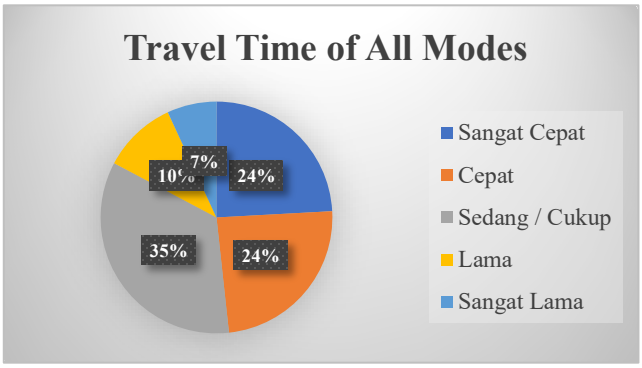

Figure 2 Travel Time of All Modes

Figure 3

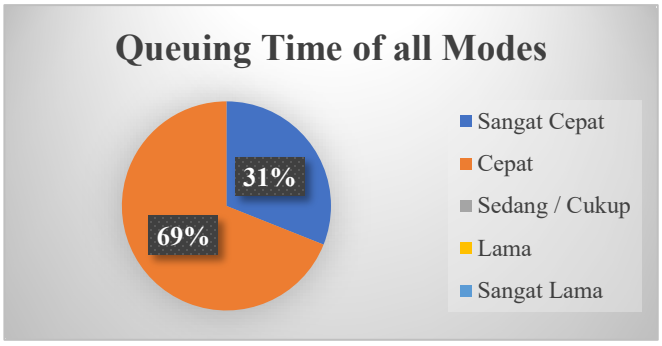

Figure 3 Passenger Queuing Time of all Modes

Figure 4

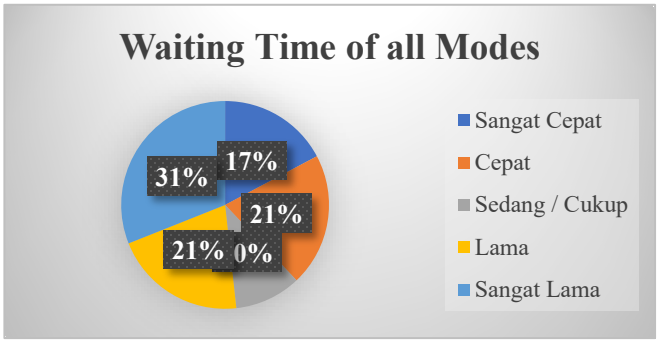

Figure 4 Passenger Queuing Time off all Modes

Based on the overall graph acquisition, it can be seen that in terms of travel time and queuing time, the highest values obtained are fast and moderate or sufficient. Meanwhile, in terms of the waiting time for modes, the highest value is very long, but if it is more detailed, this is because the waiting time for buses is quite long, while for angkot and Transjakarta it is quite sufficient. If viewed as a whole, it can be said that the level of intermodal connectivity at the Kampung Rambutan Terminal can run well.

After an assessment of the physical facilities of connectivity along the transit route, the following results were obtained Table 3

Table 3

Table 3 Facility of Connectivity Assessment Results

Variable	Observation	Connectivity Level	Findings
Distance and Time	Route from LRT station to Kampung Rambutan Terminal	3	Quite accessible because the distance ranges from 500 meters with a walking time of about 10-15 minutes.
Connectedness	The lane is a sidewalk	3	It is enough to connect with the sidewalk, but not all lanes use sidewalks because there are still pedestrian paths that coincide with vehicle/or transportation entry lanes.
Ease	Disability facilities available	3	There are already disabled facilities such as wheelchairs, special toilets, and *ramps, but* there is still no *portable ramp*.
Comfort	Road shading	2	The shady facilities are not perfect because there are still paths that are traversed without any shade roofs or trees.
	Malfunctions	3	In general, it is good, but there are still points through which there are still street vendors.
Hospitality	3 criteria *of seamless walking*	3	a. Along the route, ramps are available. b. On most routes, pedestrian paths are flat and consistent. c. There were no street vendors blocking the lane at some point.
Visibility	2 visibility criteria	2	a. There is a special station building and a bus stop/terminal. b. There is a directional sign to the Terminal.

All assessment results are then percentage according to the scale in Table 2. The results are depicted in Figure 5.

Figure 5

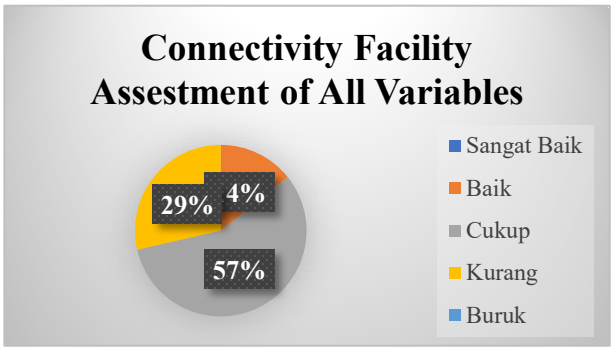

Figure 5 Connectivity Facility Assessment from all Variables.

Based on the graph, it can be seen that the result of the highest score shows a sufficient score of 57%, followed by a less than 29% score and a good score of 14%. So, it can be said that in terms of the physical condition of the connecting facilities, it is quite good

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of data processing and analysis related to the level of connectivity in terms of time and facilities, it can be said that LRT connectivity with existing modes at the Kampung Rambutan Terminal in terms of the time required is quite good where the queue time and travel time are low and moderate results, meanwhile the waiting time is high, especially for the city bus.

On the other side, passenger connectivity from the LRT Station to the Kampung Rambutan Terminal also show quite good results where the facility assessment shows the highest score, which is sufficient with a percentage of 57%, followed by a less value with a percentage of 29%, and a good value with a percentage of 14%.

Based on the analysis that has been obtained, LRT passengers can easily continue their journey with the existing modes at the Kampung Rambutan Terminal to the Jabodetabek area. This is because there are many modes of transportation, buses, and Transjakarta that go to the Jabodetabek area, and the departure time is almost every time.

CONFLICT OF INTERESTS

None.

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