Evaluation of Performance and Services of Integrated Transportation System (Case Study: Connecting Line between MRT Dukuh Atas Station and KRL Sudirman Station)

Muhammad Isradi, Prima Molina, Andri Irfan Rifa'i, Amar Mufhidin
Faculty of Engineering, University Mercu Buana Jakarta, Indonesia
isradi@mercubuana.ac.id, primamolina25@gmail.com, andrirfan@yahoo.com, amarmufhidin@gmail.com

Joewono Prasetijo
Faculty of Engineering, Universiti Tun Hussein Onn Malaysia, Malaysia
joewono@uthm.edu.my

Abstract

The level of population mobilization in the Jakarta increased along with the population increase. It causes an increase in the number of transportation modes. To overcome congestion due to increased the transportation, the concept of transportation integration was developed, one of the component is the transportation connection facility. This study aims to determine the performance and level of services of pedestrian facilities on the connecting line between Jakarta MRT Station and KRL Sudirman Station. The research methodology used survey measurements of volume and travel time to determine the level of service and direct observation of the availability of facilities. In addition, the survey was conducted by distributing questionnaires to 100 respondents to determine the level of performance of the connecting line. The data processing uses Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) using the Importance Performance Analysis (IPA) method. The results of the analysis carried out by direct measurement survey found that the pedestrian paths have met the minimum standards. From the measurement results of the volume and travel time of pedestrians, the service level is obtained with A category, the availability of facilities for regular users and and users with special needs is quite complete, as well as data analysis of the results obtained through surveys and questionnaires, it can be concluded that the performance of the connecting line is relatively good.

Keywords
Pedestrian Lines, Transportation Integration, MRT Stations, KRL Stations.

1. Introduction

Dukuh Atas is the name of a area located in the southwest corner of Menteng, Central Jakarta. Dukuh Atas area is a strategic area which is close to the business center of Jakarta. The growth of development in this region includes commercial office towers, apartments, hotels, shopping centers, residential housing and shop houses.

The inter-census population survey (SUPAS) describes that the population of DKI Jakarta in 2020 will increase by 72 thousand people to 10.57 million people. Reports from the Central Statistics Agency (BPS) and Bappenas stated that this number increased by 0.7% from the previous year which was 10,504,100 people. The activities of the population in an effort to meet their daily needs lead to a journey / movement from one place to another. In carrying out movement activities, citizen use transportation facilities and infrastructure. There is only efficiently functioning public transportation system can effectively compete with individual transport vehicles (Solecka & Jacek, 2014).

Based on the annual report of PT Kereta Commuter Indonesia in 2018, the average passenger volume was 922,736 passengers / day, and the number of passengers was 336,798,524, an increase of 7% compared to 2017 which was 315,853,991.

Meanwhile, based on the PT MRT Jakarta annual report, the number of MRT Jakarta passengers in 2019 was 24,621,467 passengers, with a total average passenger per day of 89,645 passengers.
Along with the increase in population, the level of population mobilization in the Jakarta area has also increased, to support the mobilization of the citizen, seven public transportations were built in that pass through the Dukuh Atas area, that are MRT Jakarta, LRT Jakarta, LRT Jabotetabek, BRT Jakarta, Commuter Line, Airport Train and regular Bus. With the large number of transportation that crosses this area, an integrated system between transportation modes is needed. In general, transport integration denominates such technical, economic, organizational, policy based and informational concepts and solutions that assure the continuity of travels from door to door (Janic M., 2001).
Based on the results of. Integration of an urban public transportation is defined as an organizational process by which elements of the passenger public transportation system (network and infrastructure, fares and ticketing systems, information and marketing components) and a variety of carriers who serve different transportation modes, interact more closely and efficiently, to generate an overall improvement in service quality level and enhanced performance of the combined public and individual transportation (Żak J., Fierek S., 2014).
By taking a systems perspective (Kast, F.E. and Rosenzwieg, 1981), the goal of integrating processes along the components of the supply chain to reduce costs and improve service is well established as one of the key objectives of logistics and supply chain management (D., Kaminsky, P. and Simchi-Levi, 2000).
The transportation integration concept is believed to be a solution to congestion in the capital city of Jakarta. In line with the DKI Provincial Government's program, the Dukuh Atas area has been inaugurated as a transportation transit area. The efforts that have been carried out include adjusting traffic engineering and building pedestrian paths. However, it is felt that the integration system in the Dukuh Atas area still needs to be studied more. This includes the distance between modes of transportation, facilities for pedestrians that need to be evaluated, limited user capacity, and service performance at terminals or connecting stations.

2. Research Methodology

The research method is basically a scientific procedure to obtain data with specific purposes and uses (Sugiyono, 2005). Meanwhile, according to I Made Wirartha (Wirartha, 2006) the research method is a part of science that discusses or questions the ways of carrying out research (which includes the activities of searching, taking notes, formulating, analyzing and following the report) based on facts or indications. Indications scientifically. The method used in the writing of this final project is a quantitative method because this study describes the conditions that occur at the research location accompanied by a systematic calculation related to the use and level of comfort of the facilities connecting the KRL Sudirman station and the Dukuh Atas MRT station.

2.1 Data Processing and Data Management

To obtain data, in this research uses several data collection techniques, that is field observations various things related to observing physical conditions and activities at the research location. The next data collection technique is documentation, includes the activities of collecting and studying some information from periodicals, books, documentary literature, photographs, newspapers, electronic media and statistical references.

2.1.1 Normality Test

The normality test in the regression model is used to test whether the residual value resulting from the regression is normally distributed. A good regression model is one that has a residual value that is normally distributed (Priyatno, 2014). In conducting the normality test in this study, researchers used the One Sample Kolmogorov-Smirnov test method. In this case to find out whether the data is normally distributed or not if:

1. The significance value> 0.05 means that the residuals are normally distributed.
2. The significance value <0.05 means that the residuals are not normally distributed.

2.1.2 Validity Test

The validity test is used for measuring the suitability of the questionnaire used in research with the data that occurs at the research location. In this study, the validity testing method used the Pearson Product Moment method. The basis for taking the validity test of the Pearson product moment method can be done in 2 ways, that are comparing the r count value with the r table and seeing the significance value (Sig.)

2.1.3 Reliability Test

Reliability test is used for measuring the level of data reliability of an object to ensure the level of consistency of the value of the research instrument. In this study the calculation method used for reliability testing is the Alpha Cronbach method.
The Alpha Cronbatch formula is as follows :

$$r_{11} = \left[\frac{k}{(k-1)}\right]\left[1\frac{\sum \sigma^2 b}{\sigma^2 t}\right]$$

Description:
r11 = reliability coefficient alpha
k = total of questions
$\Sigma\sigma 2b$ = total grains varians
$\sigma 2t$ = total varians
According to Sujarweni (Sujarweni, 2015) the basis for decision making in the reliability test is interpreted as follows:
If the Cronbach Alpha value > 0.60 then the questionnaire or questionnaire is declared reliable or consistent.
If the Cronbach Alpha value <0.60 then the questionnaire or questionnaire is declared unreliable or inconsistent.

2.1.4 Importance Performance Analysis (IPA)
Importance Performance Analysis is an analytical technique used to identify what important performance factors an organization must demonstrate in meeting service user satisfaction. In processing data with the IPA method, the first thing to do is recapitulate the results of the questionnaire assessment obtained.

2.1.5 Level of Services (LOS)
According to (Sukirman, 1994) The level of road service is a combined condition shown by the relationship between vehicle volume divided by capacity (V / C) and speed. The criteria for the level of service for sidewalk facilities are contained in the Regulation of the Minister of Public Works (Guidelines for Planning, Provision, and Utilization of Pedestrian Network Infrastructure and Facilities in Urban Areas, 2014), including the following:

A. Standard A, pedestrians can walk freely, including being able to determine the direction of walking freely, at a relatively fast speed without causing interference between pedestrians. Pedestrian path area ≥ 12 m2 / person with pedestrian flow <16 people / minute / meter.
B. Standard B, pedestrians can still walk comfortably and quickly without disturbing other users, but the presence of other pedestrians has started to have an effect on pedestrian flow. Pedestrian path area ≥3.6 m2 / person with pedestrian flow <16-23 people / minute / meter.
C. Standard C, pedestrians can move in the same direction normally, although in the opposite direction there will be small contact, and it is relatively slow due to limited space between pedestrians. Pedestrian path area ≥2.2-3.5 m2 / person with pedestrian flow <23 people / minute / meter.
D. Standard D, pedestrians can walk with a normal current, but must frequently change positions and change speed because the opposite current of pedestrians has the potential to cause conflict. Pedestrian path area ≥1,2-2,1 m2 / person with pedestrian flow <33-49 people / minute / meter.
E. Standard E, pedestrians can walk at the same speed, but movement will be relatively slow and irregular when many pedestrians turn around or stop. Pedestrian path area ≥0.5–1.3 m2 / person with pedestrian flow> 49-75 people / minute / meter
F. Standard F, pedestrians walk at a very slow and limited current speed due to frequent conflicts with one-way or opposite pedestrians. Standard F is no longer comfortable and is no longer in accordance with the pedestrian space capacity. Pedestrian path area <0.5 m2 / person with varying pedestrian flows.

3. Result and Analysis
3.1. Analysis of Locations Condition
The pedestrian route between Dukuh Atas MRT Station and Sudirman KRL Station is 183 m in length starting from the exit of the KRL Sudirman station to the entrance of the Dukuh Atas MRT station. In addition to the KRL and MRT stations, in the dukuh Atas transit area there is also an Airport Train Station and also a Trans Jakarta Bus Terminal. The area around the research location has office buildings, apartments and shopping centers so that activities around the research location are quite busy and varied.

3.2. Analysis of General Pedestrian Facilities

Based on observations, the authors summarize the availability of supporting facilities for public pedestrians based on the Technical Planning of Pedestrian Facilities by the Ministry of PUPR (Kementrian Perhubungan, 2015)in the following table:

Table 1 Availability of supporting facilities for connecting lines between stations

No.	Facility	Availability		Description
		Avlb	NA	
1	Signs and Markers	√	**x**	
2	Speed Controller	**x**	√	
3	Waiting station	√	**x**	
4	Lighting	√	**x**	
5	Safety fence	√	**x**	
6	Protection / Shade	√	**x**	Partial
7	Green area	√	**x**	
8	Seats	√	**x**	
9	Trash bin	√	**x**	
10	Halte	√	**x**	
11	Drainage	√	**x**	
12	Bolar	**x**	√	

3.3. Analysis of Pedestrian with Special Needs Facilities

Based on the Minister of Transportation Regulation (Kementrian Perhubungan, 2017), accessibility for service users with special needs on pre-transportation facilities includes at least:

Table 2. Availability of facilities for users with special needs

No.	Facilities	Availability	
		Avl	NA
1	Guidung block at the transportation infrastructure (pedestrian, ticket counter,toilet dll):	√	**x**
2	special signs / instructions in the service area that are easily accessible (parking area, ticket counter, toilet dll);	√	**x**
3	visual / audio information related to travel information;	√	**x**
4	accessible doors / gates with dimensions that match the width of the wheelchair;	√	**x**
5	Drop zone;	√	**x**
6	Ramp with a suitable slope;	√	**x**
7	Access to boarding and disembarking passengers that are accessible in multi-storey buildings;	√	**x**
8	An accessible toilet with a toilet door dimension that fits the wheelchair's width;	√	**x**
9	Special ticker counter that easily accessable;	√	**x**
10	Waiting room with the priority seats;	√	**x**
11	The nursing room / nursery room is equipped with sofa facilities, waist-high baby taffle for women, air conditioner, sink, trash can, and drinking water dispenser;	√	**x**
12	Polyclinic;	**x**	√
13	Playground;	√	**x**

No.	Facilities	Availability	
		Avl	NA
14	Parking area;	√	x
15	Emergency fired access;	x	√
16	Wheel chair;	x	√

3.4. Flow, Velocity, Density and Pedestrian Space

A. Pedestrian Flow

Flow is the volume of pedestrians crossing a certain area within a specified period of time. The pedestrian flow formula (Transportation Research Board, 1985) is found at :

$$Q_{15} = \frac{Nm}{15^{*}W_E}$$

Dimana:
Q15 : pedestrian flow interval 15 minutes (pedestrian/meter/minute)
Nm : The greatest number of pedestrians at 15 minute intervals (pedestrian/15 menit)
WE : Effective width of sidewalk facilities (meters)

Table.3 Pedestrian Flow

No.	Location	Number of Pedestrians	Velocity (V) (m/mnt)	Pedestrian Flow (Q15) (Ped/m/mnt)
1	Entrance of MRT Station	121	113.34	1.07
2	Entrance of KRL Station	110	107.53	1.02

B. Pedestrian Velocity

Velocity is the time taken by pedestrians within a predetermined distance. The pedestrian speed formula based (Mannering , Fred L.,& Kilareski, 1988)) is in the following equation:
v=L/t

Description:
V : Pedestrian Velocity (m/second)
L : Observation Distance (m)
t : Time (m/second)
Based on the research results, pedestrian speed data are as in the following table:
Table 4 Average speed data for pedestrians

No.	Location	Number of Pedestrians		Avrg. Velocity		Avrg. Combined Velocity (m/s)	Avrg. Combined Velocity (m/mnt)
		Male	Female	Male	Female		
1	Entrance of MRT Station	587	843	1.9	1.9	1.9	113.3
2	Entrance of KRL Station	1070	1190	1.8	1.8	1.8	107.5

C. Pedestrian Density

Density is the number of pedestrians in a space to walk at a specified distance and time. As for calculating the density is dividing the number of pedestrians by outside the area.

Table 5. Pedestrian density data

No.	Location	Pedestrian Flow	Velocity (m/d)	Density (D) (Ped/m2)

1	Entrance of MRT Station	1.07	1.9	0.57
2	Entrance of KRL Station	1.02	1.8	0.57

D. Pedestrian Space
Pedestrian Space is the amount of pedestrian area available to pedestrians.
Table 6. Calculation of pedestrian space

No.	Location	Area	Number of Pedestrians	Space/Pedestrians (m2/pej.kaki)
1	Entrance of MRT Station	1464	121	12.10
2	Entrance of KRL Station	1464	110	13.31

3.5. Level of Service Analysis

Based on the Regulation of the Minister of Public Works (Peraturan Menteri Pekerjaan Umum, 2014), the service level of the connecting pedestrian route between KRL Sudirman station and Dukuh Atas MRT station is standard A, pedestrians can walk freely, including being able to determine the direction of walking freely, at a relatively fast speed without causing interference between pedestrians. Pedestrian path area ≥ 12 m2 / person with pedestrian flow <16 people / minute / meter.

3.6. Questionnaire Data Analysis

The questionnaire data collection was carried out offline-online and fully online using google form. Offline-online filling is carried out at the research location directly by using a QR-code that directly leads to the google form link, respondents only need to scan the QR-code using a smartphone then fill out the questionnaire online. This was done as an effort to reduce long-term direct contact with respondents, remembering that Covid-19 outbreak is still quite high.

In collecting questionnaire data, a sample questionnaire is needed, the number determined using the Slovin formula. This is done to obtain relevant and accurate data in an efficient manner. With reference to the number of MRT passengers in 2019, the sample size calculation is as follows:

$$n = \frac{N}{(1+N(e)^2)},$$

$$\text{n} = \frac{24621467}{(1 + 24621467(0{,}1)^2)} = 99{,}9 \approx 100$$

Then the amount of data required is 100 respondents.

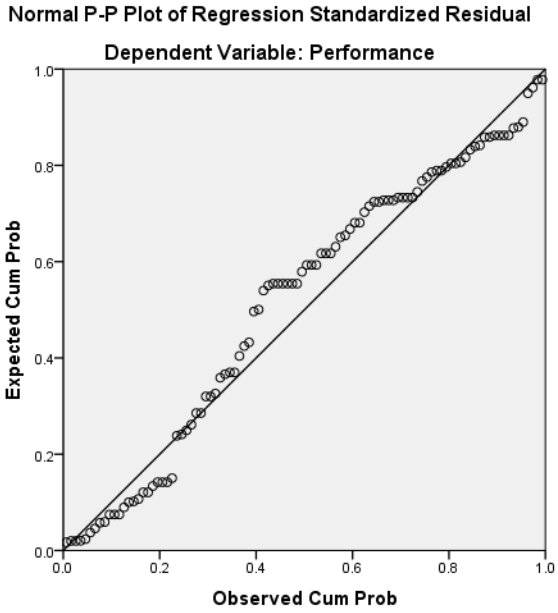
3.7. Data Testing

Data testing is one of the steps needed in research to ensure that the data obtained from the research results are appropriate.

3.8. Normality Test

The normality test is obtained from the distribution of data to determine whether the data has a normal distribution or is close to normal. As it is known, the significance value> 0.05 assumes that the residual value is normally distributed and vice versa if the significance value <0.05 then the residual value is not normally distributed. In this test, the authors used Normality Probability Plot and Kolmogorov-Smirnov Z testing with SPSS software.

Figure 1. Graph of Probability Plot normality test results



In Figure 1. It shows that the points which are the respondent's data spread out close to and in the direction of the diagonal line. This shows that the data is normally distributed.

Table 5. The results of the normality test with the Kolmogorov-Smirnov Test

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		100
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	4.24463393
Most Extreme Differences	Absolute	.131
	Positive	.081
	Negative	-.131
Kolmogorov-Smirnov Z		1.306
Asymp. Sig. (2-tailed)		.066

a. Test distribution is Normal.

b. Calculated from data.

Based on the results of the normality test with Kolmogorov-Smirnov in table 5 above, it can be seen that the results of the significance value are 0.066 so that it can be stated that the data is normally distributed.

3.9. Validity Test

The validity test is one type of test used to measure the accuracy of the questionnaire against the object assessed in the questionnaire. In this study, the object assessed is the level of service performance and the importance of connecting line facilities between two stations at the Sudirman KRL station and Dukuh Atas MRT station. In this test, this writer uses the product moment method because it correlates the performance and interests using the assessment interval.

Table 6 Validity test results with performance levels

Factors	Pearson Correlation	Sig. (2-tailed)	R_{Table} 5%	Decision
X.1.1	0.421	0	0.195	VALID
X.1.2	0.257	0.01	0.195	VALID
X.1.3	0.468	0	0.195	VALID
X.1.4	0.721	0	0.195	VALID
X.2.1	0.566	0	0.195	VALID
X.2.2	0.358	0	0.195	VALID
X.3.1	0.663	0	0.195	VALID
X.3.2	0.737	0	0.195	VALID
X.4.1	0.728	0	0.195	VALID
X.4.2	0.614	0	0.195	VALID
X.5.1	0.694	0	0.195	VALID
X.5.2	0.681	0	0.195	VALID

Table 7. Validity test results with importance levels

Factors	Pearson Correlation	Sig. (2-tailed)	R_{Table} 5%	Decision
X.1.1	0.61	0	0.195	VALID
X.1.2	0.712	0	0.195	VALID
X.1.3	0.751	0	0.195	VALID
X.1.4	0.759	0	0.195	VALID
X.2.1	0.763	0	0.195	VALID
X.2.2	0.409	0	0.195	VALID
X.3.1	0.786	0	0.195	VALID
X.3.2	0.66	0	0.195	VALID
X.4.1	0.867	0	0.195	VALID
X.4.2	0.807	0	0.195	VALID
X.5.1	0.701	0	0.195	VALID
X.5.2	0.722	0	0.195	VALID

Based on the results obtained from the validity test in Table 6 and Table 7, it is known that the questionnaire data on the level of performance and importance are declared valid.

3.10. Reliability Test

Reliability test is one type of test used in research to ensure a consistent level of research questionnaire.

Table 8. Reliability Statistics Table

Reliability Statistics

Cronbach's Alpha	N of Items
.822	12

Table 9. Table of performance level reliability test results

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X11	42.2100	20.269	.326	.819
X12	43.9200	21.004	.142	.831
X13	42.5700	19.460	.340	.820
X14	42.3400	18.813	.661	.798
X21	42.4000	18.909	.456	.810
X22	42.4300	20.349	.238	.826
X31	41.9700	18.171	.567	.800
X32	41.9000	17.747	.658	.792
X41	42.3500	17.563	.641	.793
X42	42.2400	18.467	.507	.806
X51	42.2000	17.737	.597	.797
X52	42.2200	17.224	.561	.801

Table 10. Reliability Statistics Table

Reliability Statistics

Cronbach's Alpha	N of Items
.912	12

Table 11. Table of performance level reliability test results

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X11	50.2600	20.114	.530	.910
X12	50.1600	19.752	.652	.905
X13	50.5100	18.798	.683	.903
X14	50.4000	18.848	.695	.903
X21	50.1500	19.523	.712	.902
X22	50.2100	21.380	.322	.917
X31	50.2600	19.305	.738	.901
X32	50.5800	19.297	.572	.909
X41	50.2900	18.592	.833	.896
X42	50.2600	18.841	.757	.900
X51	50.3000	19.808	.640	.905
X52	50.1900	19.751	.664	.904

According to (Sujarweni, 2015) the questionnaire is said to be reliable if the Cronbach alpha is more than 0.6. So that based on the results obtained in table 8, table 9, table 10 and table 11, it is known that the questionnaire on the level of performance and importance is stated as realistic.

3.11. Important Performance Analysis Data Processing

The IPA method data processing was carried out using Microsoft Excel and SPSS applications. The first data processing done is to find the level of suitability between performance and interests.

Table 12. Level of Suitability of Performance and Interests

Factors	Performance Score (X)	Importance Score (Y)	Level of conformity (%)
X.1.1	4.04	4.61	88%
X.1.2	2.33	4.71	49%
X.1.3	3.68	4.36	84%
X.1.4	3.91	4.47	87%
X.2.1	3.85	4.72	82%
X.2.2	3.82	4.66	82%
X.3.1	4.28	4.61	93%
X.3.2	4.35	4.29	99%
X.4.1	3.9	4.58	85%
X.4.2	4.01	4.61	87%
X.5.1	4.05	4.57	89%
X.5.2	4.03	4.68	86%

Based on the results obtained in Table 4., the assessment index is obtained in accordance with Table 3.The assessment intervals are:

A. 80-100% Interval (Exellent): 11 Elements of Statement
B. Interval 60-79.99% (Good): 0 Statement Element
C. Interval 40-59.99% (Average): 1 Element of Statement
D. Interval 20-39.99% (Fair): 0 Statement Element
E. Interval 0-19.99% (Poor): 0 Statement Element

Figure 3. Cartesian Diagram of Performance Levels and Levels of Interest

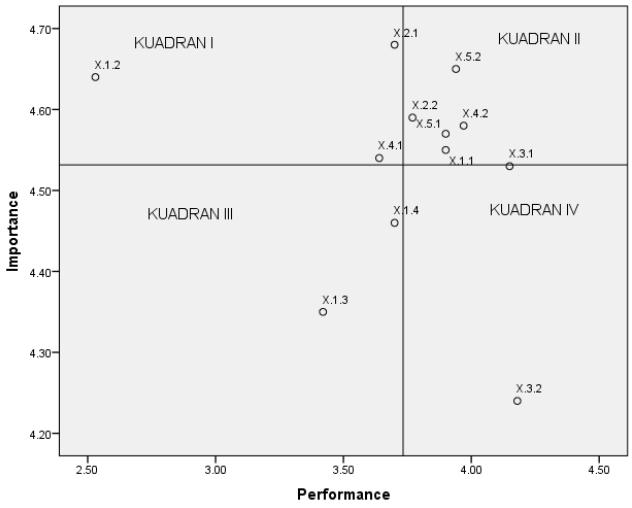


Figure 3 is a Cartesian diagram of the results of data processing on the level of performance and level of importance, so it can be determined the level of performance and importance of the facilities of the Sudirman KRL station and Dukuh Atas MRT station, including the following:

A. Quadrant I
(Main Priority) In this quadrant, there are things that are considered important and expected by service users, however, the performance provided by service providers to users is not satisfactory, so the performance needs to be improved to satisfy service users. The factors contained in Quaternary I include:
1. Protection of travel between stations from hot sun and rain
2. Security from criminal acts as long as access between stations
3. Completeness and availability of public facilities throughout access (benches, lighting, signs, shade etc.)

B. Quadrant II
In this quadrant there are things that are considered important and expected by service users and have high performance so that it needs to be maintained by service providers. The factors contained in Quadrant II include:
1. Air circulation throughout the access between stations
2. Safety from accidents along the access between stations
3. Cleanliness of connecting lines between stations
4. Availability of facilities for diffables throughout access (signs and special facilities for disabled persons)
5. Easy access to terminals / stations
6. Punctuality of KRL and MRT trains

C. Quadrant III
In Quadrant III there are factors that are considered to have a low level of performance and are less important or not really expected by service users so that service providers do not need to prioritize or pay more attention to these things. The factors contained in quadrant III include:
1. Control of noise due to vehicles or other activities along the access between stations
2. Control of odor or odor throughout the access between stations

D. Quadrant IV
In quadrant IV, there are factors that are considered to have a low level of importance by customers, but service users pay too much attention to these factors. The factors contained in quadrant IV, among others.
1. The beauty of the material and the shape of the location of the connecting lines between stations

4. Conclusion

Based on the results of the research on the performance of the dukuh Atas MRT station and the Sudirman KRL Station, it can be concluded that:

A. The number of daily users reaches 600 users on holidays and 1400 users on weekdays.

B. Based on the Regulation of the Minister of Public Works (Guidelines for Planning, Provision, and Utilization of Pedestrian Network Infrastructure and Facilities in Urban Areas, 2014), the service level of the connecting pedestrian route between KRL Sudirman station and Dukuh Atas MRT station is standard A, pedestrians can walk freely, including being able to determine the direction of walking freely, at a relatively fast speed without causing interference between pedestrians.

C. Supporting facilities for pedestrian paths is generally quite a day, 10 out of 12 factors have been met based on the Technical Guidelines for Pedestrian Facilitation Planning by the Ministry of PUPR.

D. Facilities for pedestrians with special needs have met 13 out of a total of 16 minimum facility factors based on the Minister of Transportation Regulation (PM No.98 of 2017)

E. Based on the results of the survey through questionnaires distributed to users of connecting line facilities, from 12 questionnaires distributed to 100 respondents, there are 11 Statement Elements with Exellent ratings, 1 Statement Elements with Average ratings.

References

D., Kaminsky, P. and Simchi-Levi, E. (2000). *Designing and Managing the Supply Chain* (McGraw-Hill (ed.)).
Janic M., R. A. (2001). Integrated transport systems in European Union: An overview of some recent developments. *Transport Reviews 21 (4), 469-497*.
Kast, F.E. and Rosenzwieg, J. . (1981). *Organization and Management—A Systems and Contingency Approach* (McGraw-Hill: Washington (ed.)).
Kementrian Perhubungan. (2015). *PM 48 Tahun 2015 Standar Pelayanan Minimum Angkutan Orang dengan Kereta Api*.
Kementrian Perhubungan. (2017). *PM 98 tahun 2017 Penyediaan Aksesibilitas pada Pelayanan Jasa Transportasi Publik Bagi Pengguna Jasa Berkebutuhan Khusus*.
Mannering , Fred L.,& Kilareski, W. P. (1988). *Principles of Highway Engineering and Traffic Analysis*. Wiley.

Peraturan Menteri Pekerjaan Umum. (2014). Pedoman Perencanaan, Penyediaan, dan Pemanfaatan Prasarana dan Sarana Jaringan Pejalan Kaki di Kawasan Perkotaan. *Menteri Pekerjaan Umum Republik Indonesia*, *2013*, 8.
Priyatno, D. (2014). *SPSS 22 Pengolahan Data Terpraktis*. CV. Andi Offset.
Solecka, K., & Jacek, Ż. (2014). Integration of the urban public transportation system with the application of traffic simulation. *Transportation Research Procedia*, *3*(July), 259–268.
Sugiyono. (2005). *Metode Penelitian Bisnis*. Alfabeta.
Sujarweni, W. (2015). *SPSS Untuk Penelitian*. Pustaka Baru Press.
Sukirman. (1994). *Dasar-dasar Perencanaan Geometrik Jalane*. Nova.
Transportation Research Board. (1985). Highway Capacity Manual. *National Research Council*.
Wirartha, I. made. (2006). *Metode Penelitian Sosial Ekonomi*. CV.Andi Offset.
Żak J., Fierek S., K. M. (2014). Evaluation of different transportation solutions with the application of macro simulation tools and multiple criteria. *Procedia – Social and Behavioral Sciences 111, 340 – 349*.

Author Biographies

Muhammad Isradi., born in Kandangan on 18th August 1972. He is secretary of study program of Civil Engineering of Mercu Buana University. He earned his Bachelor Degree in Civil Engineer from Muhammadiyah Malang University in 1998 with the title of his thesis is One Way Flat Plate Planning at Ratu Plaza Madiun. Then he earned his master degree in Civil Engineer with concentration in Transportation from Brawijaya University in 2001 with the title of thesis is Model Analysis of Family Movement Awakening in Resident Area Sawojajar Malang. He also teaches several courses such as Pavement Planning, Road Geometric Planning, Transportation Planningm and Environmental Engineering.

Andri Irfan Rifa'i, He is a Senior Lecturer of Civil Engineering and Planning. He completed the PhD at the Universitas Indonesia & Universidade do Minho with Sandwich Program Scholarship from the Directorate General of Higher Education and LPDP scholarship. He has been teaching for more than 19 years and much active to applied his knowledge in the project construction in Indonesia. His research interest ranges from pavement management system to advanced data mining techniques for transportation engineering. He has published more than 50 papers in journals and 2 books.

Amar Mufhidin, He was born in Majalengka on 16th June 1991. He is lecturer of some program study : pavement planning, road geometric planning, and transportation planning. He earned his Bachelor Degree in civil engineer from Indonesian University of Education, and he earned his Master Degree in Civil Enginer with concentration in transportation from Bandung Institute of Technology. He has expertise certificate of road pavement from Lembaga Pengatur Jasa Konstuksi. And he is still active in road planning project in Indonesia.

Dr.-Ing. Joewono Prasetijo, born in Pontianak on 18 October 1969. He earned his Engineer title in Civil Engineering in Tanjungpura University, Pontianak, Indonesia in 1993. He earned his Master of Science in Road and Transportation Engineering from Delft University of Technology, The Netherlands in 1996. He earned his Doctor Ingenieur from Ruhr-Universität Bochum, Germany in 1996. Now he is a Head Of Department of Rail Transportation Engineering Technology, Faculty of Engineering Technology, Univerisity Tun Hussein Onn Malaysia

Prima Molina, born in Bojonegoro on 25th October 1994. She graduated with association degree in Accounting from State Polytechnic of Malang in 2014. She continues her study in Civil Engineering to reach her Bachelor Degree in Mercu Buana University.