Analysis of the Function and Convenience of Pedestrian Public Transport Support the City of Bogor

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ABSTRACT

By looking at the conditions of the pedestrian paths located on the road section of Rd. Sholeh Iskandar, the center point is at the Uika bus stop and the drug monument stop 2, as well as Jl.KH.R.Abdullah bin nuh, the center point is at the Bubulak terminal, Yasmin shop shelter and Bogor radar shelter. the author analyzes the pedestrian path as a supporting access for public transport users. The research objectives to be achieved, among others, are to analyze existing conditions, calculate the level of pedestrian service, and analyze the perceptions of pedestrian lane users. In this study, researchers analyzed the level of pedestrian service referring to the technical planning guidelines, 1991 and produced the Level of service (LOS) for the performance of pedestrian facilities.

Keywords: service level; pedestrian path; level of service; facilities; performance.

INTRODUCTION

Pedestrians are an integral part of the road transportation system. One of the goals of traffic management is to try to separate pedestrians from the flow of vehicles, without causing major disruptions to accessibility. The characteristics of pedestrian path users and areas planned as pedestrian paths should be studied for the purpose of minimizing conflicts between pedestrian flow and vehicle flow, increasing safety for pedestrians, reducing traffic delays, and supporting pedestrian facilities in order to improve convenience for public transport users. By looking at the condition of the pedestrian paths located on the street Rd. Sholeh Iskandar, the center point is at the Uika bus stop and the drug monument stop 2, and Rd.KH.R. Abdullah bin Nuh, the central point at the Bubulak terminal, Yasmin shop shelter and Bogor radar shelter, the author observes, analyzes, evaluates the functioning of the pedestrian path as one of the supporting accesses for public transport users, level of service (LOS) and pedestrian personal characteristics. . and knowing the perceptions of the pedestrian route users.

The research objectives to be achieved in this study include analyzing existing conditions, calculating pedestrian service levels, and analyzing the perceptions of road users. In this study, researchers analyzed the level of pedestrian service referring to the technical planning guidelines, 1991 and produced the Level of service (LOS) for the performance of pedestrian facilities.

Judging from its type, PP. 79 of 2013 concerning the Road Traffic and Transportation Network states that pedestrian facilities include: A crossing place, which is stated by road markings, traffic signs and means of giving traffic signals, sidewalks, pedestrian bridges, pedestrian tunnels, while according to the regulation of the minister of public works number: 03 / PRT / M / 2014 Pedestrian facilities consist of pedestrian attachments. The facilities include: green lanes, lighting, seats, safety fences, trash cans, shelter and information boards.

In the implementation of the transportation system, it is taken into account that the condition of the pedestrians must be of particular concern. In creating a comfortable atmosphere for pedestrian users. Vehicles that pass near the pedestrian area so that they are able to create conditions will place the road as a vehicle traffic service according to the rules prepared by the government (Ganda CF et.al, 2019; Karimah H, Akbardin J, 2019; Syaiful S et.al, 2022; Syaiful S et.al, 2022; Syaiful S, Pratama Y, 2019; Syaiful S, Rusfana H, 2022; Syaiful S, Hariyadi D, 2019).

Preparation of transportation services will further develop in accordance with the demands of transportation services in a very suitable form. The expected form of service is to adjust to traffic conditions that have been agreed upon and prepared by each transportation operator, both public transportation, private transportation and online transportation which have begun to develop since the implementation of online transportation in accordance with advances in science and technology (Syaiful S et.al, 2020; Syaiful S, Fadly A, 2020; Syaiful S et.al, 2021; Syaiful S et.al, 2023; Syaiful S et.al 2023).

The term Pedestrian Capacity

Highway Capacity Manual (HCM) by the transportation research agency is used as a standard for analyzing different traffic transport modes. HCM uses the concept of service level / level of service as a qualitative measure to describe pedestrian traffic conditions, based on service measures such as speed and travel time, freedom of maneuverability in traffic disruptions, comfort and convenience. The part of HCM dedicated to the level of analysis of pedestrian flow services on sidewalks, crossings and road corners is primarily derived from the research of John Fruin. In this chapter, the pedestrian HCM method will be discussed and discussed in (Guidelines for Indonesian National Standards. SNI 03-2847-1992).

Pedestrian Facility Performance includes:

The effective road width is the part of the path that can be used effectively by pedestrians. The effective road width at a given point along a pedestrian facility is calculated as follows:

$$. WE = WT - WO =$$

Where:
- $. WE$ = Effective person walk width (ft)
- $. WT$ = Total road width (ft)

- $. WO$ = Barrier width (ft)

The pedestrian flow rate,

The hourly pedestrian requirement was used as input for the analysis. In accordance with the general analysis procedure used throughout HCM, the demand per hour is typically converted to a peak flow of 15 minutes, so the LOS is based on the busiest 15 minutes consecutively during the hour.

$$. v15 = \frac{vh4}{x\ PHD}$$

Where:
- $. v15$ = pedestrian flow rate for 15 minutes (ped/hour)
- $. vh$ = Requests for pedestrians during analysis hours (ped/hour)
- $. PHF$ = time per15 minutes

However, if a pedestrian volume as high as 15 minutes is available, the highest volume 15 minute cam can be used directly without the implementation of the peak hour factor. Next, the 15 minute peak flow is converted to a unit flow rate (pedestrians per minute per foot effective lane width):

$$. vp = v15/(15.wE)$$

Where:

- $. vp$ = is the flow of pedestrians per unit width (ped/ft/min)

Average pedestrian space,

The service measure for pedestrian facilities is pedestrian space, the opposite of density. Walker's room feet can be directly observed in the field by measuring the sample area of the facility and determining the number maximum pedestrians at any given time in the area. The pedestrian unit flow rate is related to spacepedestrians and speed:

- $. Ap = Sp/Vp$
- $. A$ = Pedestrian space (ft²/ped)
- $. S$ = Pedestrian speed (ft/mbt)

$. VP$ = Pedestrian flow unit width (ped/ft/min)

LOS (Level Of Service)

Pathways with random pedestrian flows

Where:

$$\underline{VC} \quad Ratio = \quad \underline{\text{flow of pedestrian}}$$
$$C \qquad\qquad\qquad 23$$

Volume to capacity ratio

The volume ratio can be used to determine the quality of pedestrian facilities.

Table 1. Volume to capacity ratio

LOS	Ratio (v / c)	Flow Rate (ped / min / ft)	Speed (ft / s)
A	≤ 0.21	≤ 5	> 4.25
B	> 0.21-0.31	> 5-7	> 4.17-4.25
C	> 0.31-0.44	> 7-10	> 4.00-4.17
D	> 0.44-0.65	> 10-15	> 3.75-4.00
E	> 0.65-1.00	> 15-23	> 2.50-3.75
F	Variety	Variety	≤ 2.50

Source: Highway Capacity Manual (HCM), 2010

Likert scale

According to Sugiono (2012) the Likert scale is a measurement method used to measure attitudes, opinions and perceptions of a person or group of people about social phenomena. Likert scale is commonly used questionnaire and most often used for research in the form of surveys, including in descriptive survey research.

The originator and creator of the Likert scale is the Rensis Likert from the United States who published a report explaining its use. Likert scale is used to measure attitudes, opinions and perceptions of a person or group of people about social phenomena. In the Likert scale method, this research questionnaire is used to explore aspects of the respondents' comfort and discomfort in assessing the current condition of the pedestrian path. This questionnaire discusses the results of the study with a percentage description, which first qualifies the score of each respondent's result. Perceptual analysis of the research questionnaire is to discuss the research results with a description of the percentage, first adding up the scores of each respondent's choice. In order to make it easier to analyze data, it is necessary to know the score obtained by the respondent from the results of filling out the questionnaire given. Therefore, the determination of the score is determined with the following information

a. Tabulating questionnaires from respondents.
b. Determining the score of the respondent's answer with the stipulated provisions as for the determination of the following questionnaire score:
   1) Each alternative answer for each question item is scored according to the level of alternative answers
   2) Each answer code is given a score in the form of a five scale number, namely:
      a) Very comfortable (VC)   Score: 5
      b) Convenient (C)   Score: 4
      c) Comfortable enough (QC)   Score: 3
      d) Uncomfortable (UC)   Score: 2
      e) Very Uncomfortable (VU)   Score: 1
c. Adding up the score obtained from each respondent.
d. Looking for the percentage score obtained by using the Likert scale formula.

e. The quantitative result of the calculation (equation 1) is then changed from the calculation to the sentence that is Quantitative in nature. The steps taken to determine the criteria for pedestrian comfort are:

1) Determine the maximum score obtained from the multiplication of the highest score, number of items, number of respondents. the maximum score of pedestrian comfort level is   = 5 x 15 x 30 = 2250

2) Determine the minimum score obtained from the multiplication of the lowest score, the number of items, the number of respondents. minimum score of pedestrian comfort level is = 1 x 15 x 30 = 450

3) Set a score, that is, between the maximum score minus the minimum score. The score ranges in question are:
2250 - 450 = 1800

4) Sets the class interval. The class interval is obtained from the range of scores for the criteria level.
Class interval = Range of scores = 1800 = 360
              Criteria level 5
Set the maximum percentage, which is 100%.

5) Set the minimum percentage, the minimum percentage is obtained from the minimum score divided by the maximum multiplied by 100% Minimum percentage   =   x   100%
$\frac{minimum\ score}{maximum\ score}$
$= \frac{450}{2250}$ x 100% = 20%
Set the percentage range, which is obtained from the maximum percentage minus the minimum percentage.
Percentage range   = Max percentage - Min

= 100% - 20% = 80%
Specifies the percentage class interval, which is the percentage range divided by the criteria. Thus the interval percentage classes are:
Percentage class interval = x 100% $\frac{range\ percentage}{criteria}$
$= \frac{80\%}{5}$ x 100%   = 16 %

6) Establish criteria, namely Very Comfortable (VC), Comfortable (C), Quite Comfortable (QC), Un Comfortable (UC), Very Uncomfortable (VU)

Table 2. Interval class percentage level of comfort

Class Interval Percentage (%)	Category
100%> Percent> 84%	Very Comfortable (VC)
84%> Percent> 68%	Comfortable (C)
68%> Percent> 52%	Quite Comfortable (QC)
Class Interval Percentage (%)	Category
52%> Percent> 36%	Uncomfortable (UC)
36%> Percent> 20%	Very Uncomfortable (VU)

Source: Sugiono (Administrative Research Methods ". 2008 edition. Publisher Alfabeta. Bandung.

RESEARCH METHODS

The research method used in this research is descriptive. This method describes the facts or phenomena that occur in the field (Sinulingga, 2011). The descriptive research method is to describe the existing conditions of the pedestrian path based on the comfort factors of the pedestrian path, the calculation of the level of service, and interviews to determine the level of user comfort on the pedestrian path of the research location.the flow chart is shown as follows:
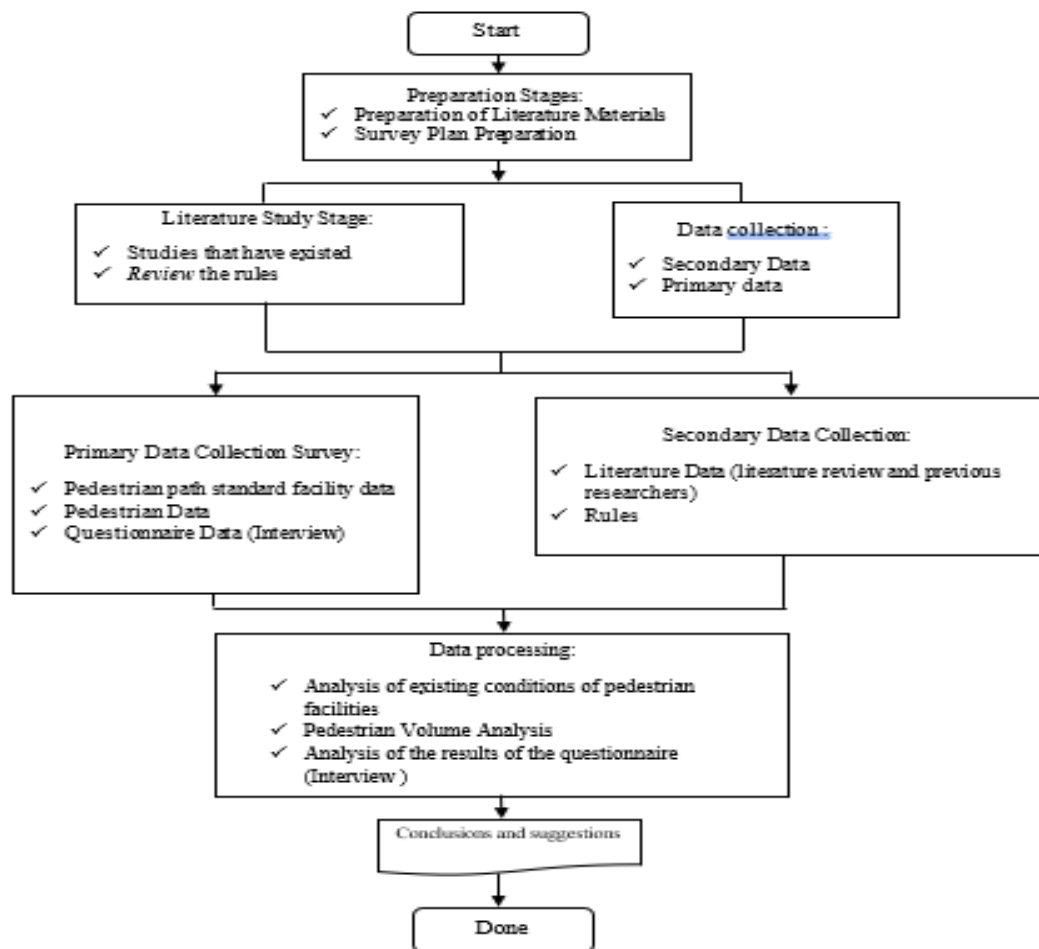
Figure 1. Research methodology flow chart

The research site was conducted at Rd. Sholeh Iskandar and Rd. KH.R.Abdullah Bin Nuh, the city of Bogor, in this study there are five central points as the target center for research on pedestrian paths, namely as follows :

a. Pedestrian route, the center point of Uika Bus Stop, Rd. Sholeh Iskandar, Kedung rhinoceros, Tanah Sareal, Bogor City.

b. Pedestrian route center point of Tugu Narcotics Stop 2, Rd.Sholeh Iskandar, Cibuluh, North Bogor District, Bogor City.

c. Pedestrian route for the center point of Ruko Yasmin Stop, Rd.KH.R.Abdullah Bin Nuh, Curug Bloom, West Bogor District, Bogor city.

d. Pedestrian route for the center of the Radar Shelter Bogor, Rd.KH.R.Abdullah Bin Nuh, Curug Bloom, West Bogor District, Bogor city.

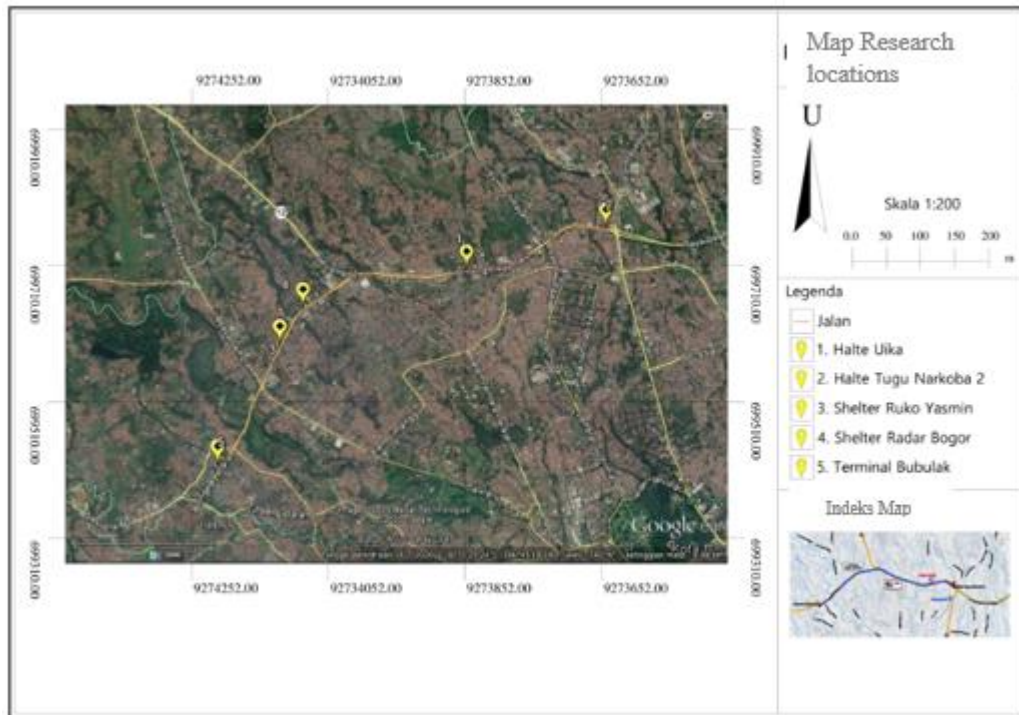e. Pedestrian line, the center point of Bubulak Terminal, Rd.KH.R.Abdullah Bin Nuh, Bubulak, Bogor Barat, Bogor City.

Figure 2. Research Location Source: Google earth, 2020

RESULTS AND DISCUSSION

Pedestrian Road (Halte Uika)

Knowing the level of pedestrian facility function, here are some problems with pedestrian path conditions:

a. On the pedestrian path, the central point of the bus stop is not available for a zebra crossing as a crossing access for pedestrians. So it is necessary to make a crossing place, which is stated by Road Markings, Traffic Signs and / or other Traffic Signaling Equipment.

b. The unavailability of disability friendly infrastructure installations (tactile tiles, ramps, railings).

c. Damaged sidewalk structures at several points that have been broken, cracked and have holes.

Pedestrian Facilities Service Level

Table 3. The result calculation of working days for Uika Bus Stop Pedestrian Facilities

Effective Width Pedestrian Facilities We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v/c	LOS
2.04	1	295.68	1.29	A
2.04	1	227.64	1.19	A
2.04	2	227.47	1.54	A

Source: Analysis Results

Table 4. The result holiday calculation for the Uika Pedestrian Stop Facility

Effective Width Pedestrian Facilities We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v / c	LOS
2.04	1	319.31	0.04	A
2.04	1	317.89	0.05	A
2.04	1	309.51	0.06	A

Source: Analysis Results

Perceptions of Road Users of Pedestrian Facilities for Access to and from Public Transportation It can be concluded that from 30 respondents who showed the lowest score were:

a. Environmental conditions in the pedestrian path area.

Score: 71 (47%), uncomfortable category on the completeness of supporting facilities for crossing (zebra crossing), signs, information media, and others. Score: 70 (46%), uncomfortable category on the safety of the pedestrian path itself (slippery, holes, etc.).

b. Conditions for stops / shelters / terminals in the pedestrian path area

Score: 70 (46%), uncomfortable category in the completeness of supporting facilities (benches, shade, signs, lighting and others). Score: 71 (47%), Uncomfortable category on Hygiene.

c. Level of function and convenience for access to bus stops for users of public transportation.

Score 55 (36%), very uncomfortable category on the completeness of supporting facilities, namely direct access to information, information boards, directions.

Pedestrian Routes (Halte Tugu Drugs 2)

Knowing the level of pedestrian facility function, here are some problems with pedestrian path conditions:

a. Unavailability or improper installation of disability-friendly infrastructure (tactile tiles, ramps, railings, etc.)

b. Because the sidewalk height of the pedestrian lane is only 23 cm from the road surface, which means that it is not in accordance with the ideal standards of existing guidelines, it is necessary to re-plan such as making a barrier fence so that there are no illegal crossers and the transportation of illegal passengers.

c. The occupation of sidewalks by the activity of street vendors and the presence of road equipment, utilities or road furniture (banners) that interfere with sidewalk space that impedes pedestrian flow.

Pedestrian Facilities Service Level.

Table 5. The result Calculation of working days for the Tugu Narcotics Pedestrian Facility 2

Facility Width Pedestrian We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v / c	LOS
3.45	1	483.32	0.05	A
3.45	1	564.34	0.04	A
3.45	1	384.50	0.07	A

Source: Analysis Results

Table 6. The result holiday calculation for the Tugu Narcotics Pedestrian Facility 2

Effective Width Pedestrian Facilities We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v / c	LOS
3.45	1	560.17	0.04	A
3.45	1	543.55	0.04	A
3.45	1	379.80	0.07	A

Source: Analysis Results

Perceptions of road users on pedestrian facilities for access to and from public transportation. It can be concluded that from 30 respondents who showed the lowest score were:

The level of function and convenience for access to bus stops for users of public transportation.

Score 73 (48%), uncomfortable category on Ease and comfort when getting on or off the vehicle. Score 72 (48%), uncomfortable category in traffic conditions when getting on and off the vehicle, (does not cause traffic jams). Score 51 (34%), very uncomfortable category on the completeness of supporting facilities, namely access to information directly, information boards, directions

Pedestrian Road (Shelter Ruko Yasmin)

Knowing the level of pedestrian facility function, here are some problems with pedestrian path conditions:

a. Unavailability or improper installation of disability-friendly infrastructure (ramps, tactile tiles and railings)

b. The unavailability of a place for crossing (zebra crossing) as an access for pedestrian crossing.

c. On the pedestrian path, the center point of the Yasmin shophouse shelter is not available for crossings (zebra cross) as pedestrian crossing access. Then it is necessary to make a crossing place, which is stated with Road Markings, Traffic Signs and / or other Traffic Signaling Equipment.

d. It is necessary to maintain or add supporting facilities for stop conditions such as: signposts, route information boards, lighting lamps that are still not available at the shelter facilities on this rural route

Pedestrian Facilities Service Level.

Table 7. The result working days calculation for the Ruko Yasmin pedestrian facility

Effective Width Pedestrian Facilities We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v / c	LOS
2.21	0	670.82	0.02	A
2.21	1	483.65	0.02	A
2.21	1	558.81	0.02	A

Source: Analysis Results

Table 8. The result holiday calculation for the Yasmin Ruko Shelter pedestrian facility

Effective Width Pedestrian Facilities We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v / c	LOS
2.21	1	409.88	0.04	A
2.21	1	342.95	0.03	A

| 2.21 | 1 | 323.68 | 0.03 | A |

Source: Analysis Results

Perceptions of road users on pedestrian facilities for access to and from public transportation. It can be concluded that from 30 respondents who showed the lowest score were:

The level of function and convenience for access to bus stops for users of public transportation.

Score of 48 (32%), category very uncomfortable in completeness of supporting facilities, namely direct access to information, information boards, directions.

Pedestrian (Shelter Radar Bogor)

Knowing the level of pedestrian facility function, here are some problems with pedestrian path conditions:

a. Maintenance is needed to remove side barriers (vertical and horizontal) such as the existence of street vendors, which reduce the width of the pedestrian path and inhibit the flow of pedestrian movement.

b. The unavailability of a crosswalk (zebra cross) or a pedestrian bridge (JPO) has an impact on the safety of road crossers, because this area is a fast flow lane for vehicles.

c. Maintenance is needed to remove side barriers (vertical and horizontal) such as street vendors and illegal parking on rural routes.

Pedestrian Facilities Service Level.

Table 9. The result working days calculation for the pedestrian Shelter Radar Bogor facility

Effective Width Pedestrian Facilities We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v / c	LOS
2.24	1	501.97	0.03	A
2.24	1	427.81	0.03	A
2.24	1	357.63	0.03	A

Source: Analysis Results

Table 10. The result calculation of working days for pedestrian facilities at Uika Bus Stop

Effective Width Pedestrian Facilities We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v / c	LOS
2.24	1	199.74	0.05	A
2.24	1	197.90	0.05	A
2.24	1	214.42	0.07	A

Source: Analysis Results

Perceptions of road users on pedestrian facilities for access to and from public transportation. It can be concluded that from 30 respondents who showed the lowest score were:

a. Condition of stops / shelters / terminals in the pedestrian lane area

Score: 60 (40%), uncomfortable category on the completeness of supporting facilities (benches, shade, signs, lighting and others)

b. The level of function and convenience for access to bus stops for users of public transportation.

Score: 48 (32%), category very uncomfortable on the completeness of supporting facilities, namely access to information directly, information boards, directions.

Pedestrian Road (Terminal Bubulak)

Knowing the level of pedestrian facility function, here are some problems with pedestrian path conditions;

a. On the pedestrian path, the central point of Bubulak Terminal is not available for a zebra crossing as a pedestrian crossing access.

b. At some point, the pedestrian path to the terminal has not yet been made. Only a few points of the rural route have been made in the area to the terminal, and even then it is still cut off and blocked by illegal buildings and street vendors.

Pedestrian Facilities Service Level.

Table 11. The result calculation of working days for pedestrian facilities at Uika Bus Stop

Effective Width Pedestrian Facilities We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v / c	LOS
3.91	0	1226.41	0.02	A
3.91	1	735.40	0.02	A
3.91	0	916.45	0.02	A

Source: Analysis Results

Table 12. The result calculation of working days for pedestrian facilities at Uika Bus Stop

Effective Width Pedestrian Facilities We (ft)	Pedestrian currents Wide Unity vp (ped / ft / min)	Room Pedestrian Ap (ped / ft²)	Ratio v / c	LOS
3.91	1	821.75	0.02	A
3.91	0	913.52	0.02	A
3.91	0	593.64	0.06	A

Source: Analysis Results

Perceptions of road users on pedestrian facilities for access to and from public transportation. It can be concluded that from 30 respondents who showed the lowest score were:

a. Environmental conditions in the pedestrian path.

Score: 37 (24%), very uncomfortable category on the beauty and shape of the pedestrian path. Score: 43 (28%), category very uncomfortable on the clarity of circulation between pedestrians and other activities (street vendors, parking, cycling, etc.). Score: 37 (24%), very uncomfortable category on the completeness of supporting facilities for crossing (zebra crossing), signs, information media, and others. Score: 44 (29%), category very uncomfortable on cleanliness. Score: 42 (28%), very uncomfortable category onSecurity from the pedestrian path itself (slippery, perforated)

b. Condition of stops / shelters / terminals in the pedestrian lane area

Score: 47 (31%), category very uncomfortable on how you respond to the physical condition of the bus stop / shelter /terminal on this pedestrian route. Score: 39 (26%), very uncomfortable category on the completeness of supporting facilities (benches, shade, signs, lighting and others). Score: 38 (25%), category very uncomfortable on cleanliness.

c. The level of function and convenience for access to bus stops for users of public transportation.

Score 51 (34%), very uncomfortable category on the completeness of supporting facilities, namely access to information directly, information boards, directions.

CONCLUSION

Functions of pedestrian lane facilities and infrastructure at the research location, there are aspects that need to be prioritized because their performance is still not available as crossing access for pedestrians, Unavailability or improper installation of friendly infrastructure for people with disabilities, Damaged sidewalk structures at several points The pedesrian lane, sidewalks are occupied by the activity of street vendors, illegal parking and the presence of road equipment, utilities or road furniture (banner) that disturbs the sidewalk space that hinders the flow of pedestrians. Based on the calculation of the pedestrian service level at 5 (five) research location points, both the analysis of the speed and space flows have the same LOS (service level) value. The service level of pedestrian facilities on weekdays and holidays is Level Of Service (LOS) A Which means that at 5 points the research location has a service level with the ability to move in the desired path, without the need to change movements. Based on the results of distributing questionnaires to five points of the study, there are factors that cause discomfort according to the most respondents and require special attention to the categories: Complete supporting facilities, namely direct access to information, information boards, directions. Completeness of supporting facilities for crossing (zebra crossing), signs, Information Media, and others.

REFERENCES

Tedy Murtedjo, 2020, 'FS and PRA Design Development of Increasing Pedestrian Access to Public Transportation (Sidewalks, JPOs, Trowongan, PJU) in the Jabodetabek Area.

Saefudin and Rulhendri, 2017, „Study of Traffic and Pedestrian Volume in Determining Road Crossing Facilities (Case Study: Jalan Padjajaran Bogor City STA. 0 + 000-0 + 250)". ASTONJADRO Journal of Civil Engineering, vol. 6, no. 1, pp. 1-14.

Ria Roida Minarta, Institute for Transportation Development and Policy (ITDP), March 2017, "Design report on improving connectivity and improving pedestrian comfort in the city center of Medan": Jalan Johar No 20, Menteng, Jakarta 2017

Muslihun, Muhammad, 2013. "Study of Pedestrian Comfort on the Utilization of Pedestrian Paths on the Semarang City Protocol Street (Case Study of Jl.Pahlawan)". Essay. Department of Civil Engineering, Faculty of Engineering, State University of Semarang. Semarang

Directorate General of Land Transportation. 1997. Decree of the Director General of Land Transportation No: SK.43 / AJ 007 / DRJD / .97. Department of Transportation. Jakarta.

Decree of the Director General of Highways No. 032 / T / BM / 1999, Guidelines for Pedestrian Path Planning on Public Roads, Bina Marga Publisher, Jakarta.

PP 79/2013, Government Regulation Number 79 of 2013 concerning Road Traffic and Transportation Networks.

Directorate General of Highways (1995), Procedures for Planning Pedestrian Facilities in Urban Areas.

Khisty, C. Jotin. "Evaluation of Pedestrian Facilities: Beyond the Level of Service Concept." Transportation Research Record. 1438 (1994): 45-50.

Highway Capacity Manual, 3rd ed. (2000). TRB, National Research Council, Washington, DC, 1998.

Hanafi Suryo Kusomo, 2010. "Study of Analysis of Service Level Calculation (Level of Service) Pedestrians on Jalan Margonda (the road between Jl.Arif Rahman Hakim-Jl.Siliwangi), Depok City. Department of civil engineering, Faculty of engineering, University of Indonesia.

Sugiono, 2012. "Quantitative Research Methods, Qualitative, and R & D". Alfabeta Publisher. Bandung.

Sugiyono. 2013.*"Administrative Research Methods"*. 2008. Edition Publisher Alfabeta. Bandung.

Lubis, Hammi Fadhilah, 2018. "Analysis of the comfort of pedestrian users in the city center of Padang Sidempuan". Description of the Civil Engineering Department, Faculty of Engineering, University of North Sumatra, Medan.

Regulation of the Minister of Public Works number: 03 / prt / m / 2014/2011 concerning Guidelines for planning, provision and utilization of pedestrian network infrastructure and facilities in urban areas of Jakarta: Minister of Public Works. www. wikipedia.org/wiki/ Walking accessed on September 1, 2020.

Cicilia Fransisca Ganda, Hary Moetriono, Sri Wiwoho Mudjanarko, (2019). Analisis Alternatif Pembiayaan Penyeberangan Asdp Ujung-Kamal Akibat Dibangunnya Jembatan Surabaya-Madura. ASTONJADRO, 8(2),pp.103-109. http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO/article/view/2801/1681

Hana Karimah, Juang Akbardin, (2019). Kajian Tentang Model Bangkitan Pergerakan Permukiman Kawasan Ciwastra Kota Bandung, ASTONJADRO, 8(2),pp.97-102. http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO/article/view/2799.

Syaiful Syaiful, Hermanto Siregar, Ernan Rustiadi, Eri Susanto Hariyadi. (2022). Performance Of Three Arms Signalized Intersection At Salabenda In Bogor Regency, ASTONJADRO, 11(1),pp.13-29.

S Syaiful, H Siregar, E Rustiadi, ES Hariyadi. (2022). Model Rekayasa Lalu lintas dalam Sistem Transportasi dengan Pola Kerjasama antar Wilayah Berkelanjutan di Kota Bogor. IPB University.

S Syaiful, H Rusfana. 2022. Rigid Pavement Planning In Traffic: Case Study In Ciherang Road And Pemuda Road, Bogor Regency, Indonesia. Journal of Applied Engineering Science, 1-13.

S Syaiful, Y Pratama. 2019. Sustainable Studies about General Public Transport Performance in the City Of Bogor, ARPN Journal of Engineering and Applied Sciences 14 (18), 3241-3247.

S Syaiful, D Hariyadi. 2019. Case Study on Sustainable T-Jungtion Cibinong City Mall (CCM) in Bogor Indonesia, ARPN Journal of Engineering and Applied Sciences 14 (17), 2960-2971.

S Syaiful, H Prayoga, J Akbardin. 2020. Sustainable about the Need of Parking Systems at the Mall RDS Bogor, ARPN Journal of Engineering and Applied Sciences 15 (22), 2620-2626.

S Syaiful, A Fadly. 2020. Analysis of the Effectiveness of Bus Services Outside of Campus IPB Dramaga Bogor. ASTONJADRO, 9 (2), 173-186.

S Syaiful, H Siregar, E Rustiadi, ES Hariyadi. 2021. Traffic Improvement Strategy in Transportation System Using AHP Method. ARPN Journal of Engineering and Applied Sciences 16 (22), 2431-2439.

Syaiful Syaiful, Renea Shinta Aminda, Yuggo Afrianto, 2023. Influence motor cycle density on noise sound at the highway. ASTONJADRO, 12 (1), 304-313.

S Syaiful, P Pratikso, SW Mudjanarko, 2023. Literature Study of the Sustainability Model of Transportation Facilities and Infrastructure in the Management of Public Transportation with the Concept of Inter-Regional Cooperation (Case in the City and District of Bogor). ASTONJADRO 12 (2), 613-634.