THE EVALUATION OF PEDESTRIAN FACILITIES IN UNIVERSITAS PANCASILA AREA

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ABSTRACT

The campus area has a potential to generate pedestrian trips for relatively close trips such as access between buildings or faculties. Then the provision of adequate pedestrian facilities in this area is important, moreover this is also one of the indicators in the UI Green Metric assessment. This study aims to determine the existing condition of pedestrian facilities in Universitas Pancasila educational area through an assessment developed by ADB with nine walkability parameters, to determine the perceptions of pedestrians on the quality of the facilities and to provide recommendations based on research results for improving the quality of pedestrian facilities in the campus area. The survey was conducted by distributing online questionnaires and an inventory survey of pedestrian facilities. The result indicates the presence of pedestrian facilities is sufficient, although some improvements are needed in several paths. The proposed improvement recommendations are improving disability facilities and pedestrian paths (the availability and its maintenance), adding crossing facilities and removing barriers on paths.

Keywords: *Pedestrian facilities, Walkability, Campus area.*

INTRODUCTION

Walking is the most basic, cheapest, and healthiest mode of transportation that can be reached by all levels of society. Pedestrians are the highest priority mode based on vulnerability of road users (Adminaite-Fodor & Jost, 2020), that is why providing pedestrian facilities is one of the important things in order to ensure the safety, security and comfort of its users. This guarantee for walking trips does not only apply on the road, but also in various urban areas, including campus area. In addition, the campus is also one of the places that can generate or attract pedestrian movements.

Figure 1. Modal Priority based on vulnerability of road users **(Adminaite-Fodor & Jost, 2020)**

Regarding environmental issues, almost all universities in Indonesia are promoting the Green Campus program. There is the UI Green Metric World University Rankings program was initiated by the Universitas Indonesia (UI) which aims to rank universities all over the world regarding the current condition and policies related to Green Campus and Sustainability. One of the aspects that is a concern in the program is green transportation. The indicator assessed in this ranking is the transportation sector, especially the pedestrian path policy on campus. The instrument concerns about availability of pedestrian paths, and then the safety, convenience, and disabled-friendly features of pedestrian paths (Universitas Indonesia, 2021). The success of the campus related to this policy will encourage students and employees to walk around the campus so that the walking mode is expected to replace the role of motorized vehicles for short distance trip.

Looking at the issues above, it is very important to provide adequate pedestrian facilities in the campus area. In terms of accessibility, several pedestrian access paths between faculties or buildings in Universitas Pancasila (UP) campus area look poorly maintained and less connected. Some pedestrians choose a detour rather than endangering themselves. So, it becomes important to evaluate how walkable pedestrian facilities in this area. This study aims to examine pedestrian perceptions of the facilities, evaluate the existing pedestrian facilities, and recommend its improvements in the Universitas Pancasila area.

Pedestrian Facilities

Pedestrian facilities are defined all infrastructure and facilities provided for pedestrians in order to increase smoothness, security, comfort and safety of its users. Then, the pedestrian facilities are divided into [1]:

- Main facilities: pedestrian paths, such as sidewalk, walkway, pedestrian crossing (zebra cross, bridge, tunnel) and so on.
- Supporting facilities: all supporting facilities, for example: signs, markings, speed controllers, information boards, lighting lamps, fences, shades, benches, bins, bus stops, drainage, bollards, and so on.

Pedestrian paths are classified into three types, (1) sidewalk, which is paved areas, placed parallel to traffic line (separated by curb or ditch). This type is common in urban areas, and it is rarely found in rural areas due to high cost and usage; (2) walkway, is an area for public pedestrians (except sidewalk or pathway) such as parks, yards, plazas, and other pedestrian-only areas; (3) pathway, is a temporary or permanent area which is usually a bit dirty and rocky, although some paths are paved. Pathway can be interpreted as footpath that usually indicates the general route taken by most pedestrians between two locations and also often indicates the need for a sidewalk or at least a paved surface.

In principle, the planning of pedestrian paths and its furnishings are required in accordance with regulations, such as the guidelines for planning pedestrian paths on public roads [9]:

- when walking to reach a destination, pedestrians tend to choose the track/route as close as possible, comfortable and smooth from distractions.
- The continuity of the paths is interconnected between the origin to the destination location, and vice versa.
- Availability of supporting facilities on paths, such as signs, markings, street lighting, special access for disability people and so on.
- Pedestrian facilities are not related to the function of the road.
- Pedestrian paths are built properly, so that when it rains the pedestrian path is not slippery, or flooded, and it would be nice if it is also equipped with shade.
- Pedestrian paths and traffic lines are built physically separate, in order to maintain safety and flexibility in walking.

- the point between the types of interconnected paths must be built as well as possible to provide a sense of safety and comfort for pedestrians.
- If there is a difference in the type of pedestrian paths, then the end of a segment must be built as well as possible to provide security and comfort for pedestrians.

Walkability

Walkability is the overall support for the pedestrian environment. This term reflects the overall walking conditions in an area (Krambeck, 2006). Many methods have been developed to assess the walkability. The methods have been developed according to various purposes and needs then the use of parameters also varies. There are 40 walkability assessment methods that are reviewed and classified based on the type of data assessed considering objectivity, subjectivity, qualitative and quantitative (Setianto & Joewono, 2018), one of them is the Global Walkability Index (Krambeck, 2006)which was adopted by ADB research with studied walkability in several cities in Asia (Leather et al., 2011), then it was adopted and modified by a research in several types of areas in Bandung City (Tanan et al., 2017; Wibowo et al., 2015).

List of parameters used in this study (Wibowo et al., 2015):

1. Pedestrian conflict with other motorized mode (P1): Focus in potential conflict between vehicle movement and pedestrian flow.
2. Presence walking facilities (P2): Considering on presence of sidewalk along to route. Then, the surface condition and cleanness were evaluated as well.
3. Crossing availability (P3): It is about the availability of crossing facilities, like zebra cross, pedestrian bridge (JPO), tunnel and so on. Average speed of vehicle also to be considered.
4. Safe Crossing (P4): pedestrian can cross safely. This parameter considers on exposure in crossing (time to wait and time needed to cross).
5. Motorist behavior (P5): It is to express where the crossing facilities were blocked by vehicle, especially motorcycle.
6. Walking amenities (P6): Appearance the walking amenities along the walking route, such as (benches, bins, street lightings and so on)
7. Walking infrastructure for disability (P7): Appearance walking infrastructure and special structure on walking path for disability people.
8. Obstruction (P8): Considering on permanent and temporary obstruction along the walking route.
9. Walking secure (P9): General situation on presence insecure on the walking route, especially walking in the night or in silent route.

METHODS

The data in this study are divided into two, primary and secondary data. Secondary data is data on the number of the Universitas Pancasila academicians (lecturers, staff, and students) that will be used to determine the minimum number of samples which are calculated by the Slovin formula (Sugiyono, 2013). The primary data consists of two parts, (1) pedestrian perception and preference data, and (2) pedestrian facilities inventory data. The part one was obtained from from the distribution of online questionnaires. The last one was obtained from the inventory survey of pedestrian facilities in Universitas Pancasila area. Some walkability parameters could not be assessed because the survey was conducted during pandemic era (to avoid bias data).

Each questionnaire contains questions including:

- Walking route
- Perception regarding walking route
- Preferences regarding pedestrian facilities
- Trip characteristics
- Profile of respondent

The target respondents in this study were Universitas Pancasila academicians and the other employees (OB) who often walked around the campus (except students in batch 2020 and 2021).The minimum number of respondents is 110 people.

The analytical method used in this study consisted of descriptive statistics for perception and preference data, and the Walkability Index (WI) for pedestrian facilities inventory data. However, validity and reliability tests were carried out to test the questionnaire instrument. The validity testing technique used Bivariate Pearson correlation (Pearson Moment Product). The indicator of the validity of a questionnaire is stated by the correlation value of r (validity test) is greater than equal to r product momen (two-sided test with a significance of 0.05). While the reliability test shows the level of consistency, predictive power and accuracy. High reliability is indicated by the value of r close to 1. In general, the reliability that is considered satisfactory is 0.7 (Nunnally, Jum C.; Bernstein, 1967). The reliability test used the Alpha Cronbach formula because the response in the form of a likert scale. The table below shows the results of both tests.

Table 1. Result of validity and reliability test

Question	Validity test r	Reliability test r	r product moment
P1	0.711		
P2	0.655		
P3	0.722		
P4	0.769		
P5	0.743	0.981	0.131
P6	0.769		
P7	0.033		
P8	0.715		
P9	0.722		

Based on table above, it is found that most of the

research instruments are valid except for parameter 7 (infrastructure for disability), this can be caused by several things including the respondents did not know yet about the type of disability infrastructure, or question was not understood, then the respondents answer became inconsistent. Meanwhile, all research instruments have been reliable or can be trusted as indicated by the r value of 0.981.

Walkability Index (WI)

Basically, there are many approach methods used in pedestrian facilities, one of them is the Walkability Index (Wibowo et al., 2015). WI is a value that states a condition of pedestrian facilities in a certain area. In order to calculate the index, it is necessary to directly assess the condition of the pedestrian infrastructure. Each segment of walking is assessed for each parameter using a 1-5 scale (1 is the smallest value), then it is called a score. The score of each parameter is multiplied by the weight of the value. In this study, all parameters are considered equally important, so the weight is 1.

$$\text{Score of segment} = \sum_{j=1}^{n}(\text{score} \times \text{weight}) \quad \text{……..(1)}$$

$$\text{Score of distance} = \text{score of segment}_i \times \text{segment length}_i \quad \text{……..(2)}$$

Then the WI of a route is,

$$\text{WI} = \frac{\sum \text{score of distance}}{\sum \text{i}} \quad \text{……..(3)}$$

Where,
n = number of parameter,
I = segment,
J = parameter

The interpretation of index as follows (Leather et al., 2011):

1. Green category, with a score of > 70, stated that it was highly walkable (very good for walking);
2. Yellow category, with a score of 50 – 70, states waiting to walk (good enough to walk);
3. Red category, with a score of < 50, states not walkable (not good for walking)

The index obtained explains the condition of pedestrian facilities as a function of accessibility in the Universitas Pancasila area. Proposed improvements can be seen based on the lowest WI on certain parameter. Another thing that can be considered in proposing improvements to pedestrian facilities is the result of pedestrian perceptions and preferences.

RESULTS AND DISCUSSION

Walking Routes

The walking mode is viewed as a function of accessibility, then the center point of activity is defined as faculty building or the other important building. The determination of the walking route is based on the assumption of origin-destination as well as the experience of researchers as pedestrians in the Universitas Pancasila area. There are nine (9) identified walking routes with a total length of 2.26 km which consisting of 3 types of pedestrian path segments (sidewalk, walkway and pathway). All of them have various effective pedestrian paths ranging from 0.5 m to 2.5 m. Each route is divided into several segments, where each segment is limited by intersection (in-out street) or different types of pedestrian paths.

The origin-destination of walking trip is main gate of campus to building/faculty. This assumption is based that each pedestrian knows the route with several consideration in choosing a walking route (Osly et al., 2021) and most of pedestrians are public transport users. The walking routes are as follows:

Table 2. List of identified walking routes

No	Name of route	Length (m)	Num. of segments
R1	Main gate to Head Office (Rektorat)	50.1	2
R2	Main gate to Faculty of Engineering (FT)	105.4	4
R3	Main gate to Faculty of Tourism (FPar)	305.4	11
R4	Main gate to LIA office	312.7	12
R5	Main gate to Faculty of Communication Science/Faculty of Psychology (FIKOM/FPsi)	437	14
R6	Main gate to Faculty of Pharmacy (FF)	322.4	10
R7	Main gate to Faculty of Law (FH)	208.9	5
R8	Main gate to Faculty of Economics and Business (FEB)	244.5	4
R9	Main gate to the Mosque (Masjid)	276	4

Figure 2. Walking routes in Universitas Pancasila area

Profile of Respondents

The profiles of respondents in this study are presented in Table 3.

Table 3. Profile of respondents

Characteristic of respondents	%
1. Gender	
Male	56%
Female	44%
2. Age	
< 20 years	4%
20-30 years	83%
31-40 years	6%
41-50 years	3%
> 50 years	4%
3. Educational background	
High School	78%
Diploma	0%
D4/S1	9%
S2/S3	13%
4. Occupation	
Students	86%
Lecturers	12%
Staffs	1%
Other employees (OB)	1%

Respondents in this study were academics consisting of students, lecturers, staffs and other employees at the Universitas Pancasila area (Srengseng Sawah) with a total of 223 respondents. Most respondents were students (86%) who they were 20-30 years old (83%) and males (56%).

Travel Characteristic

The trip characteristic contains information about the most used transportation mode, the origin of the trip, the most used walking route and its perception of the distance. In getting to campus, there are various modes used by respondents. Figure 3 shows the mode of transportation used by respondents to go to campus. Most of the respondents use motorbikes (28%), followed by the use of KRL (22%), private cars (14%), online taxis/ojek (13%), and car sharing (12%). Based on Figure 4.6, most of the respondents live in Bogor, Jakarta and Depok.

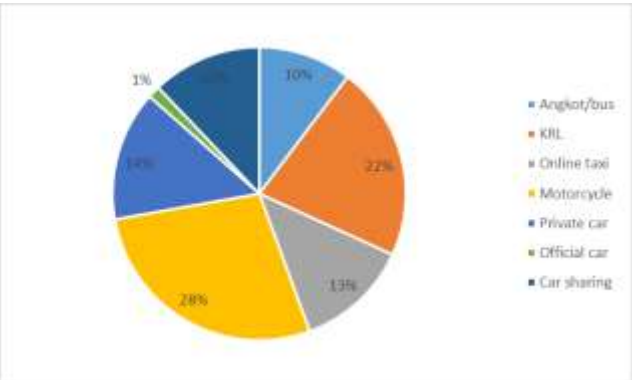

Figure 3. The most used mode of respondents

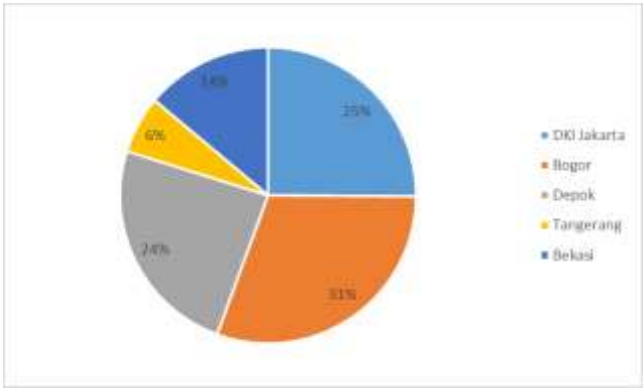

Figure 4. Trip origins of respondents

Figure 5 shows the most respondents are academicians of Faculty of Engineering (FT), where the dominant walking route is R2 (main gate to FT). Then, it is followed by R8 (main gate to FEB), and so on. Respondents were asked about their perception of the walking route. Most of them stated that the walking route is relatively close (71%). The 28% of all respondents stated that it is quite far but still acceptable. There is only 1% of them stated that it is far away. The data can be seen in Figure 6. Talking about distance perception of walking, some researchers has identified classes of factors that influence distance perception: (1) amount of information about the route, number of segmentations of the route, and exploration active or passive (Radvansky et al., 1995); (2) number of environmental features, travel time, travel effort or expended energy (Montello, 1997).

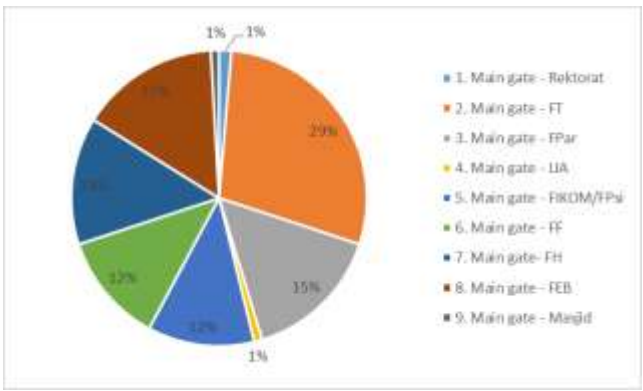

Figure 5. The most used walking route

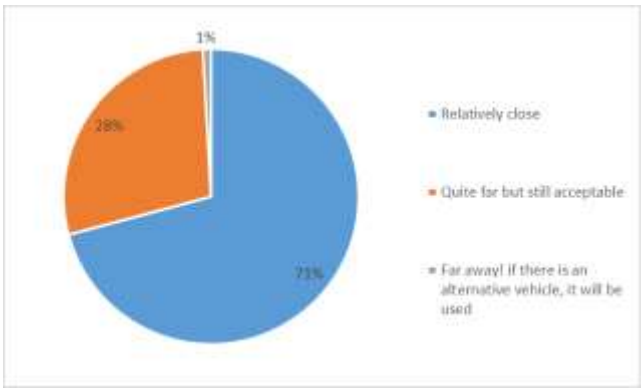

Figure 6. Distance perceptions of walking route

Further finding shows that the pedestrian perception and evaluation of campus walking routes are impacted differently in two conditions: walking with smartphone use and walking without smartphone use. Safety and quality of routes are more important for smartphone walkers, while the shortest distance and positive walking experience is considered to be important in route choice for another ones. (Lee & Shepley, 2020). These findings give the idea that the campus environment needs to respond the changes in pedestrian behavior.

Pedestrian Perceptions

Figure 7 illustrates respondents' perceptions of pedestrian paths in Universitas Pancasila area based on nine (9) parameters of walkability. They were asked to describe their experience of walking before the pandemic.

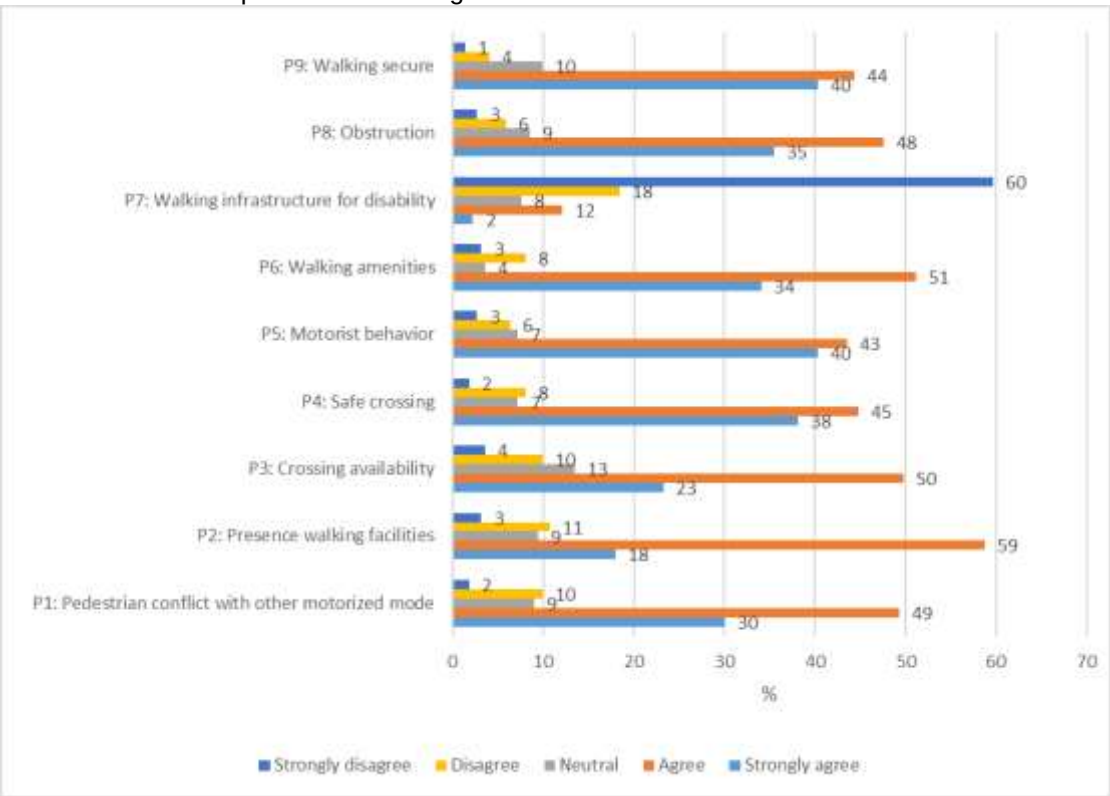

Figure 7. Perception of pedestrians related to pedestrian facilities

Almost all of the walkability parameters have similar pattern of responses, except for Parameter 7 (infrastructure for disability people). Most of the respondents considered that this feature was still minim in the UP area, which was indicated by disapproval response of 60% respondents. These are in accordance with the findings of previous study (Meutia et al., 2020).

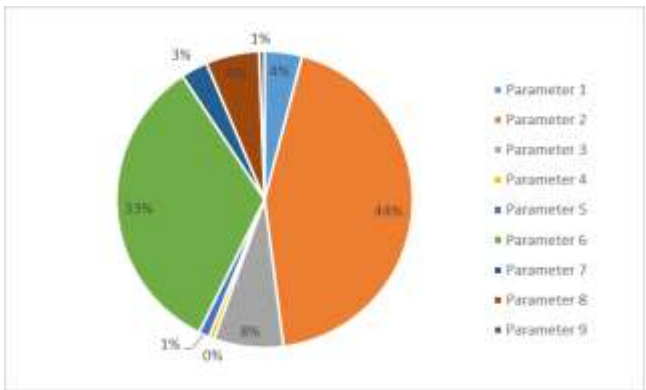

Figure 8. Improvement of pedestrian facilities expected by respondents

Furthermore, respondents gave an assessment of the parameters that need to be improved in quality. From **Figure 8**, it can be seen that the availability of pedestrian paths (parameter 2) needs to be improved. Many respondents (44%) complained about cleanliness, comfort (at some points, pavement tiles were broken), and the sidewalks were not wide enough. Likewise, the walking amenities (Parameter 6) were requested by the 33% of respondents. It is necessary to add supporting feature for existing pedestrian paths such as additional shades, benches, bins, and street lighting. The next one is availability of crossings (8%), because some of the walking paths are still mixed with motorized roads, pedestrians often feel little bit safe are more careful when crossing the road. motorbikes are often seen with high enough speed to drive in the campus area. Obstruction (Parameter 8) are also expected by respondents to be repaired. In some walking paths there are obstacles like bin or tree that reduce the effective width of paths.

Walkability Score

An inventory survey of pedestrian facilities was conducted on the nine (9) identified routes. Due to the pandemic condition, the assessment is only carried out on parameters that describe the physical condition of

pedestrian facilities. To prevent bias on the subjectivity of the surveyors, an assessment of the environmental conditions of pedestrians was not carried out, then the it is only based on the results of the pedestrian perception survey. The parameters assessed in the pedestrian inventory survey include:

a) Parameter 2 (Presence walking facilities
b) Parameter 6 (Walking amenities)
c) Parameter 7 (Walking infrastructure for disability)
d) Parameter 8 (Obstruction)

Table 4. Walkability scores

Route	Walking route	Length (m)	Parameter score				Walkability score	Category
			P2	P6	P7	P8		
1	Main gate - Rektorat	50.1	95.00	90.00	20.00	100.00	75.15	Highly walkable
2	Main gate - FT	105.4	82.50	95.00	20.00	100.00	72.35	Highly walkable
3	Main gate - FPar	305.4	80.00	85.45	20.00	94.55	70.97	Highly walkable
4	Main gate - LIA	312.7	80.00	81.67	20.00	85.00	68.55	Waiting to walk
5	Main gate - FIKOM/FPsi	437	79.29	75.71	20.00	82.86	62.74	Waiting to walk
6	Main gate - FF	322.4	79.00	86.00	20.00	100.00	72.03	Highly walkable
7	Main gate- FH	208.9	74.00	88.00	20.00	100.00	69.22	Waiting to walk
8	Main gate - FEB	244.5	85.00	80.00	20.00	100.00	73.10	Highly walkable
9	Main gate - Masjid	276	70.00	60.00	20.00	100.00	65.72	Waiting to walk
Average			80.53	82.43	20.00	95.82	69.98	

Based on the results of calculations in table 4, the average walkability score is 69.98 where the average score for parameter 2 is 80.53; parameter 6 is 82.43; parameter 7 is 20; and parameter 8 is 95.82. It would certainly be better if the results of the inventory survey could be taken with the overall walkability parameter, so the quality of pedestrian facilities can be expressed in a walkability index which shows the overall support for the pedestrian environment in Universitas Pancasila area.

If the two survey results are juxtaposed where parameters 2, 6, 7 and 8 use walkability scores, while parameters 1, 3, 4, 5, and 9 use the average perception response on a scale of 0-100, it will be illustrated as in Figure 9.

Related to pedestrian conflicts with motorized modes, Pedestrians felt that it was in good or controlled condition. This condition shows that in this area there is no need for controlled crossings yet because pedestrians are safe to cross anywhere. However, to minimize the risk, it would be better to install the traffic calming at some points in the streets, such as speed humps, rumble strips, and so on.

The presence walking facilities in Universitas Pancasila area, either its maintenance has provided a smooth and well-maintained surface of paths (only a small part of the walking paths is not in good condition and poorly maintained) or cleanliness looks sufficient. This result is in accordance with pedestrian perception (see in Figure 7), but it becomes the opposite of what the respondent wants (see in Figure 8). In the questionnaire, the only thing that is asked for perception of parameter 2 is the presence of walking facilities, while in open questions regarding the improvement of pedestrian facilities, respondents want more detailed things about surface condition of walking paths and its cleanliness. Also, this could have happened because the level of acceptance of respondents was different.

The walking infrastructure for disability people (parameter 7) shows a very minimal score. It is often found that accessibility of disability people is not adequately connected. The difference in level of pedestrian paths is quite difficult for disability people. There is no guiding block for blind users on sidewalks or other pedestrian paths, and also the slope of some of the ramps is still steep so it is still not safe for wheelchair users to pass.

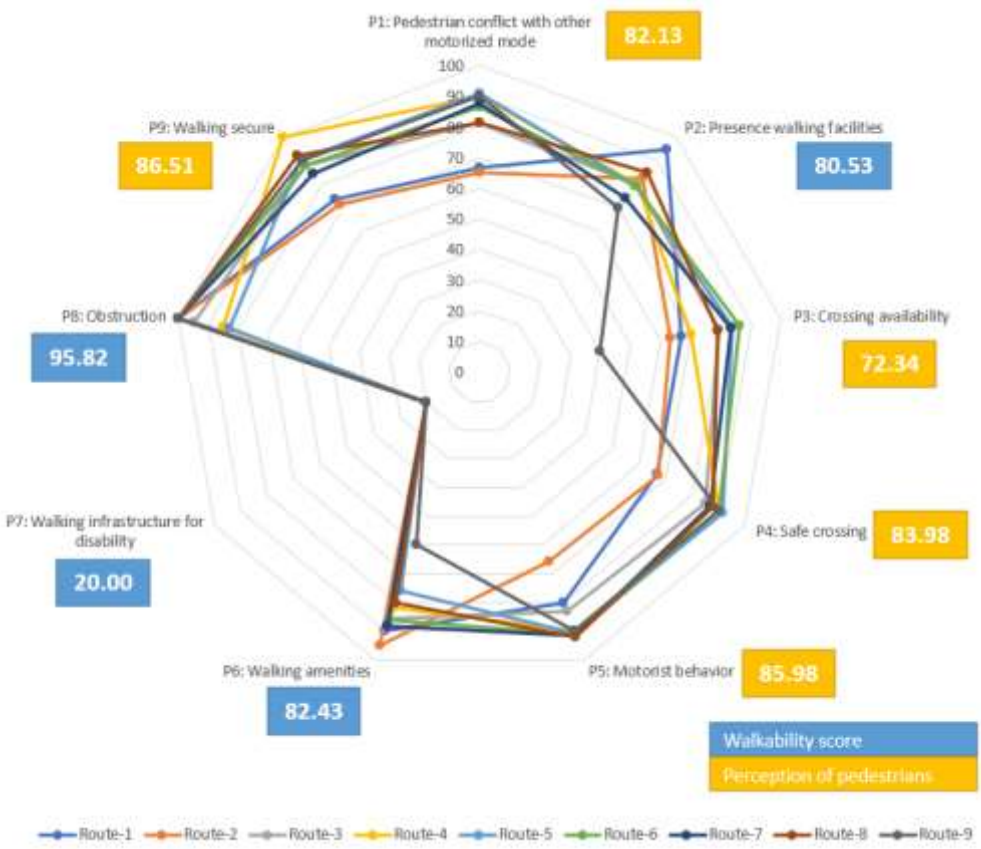

Figure 9. Walkability scores and pedestrian perception scores per parameter for each route

Regarding of completeness of facilities, some of the pedestrian paths are already look quite good, the vegetation is quite good around paths, bins are available in several places, shade is available in some segments of the walking paths. In terms of obstacles and security from crime, it is considered good.

CONCLUSION

Many methods have been developed to evaluate pedestrian facilities. the choice of method will depend on what aspects will be focused on in the evaluation. Each method presents a specific methodology that can be adapted to the needs of the study. The walkability index method (Tanan et al., 2017; Wibowo et al., 2015) which is modified from the Global Walkability Index method (Krambeck, 2006) can be used as a method for evaluating pedestrian facilities. Furthermore, policy regarding pedestrian from stakeholders can support overall walkability in a particular area (such as aspects required by the GWI method).

The result study regarding pedestrian perception of the existing condition of pedestrian facilities shows that all walkability parameters are responded in good condition except for walking infrastructure for disability (parameter 7). Next for evaluation of the condition of pedestrian facilities is expressed by the walkability score and pedestrian perception. For walkability scores, the presence walking facilities (parameters 2), walking amenities (parameter 6), and obstruction (parameter 8) show adequate good. While for pedestrian perception, the pedestrian conflict with other motorized mode (parameters 1), Presence walking facilities (parameter 2), crossing availability (parameter 3), safe crossing (parameter 4), and Motorist behavior (parameter 5) also show quite good.

Then, several pedestrian facilities that need to be improved in Universitas Pancasila area are (1) disability support infrastructure; (2) presence, cleanliness, comfort (many are damaged) and widening of Sidewalks or walkway; (3) walking amenities such as shades, benches, bins, street lighting and so on; (4) installing traffic calming in some spots; and (5) removal some obstructions in pedestrian paths (such as bins and trees).

While the suggestions in this study are (1) provision of adequate, safe, comfort and secure pedestrian facilities can increase interest in walking activities, especially in area that have the potential to generate pedestrian movement such as campuses. So this will suppress the use of motorized vehicles in the campus area; (2) data collection during a pandemic will be more difficult than normal conditions. A direct assessment of the walking environment will be difficult to describe, so that similar studies must consider the conditions that occurred at that time

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