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Application of Walkability Principles of Pedestrian Path in Supporting the Green City Concept

(Case of Parasamya Street Corridor, Sleman Regency)

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ABSTRACT

The convenience of pedestrian paths is an essential aspect that needs to be studied in urban planning. Along with the increasing use of motorized vehicles, facilities for pedestrians must also be considered to minimize the acquisition of pedestrian space. Walkability is a concept that prioritizes safety, comfort, and being able to provide friendliness to its users. The provision of facilities on pedestrian paths is also one of the supporting aspects in realizing a green city because the green lanes found on pedestrian paths have benefits such as circulation, city aesthetic functions, and maintaining urban air quality. The government area of Sleman Regency is an integrated office area that has begun to improve the pedestrian path, including Parasamya Street. This study aims to examine the application of the walkability principle on Parasamya Street, Sleman Regency, as an effort to support the concept of a green city. The research method used is qualitative through observation, documentation, mapping, and interpreting the results descriptively by comparing the existing conditions with theories and regulations related to the concept of pedestrian paths and the concept of a green city. The results obtained from this study are that the application of the walkability principles on Parasamya Street can support the concept of a green city which is indicated by the fulfilment of infrastructure facilities, including ecological comfort. Things that need to be improved are an equal distribution of facilities for the disabled and the improvement of crossing facilities.

1. Introduction

The pedestrian path is one of the elements that must be well-designed in urban planning. A road is a form of public space that also serves the social activities of the community or space users [1]. The increasing use of motorized vehicles at this time should also be balanced with improving the quality of pedestrian paths so that pedestrian rights as space users are still fulfilled and not threatened.

One criterion that needs to be met in constructing a pedestrian path is that it is inclusive and can be used by various community groups: the elderly, people with disabilities, pregnant women, and children [2]. Improper pedestrian way planning and not being accompanied by policies will increase the number of accidents [3]. The benefits of providing pedestrians are as follows [4]

a. Supporting efforts to revitalize urban areas;
b. Stimulate various economic activities to support the development of attractive business areas;
c. Presenting a distinctive, unique, and dynamic atmosphere and environment;
d. Foster positive activities to reduce environmental vulnerabilities, including crime;
e. Reducing air and noise pollution;
f. Preserving historical areas and buildings;
g. Controlling the level of road service; and
h. Reduce traffic jam

A walkable city (walkability) is an idea to create ideas in reaching the area on foot and accompanied by adequate complementary facilities [5]. Walkability covers the concepts of transportation, urban design, and urban form, which are viewed from a more macro and closer to the spatial layout [6]. Walkability is a concept that prioritizes aspects of pedestrian safety and comfort, lane

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connectivity, and attractive visual views to increase public interest in travelling on foot [7]. Walkability is a city's environmental condition that can provide friendliness to its users [8]. The concept of walkability is expected to increase people's desire to walk to support sustainable transportation [6]. The components and variables of the Global Walkability Index can be seen in Table 1 [9].

Table 1. *Global Walkability Index* – Components and Variables

Component	Variable
Safety and Security	- *Proportions of road accidents* - *Walking path modal conflict* - *Crossing safety* - *Perception of security from crime* - *Quality of motorist behaviour*
Convenience and Attractiveness	- *Maintenance and cleanliness* - *Existence and quality of facilities for blind and disabled persons* - *Amenities* - *Permanent and temporary obstacles on walking paths* - *Availability of crossings along major roads*
Policy Support	- *Funding and resources devoted to pedestrian planning* - *Presence of relevant urban design guidelines* - *Existence and enforcement of relevant pedestrian safety laws and regulations* - *Degree in public outreach for pedestrian and driving safety and etiquette*

Walkability parameters consist of: (1) pedestrian path conflicts with other modes of transportation; (2) availability of pedestrian paths; (3) the availability of crossings; (4) crossing safety; (5) motor vehicle driver behaviour; (6) amenities; (7) supporting infrastructure for groups of people with disabilities; (8) obstacles/obstacles; and (9) security from crime [10].

The provision of pedestrian paths must be equipped with supporting facilities to encourage mobility in walking for the community [11]. Physical aspects such as vegetation, lighting, paving, and cleanliness must be improved in pedestrian path planning because they greatly affect user comfort [12]. The conversion of pedestrian paths is also the main problem encountered which greatly affects user comfort [13].

Walking is related to physical and mental health [14]. Apart from being a healthy lifestyle, walking is also a form of sustainable transportation because it can reduce emissions [15]. Concerning the green city concept, the provision of pedestrian facilities is one of the supporting aspects in the realization of the Green City Development Program (Program Pembangunan Kota Hijau (P2KH)) [16]. Green lanes found on pedestrian ways have benefits such as circulation, city aesthetic functions, and maintaining urban air quality [17].

The concept of a green city stems from developing an increasingly densely populated city and buildings. The concept causes the population's comfort level to decrease and impacts the quality and productivity of human resources. The concept of a green city then emerged and became a policy in urban development over the last two decades [18].

Sleman Regency has a central government area consisting of offices of government agencies that are integrated and close to each other. Parasamya Street is one of the road corridors that received a pedestrian repair and widening project in Sleman Regency. In the project managed by the Environment Agency (Dinas Lingkungan Hidup (DLH)), the main concept is reforestation by planting shade trees and other vegetation with other functions such as aesthetics.

The concept of walkability and green city is often seen separately. Studies on walkability and pedestrian paths are often carried out concerning urban design concepts, while the green city is identical to city parks' provision. Thus, this paper aims to connect walkability as a part of a healthy lifestyle and transportation to support the concept of a green city.

2. Methods

The data collection method and the steps used in this research are literature studies on theories and previous research to synthesize walkability principles and research frameworks, conduct field observations through recording and documentation, and conduct a comparative analysis between the results of theory synthesis and findings in the field. This research uses qualitative and quantitative methods. The qualitative descriptive method in this study explains the findings in words by comparing the existing conditions with related theories and regulations. The quantitative method is used to assess the walkability principle to support the green city concept by scoring in each component.

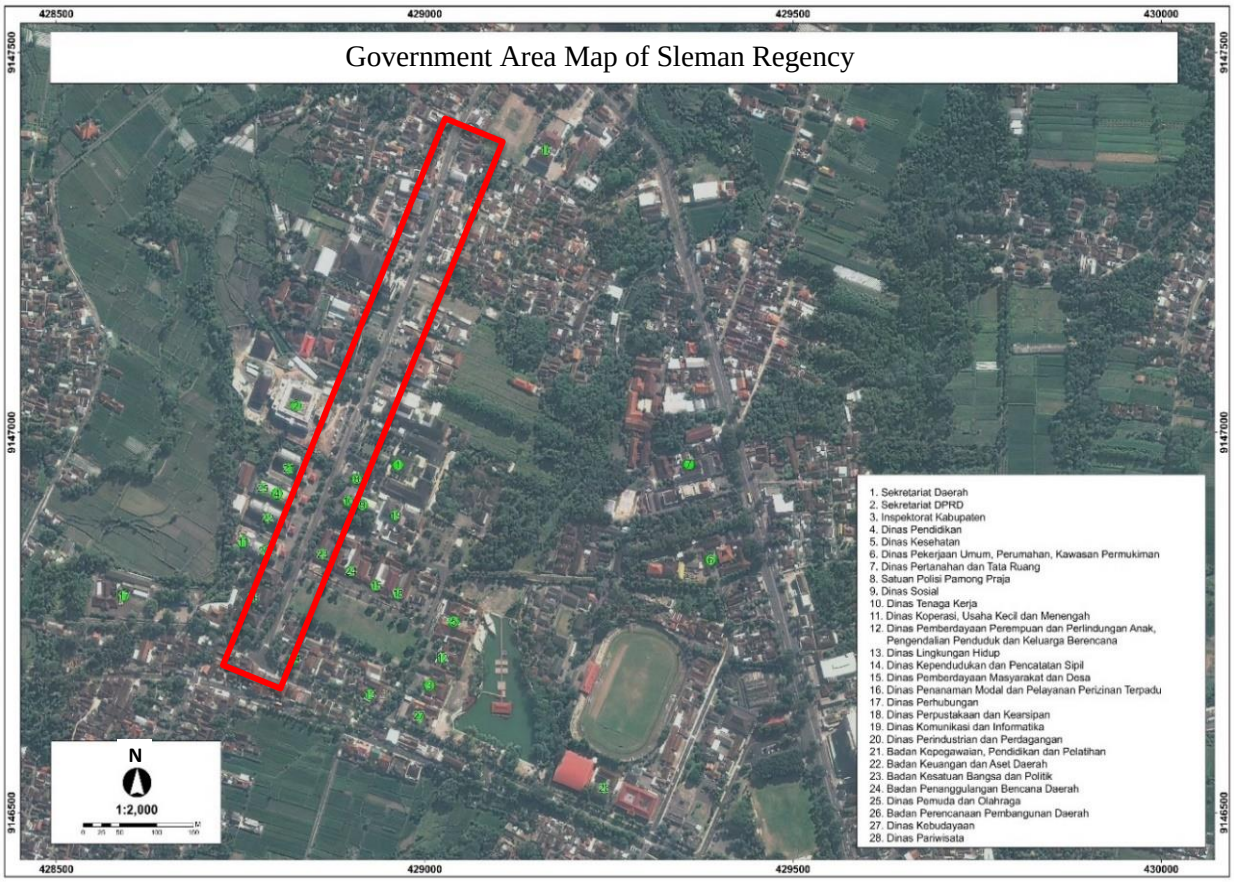

Figure 1. Parasamya Street Map (Source: Sleman Regency Government)

The research location is in the government area of Sleman Regency, precisely on Parasamya Street, along 900 meters (see Figure 1). Regarding location, the selection is based on the area's character as an integrated government area located in the centre of Sleman Regency, which has quite high activity and mobility.

3. Results and Discussion

3.1 Safety and Security

Pedestrians vary from children to adults, as space users should be able to feel safe and secure. The security in question includes the low number of accidents and crime in the area, the behaviour of motorized vehicle users that does not threaten or endanger pedestrians, adequate road crossing facilities, and low barriers or conflicts between pedestrian lane users. The following are the general criteria for safety on pedestrian paths according to the Regulation of the Minister of Public Works No. 03 of 2014 [4] concerning Guidelines for Planning, Provision, and Utilization of Pedestrian Network Infrastructure and Facilities in Urban Areas (see Table 2).

Table 2. Safety Criteria [4]

Facilities	Safety Criteria
Crossings	Pedestrian spaces are separated from vehicular traffic and have different heights
Green lanes	Located between pedestrian and vehicle paths
Street furniture/ pedestrian facilities	Located at points that are safe from vehicle circulation

Based on observations, the pedestrian space on Parasamya Street has been separated from the vehicle traffic lane and has different heights. Street furniture such as seats, street lamps, and trash cans have been placed on sides or points that do not directly intersect with vehicle circulation. Although the green lane on Parasamya Street is placed on the side between the pedestrian path and the building and not between the pedestrian and vehicle lanes, it is not considered to have much effect on the safety aspect, considering the width of the pedestrian path is wide enough so that pedestrians can choose to walk on the side that feels safer. The laying of the green lane on Parasamya Street is also considered to accommodate space users sitting on the available benches so that it is not too hot during the day. The speed of vehicles passing on Parasamya Street is also

classified as average or does not exceed the maximum limit of 40 kph, so there is no conflict between vehicle users and pedestrians. Also, no significant obstacles, such as on-street parking vehicles and hawkers, can influence the safety and security of pedestrians passing the path. It is safe and secure to walk on the Parasamya street corridor.

3.2 Convenience and Attractiveness

The properties in the pedestrian path must be comfortable and attractive (see Table 3). Pedestrian paths must be able to create a sense of comfort, there are no obstacles, and there is no conflict of interest. Pedestrian paths must also be attractive to attract pedestrians to use the existing pedestrian paths. Comfort and attraction can be achieved by arranging good support facilities. This sub-chapter will explain the condition of the pedestrian facilities on Jalan Parasamya.

Pedestrian Paths

The provision of pedestrian paths must consider the width of the lane that must be provided. The pedestrian paths are closely related to the activities contained in the area. The higher the intensity of the area's activities, the more mature pedestrian path planning is needed. The following are the requirement for pedestrian path width according to the Regulation of the Minister of Public Works 03/2014 (see Table 4).

The width of the pedestrian paths in the Parasamya Street corridor varies. The width of the pedestrian path on the east side tends to be wider, ranging from 2 to 3.5 meters (see Figure 2). The type of pavement used on the east side of the pedestrian path is a paving block with colouring and ornaments. Colouring and ornamentation on pedestrian paths are related to aesthetic function because the east side of the pedestrian path has become a priority for improvement by the Regional Government and is connected to public green open spaces in the form of a local government field. While on the west side, the width of the pedestrian path ranges from 2 - 2.5 meters with grey paving blocks.

Compared with the applicable guidelines or standards, the condition of the pedestrian path on Parasamya Street in terms of width and pavement can be considered appropriate. According to the guidelines, the minimum recommended pedestrian path width in office areas is 2 meters. The width of the pedestrian path has been implemented on the pedestrian path on Parasamya Street, although it can still be optimized again to 3 meters. The paving block is a type of pavement that is considered good as a pedestrian path pavement material because it can absorb water and is not slippery, so it does not endanger pedestrians.

Table 3. Convenience Criteria [4]

Facilities	Convenience Criteria
Crossings	- Pedestrian path has a comfortable width
	- Pedestrian path has a non-slip surface
Green lanes	- Has pedestrian shade vegetation for microclimate reduction
Street furniture/ pedestrian facilities	- Has a high level of comfort with materials as needed
	- The layout does not interfere with the flow of pedestrians

Table 4. Pedestrian Path Width Provision [4]

Land Use	Minimum width (m)	Recommended with (m)
Residential	1.6	2.75
Office	2	3
Industry	2	3
Schools	2	3
Terminal/ bus stop/ TPKPU	2	3
Shops/ Entertainment	2	4
Bridges, tunnels	1	1

Figure 2. Pedestrian path condition on Parasamya Street

Seats

Benches or seats are one of the pedestrian facilities that must be provided, especially on long roads. The provision for the distance between seats, according to the Regulation of the Minister of Public Works No. 03 of 2014, is 10 meters. The seats are made with dimensions of 0.4-0.5 meters wide and 1.5 meters long and use materials that have high durability.

The availability of benches on the pedestrian path of Parasamya Street can accommodate the needs of pedestrians. The condition of the bench is very good, with materials that meet the requirements and are located on the east and west sides (see Figure 3). However, the distribution of seats on the pedestrian path of Parasamya Street is considered uneven because it tends to cluster south to the Pemda field on the east side and only to the DPRD Secretariat office on the west side. The bench placement is generally also adjacent to the trees to create comfort for its users.

Trash bins

The provision of trash bins is one of the things that need to be considered in the arrangement of pedestrian paths because it relates to the cleanliness and aesthetic aspects of the area. Based on the reference to the Regulation of the Minister of Public Works No. 03 of 2014, the trash can is placed outside the free space of the pedestrian path with a distance between the trash cans of 20 meters. Trash cans are made with dimensions as needed and use materials with high durability.

Figure 3. Seat facilities for pedestrians on Parasamnya Street

Garbage facilities are located along the pedestrian path of Parasamya Street (see Figure 4). There is a segregation of organic and inorganic waste that pedestrians have put to good use. Garbage facilities are available evenly on the west and east sides of the pedestrian path on Parasamya Street. The availability of trash bin facilities greatly affects the cleanliness and aesthetics of the area. No trash was found scattered or scattered on the pedestrian path of Parasamya Street.

Figure 4. Trash bins on the pedestrian path of Parasamya Street

Crossings

Crossing facilities are useful for pedestrians to make it easier to cross the road. Types of pedestrian facilities are generally adjusted to the hierarchy, characteristics, and flow of vehicles that pass on the road segment. The crossing facilities in the Parasamya Street corridor are in the form of a zebra cross. However, the condition of the zebra cross is not good, which is indicated by the faded colour (see Figure 5).

People usually use the Zebra cross to cross from the east to the west and vice versa. Considering that this is a government area, there is also high mobility of pedestrian moving from one office building to another, so the availability of crossing facilities is certainly needed in this area. The zebra cross can be upgraded to a pelican crossing by adding a traffic signal and button for pedestrians to increase their safety.

Figure 5. Crossing facilities on the Parasamya street corridor

Facilities for Special Needs Pedestrians

A good pedestrian path is a pedestrian path that is also inclusive, meaning that the pedestrian path must be able to accommodate users from various backgrounds, including pedestrians with special needs. The Parasamya Street pedestrian path has guiding block facilities for persons with disabilities (see Figure 6). A guiding block is a facility for blind people as their guides. Guiding blocks are available along the pedestrian path in a well-maintained condition. However, at some points, guiding blocks are found disconnected from the access to the building, causing difficulties for blind people to walk through the path.

Figure 6. Facilities for the disabled on the pedestrian path of Parasamya Street

The ramp is an inclined plane that distinguishes the height of the floor surface and can facilitate movement, including on pedestrian paths. In the existing condition on Parasamya Street, ramps have been found at several main points on the east side around the government square. The condition of the ramp is very good, with a sufficient slope. However, there are still many other points of pedestrian paths on Parasamya Street that are not equipped with ramps, making it quite difficult for users with special needs, such as wheelchairs, to access the pedestrian path.

3.3 Policy Support

At the national level, the provisions for pedestrian paths are regulated in the Regulation of the Minister of Public Works no. 03 of 2014 concerning Guidelines for Planning, Provision, and Utilization of Pedestrian Network Infrastructure and Facilities in Urban Areas. The regulation also applies as a reference in analyzing the existing condition of the pedestrian path on Parasamya Street as the central corridor of the Sleman urban administration.

The Sleman Regency Government has revitalized the pedestrian path on Parasamya Street. The arrangement of pedestrian paths and the construction of jogging tracks in the local government's field is carried out by the Sleman Regency Environmental Service/ Dinas Lingkungan Hidup (DLH).

The pedestrian path arrangement is carried out in stages. The east side pedestrian path has already been arranged. Following the arrangement of the west side, it will be carried out in 2021. The budget for the pedestrian path on the west side comes from the Revised Regional Budget of 190 million rupiahs (see Figure 7).

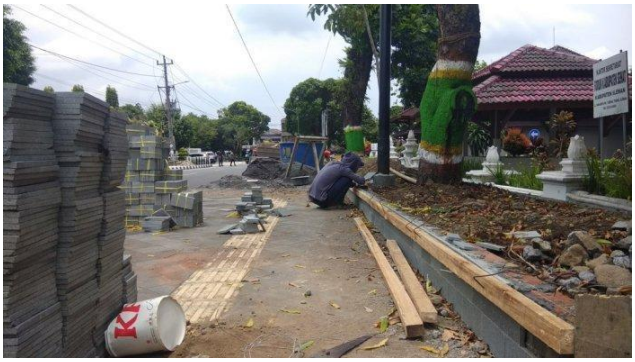

Figure 7. Revitalization of the west side of the Parasamya Street pedestrian path [19]

3.4 Walkability to Support Green City

Pedestrian paths that are integrated with green open spaces will add comfort for users. Various forms of greenery can be provided, such as trees, parks, green lanes, or road islands.

Arrangement of vegetation on pedestrian paths must be carried out by meeting basic criteria. Plants or trees that function as shade must be placed on the side that does not interfere with the mobility of pedestrians, including persons with disabilities. The arrangement of vegetation in terms of aesthetics considers the area's size and scale. The colours in the vegetation are made attractive with adjustments and uniformity but are not flashy. It is also necessary to determine the type of tree or vegetation that is the main character in the street corridor [16].

The presence of vegetation in the Parasamya street corridor is evenly distributed on the road's west and east sides (see Figure 8). Parasamya Street observations show there is

large, medium, and small-scale vegetation. Some of the vegetation found on Jalan Parasamya, among others:

a) Mahogany trees
b) Banyan trees
c) Tanjong trees/ Spanish Cherry
d) Whistling Pine
e) Blackboard trees
f) Bonsai trees
g) Pinwheel Flower
h) Chinese Croton
i) Sorrowless Tree

Large vegetation in the form of mahogany and banyan trees is planted at a certain distance and forms a repeating pattern that can create space characteristics other than their main function as shade. The shaded vegetation is also placed adjacent to the bench so pedestrians will not feel hot from the sun. Meanwhile, small vegetation functions in terms of area aesthetics complement green roads and ecological functions.

The next step after identifying the walkability component is scoring. Each component is assigned a score in the 1-3 based on availability and performance. The scoring is displayed in Table 5.

Figure 8. Vegetation on Parasamnya street corridor

Table 5. Scoring Assessment for Each Component

No.	Component	Score
1	Safety and Security	3
2	Convenience and Attractiveness	
	a. Pedestrian Paths	2
	b. Seats	3
	c. Trash bins	3
	d. Crossings	2
	e. Facilities for Special Needs Pedestrians	2
3	Policy Supports	3
4	Vegetations	3
	Total Score	21

1 = not available
2 = available
3 = available and working optimally

It is shown in Table 5 that the value is 21 (for the maximum value of 24). This result indicates that the walking environment on Parasamya Street is already well-designed to support the green city concept.

4. Conclusion

Based on the results of the discussion that has been carried out in the research "Application of the Principles of Pedestrian Walkability in Supporting the Green City Concept", it can be concluded that the walkability principles applied to the pedestrian path of Parasamya Street are in line with the concept of a green city. The arrangement of pedestrian paths not only meets the technical criteria for supporting facilities but also pays attention to ecological aspects by providing green lanes equipped with vegetation as shade and aesthetic functions. In addition, things that could be improved in the arrangement of pedestrian paths on Parasamya Street are an equal distribution of pedestrian paths in the south and north in terms of lane width, materials and ornaments used, as well as the completeness of facilities such as seats and traffic signal for pedestrian crossing

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