International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

Analysis of Characteristics and Service Level of Pedestrian Facilities: Case Study of Ubud Tourist Destination, Gianyar Regency, Bali Province, Indonesia

Nyoman Budiartha RakaMandi[1], Ni Nyoman Minati Sukardina[2], Alit Suthanaya[3]
[1,2,3] Engineering Faculty, Udayana University

ABSTRACT: The purpose of this study was to analyze the characteristics of sidewalks and pedestrians, the level of service and the type of pedestrian crossing facilities that are appropriate on Jalan Raya Ubud. Primary data collection using manual survey methods, including road geometric data, pedestrian volume, pedestrian speed, volume of road crossers and vehicles. Secondary data collection use literature study methods which include the location maps and population. Data analysis based on the guidelines of the Ministry of Public Works (2014). Based on the results of the analysis, the average width of the North and South sidewalks is 1.4 m with an average effective width of the North sidewalk is 0.9 m, while on the South sidewalk the average effective width of the sidewalk is 0.95 m. The largest pedestrian flow on the North and South Sidewalks on weekdays and holidays occurs in the afternoon with a total of 520 p/h with an average speed of 4.32 km/h, a density of 12 p/100 m^2 and 8 m^2/p pedestrian space for the North sidewalk, and the South sidewalk with a flow of 389 p/ h with an average speed of 3.72 km/h, a density of 10 p/100 m^2, and 10 m^2/p pedestrian space. On holidays, the flow is 744 p/ h with an average speed of 2.63 km/ h, a density of 28 p/100 m^2 , and a pedestrian space of 4 m^2 /org for the North sidewalk. While the South sidewalk has a flow of 351 org / hour with an average speed of 4.06 km / hour, a density of 9 org / 100 m^2 , and a space of 12 m^2 /org. The level of service of the North and South sidewalks on weekdays is included in the "B" category. The level of service of the North sidewalk on holidays is in the "C" category and the South sidewalk is in the "B" category.

KEYWORDS: Pedestrian Crossing Facility Type, Pedestrian Trajectories, Sidewalk Characteristics, Walking Speed, Level of Service, Ubud tourist destination.

INTRODUCTION

Indonesia is changed paradigm of transportation development policy in order to prioritize pedestrian(Kementrian PUPR, 2023). The primary function of the pedestrian network is to provide mobility for pedestrians, allowing them to travel from one location to another by walking(Gao et al., 2022) . The pedestrian network in tourism destinations such as Ubud serves as the framework of a tourist town and contains key tourist elements and activities including art market complexes, restaurants, hotels and cultural neighborhood centers. The pedestrian network can be understood as a structure within the urban space, consisting of interconnected streets with elements of accessibility and connectivity.

The island of Bali, which is one of the provinces of Indonesia, is the main destination for tourists entering Indonesia. Ubud is one of the districts of Gianyar regency is the third main destination for tourists visiting Bali after Kuta and Sanur. Transportation is a major issue and walking can be an important means of transportation for shorter trips, and for changing modes. The personal, social, economic and environmental benefits of walking are well documented: Walking reduces traffic congestion, air pollution, and noise; benefits individual health and well-being; and increases the friendliness and vitality of urban spaces.

Along with the increasing number of pedestrians and the increasing provision of public transportation, the Gianyar Regency Government has built new sidewalks in several areas in Ubud. These new sidewalks have better material quality than previous sidewalks, such as sidewalk surfaces using granite or cast concrete. Previous studies have shown that large investments in sidewalk construction will increase pedestrian interest and comfort (Putra.S, Purbanta, & Negara, 2013)

For these reasons, the promotion of walking and walkability has become the focus of many urban policies, especially since the emergence of the green mobility debate. The purpose of this study is to review and synthesize existing knowledge on pedestrian networks and use guidelines from PUPR to analyze them and how pedestrian networks can be analyzed.

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

MATERIALS AND METHODS

A. Overview of the Study Area

Ubud, as part of Gianyar Regency in Bali Province, has an area of 42.38 km^2 and a population of approximately 71,834 people(BPS Kabupaten Gianyar, 2024). Ubud is one of the tourist destinations in Bali, ranked third as a destination for foreign tourists (RakaMandi, 2022). Jalan Raya Ubud, one of the lanes in the Ubud sub-district, is famous for its tourist crowds. Along the road, there are many interesting places for tourists, such as art shops that provide various art crafts that are in demand by foreign tourists, as well as restaurants that serve culinary both from local and international food. The existence of tourism support facilities such as money changers, banks, homestays, and others around the Raya Ubud road makes it congested with pedestrians. This affects the condition of the facilities and traffic in the area.

Based on observations that have been done, pedestrian facilities on Jalan Raya Ubud have not met the standards of the Pedestrian Facilities Technical Planning Guidelines (Kementerian PUPR, 2018). Such as the absence of facility lanes (shade trees, seats, etc.) due to the limited land available. The entrance lane on the Ubud Highway section also does not meet the standards because of the number of disconnected sidewalks and *ramp* widths that do not meet the minimum width, and there is no shared lane for bicycle users. Pedestrian support facilities such as signs, seating, trash bins and others also do not meet the criteria for pedestrian support facilities. The results of the correlation test analysis conducted showed that accessibility and supporting facilities were considered to have a strong relationship with walkability. Conversely, safety and comfort aspects were considered to have a low relationship with walkability (Gao et al., 2022), (Agah Muhammad Mulyadi, Hendra Hendrawan, Anita Vitriana, & Nugroho, 2022)

In addition, problems such as damage to some parts of the sidewalk, the use of sidewalks as a place to place billboards and the existence of roadside parking that extends to the sidewalk due to the absence of parking lots for visitors to restaurants, shop houses and others affect the small space for pedestrians and the relatively slow speed of pedestrians due to limited pedestrian space. The density of traffic and pedestrians often leads to conflicts between motorists and pedestrians. These problems have an impact on the low level of service of pedestrian facilities (Yasar, 2019).

The lack of pedestrian facilities in the form of road crossings along Jalan Raya Ubud, the number of pedestrians who cross directly without the use of crossing facilities and the placement of pedestrian crossings that are not in accordance with the needs, have an impact on conflicts between pedestrians and motorized vehicles. Therefore that the appropriate type of road crossing facility is needed.

B. Selection of Indicators and Data Source

The selection of indicators that measure pedestrian service levels considers suitability and data availability, according to previous research. Pedestrian characteristics are an important factor in the planning and operation of transportation systems. Pedestrian flow analysis is based on the average value of parameters such as flow, speed, density and space.

1. Flow

Pedestrian flow is the number of pedestrians crossing a point on the sidewalk at a given interval and is measured in units of pedestrians per meter per minute. The flow is obtained by using the formula as in the following equation:

$$Q = \frac{N}{t} \quad (2.1)$$

Where: Q = Pedestrian flow (p/m/min)
N = number of pedestrians passing per sidewalk width (p/m)
t = time (min)

2. Speeed

Speed is the distance a pedestrian can retrieved on a sidewalk section per unit time. The observed pedestrian speed was obtained using the following equation:

$$V = \frac{L}{t} \quad (2.2)$$

Where: Q = Pedestrian speed (m/min)
L = Length of observation segment (m)
t = travel time of pedestrians passing through the observation segment (min)

Pedestrian speed is also calculated based on:

- Time Mean Speed

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

Time mean speed is the average speed of pedestrians passing a point during a specific time interval, which can be calculated using the following formula:

$$Vt = \frac{1}{n}\sum_{i=1}^{n} Vi \quad (2.3)$$

Where: Vt = Everage speed (m/mnt)

- n = Number of observed speed data
- Vi = Speed of each observed pedestrian (m/min)

- Space Mean Speed

Space mean speed is the average speed of pedestrians traveling a certain distance of a sidewalk during a certain time interval, and is calculated based on the average travel time of pedestrians passing through an observation. The space mean speed can be calculated with the following formula:

$$Vs = \frac{1}{\frac{1}{n}\sum_{i=0}^{n}\frac{1}{Vi}} \quad (2.4)$$

Where: Vs = Space mean speed (m/min)
n = Number of observed speed data
Vi = Speed of each observed pedestrian (m/min)

3. Density

Density is the number of pedestrians per unit area of a given sidewalk at a given distance and time, formulated in units of pedestrians per square meter or can be formulated as the ratio between flow and average speed as in the following equation:

$$D = \frac{Q}{Vs} \quad (2.5)$$

Where: D = Density (org/m)^2
Q = Flow (org/m/min)
Vs = Space average velocity (m/min)

4. Pedestrian space

Pedestrian space is the average area available to each pedestrian on a sidewalk formulated in units of m^2 /pedestrian. Pedestrian space is proportional to the average speed of the space divided by the flow. Pedestrian space can be obtained using the formula as in the following equation:

$$S = \frac{vs}{Q} = \frac{1}{D} \quad (2.6)$$

Where: S = Pedestrian space (m^2 /org)
D = Density (org/m)^2
Q = Flow (org/m/min)
Vs = Space mean speed (m/min)

C. Research Methods

Design criteria for pedestrian paths according to circular letter of the minister of public works (SE Menteri PUPR) No. 02/SE/M/2018 (Kementerian PUPR, 2018) as follows:

- The minimum effective width of the pedestrian space based on the needs of people is 60 cm plus 15 cm to sway without carrying goods, so the total minimum requirement for 2 pedestrians passing each other is 150 cm.
  In an ideal situation, the following formula is used to obtain the minimum width of the pedestrian path (W):

$$W = \frac{p}{35} + N \quad (2.7)$$

Where: p = Pedestrian volume (org/m/min)
W = Pedestrian path width (m)
N = additional width according to local circumstances (meters), determined in Table 2.1

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

Table 2.1 N Value

N (Meter)	*Condition*
1,5	Roads in areas with high pedestrian traffic*
1	Roads in areas with moderate pedestrian traffic**
0,5	Roads in areas with low pedestrian traffic***

Description:
* Pedestrian flow > 33 p/min/m, or it may be an area such as a market or terminal.
** Pedestrian flow 16-33 p/min/m, or it may be a non-market shopping area.
*** Pedestrian flow < 16 p/min/m, or it may be any other area.
Source: (Ministry of PUPR, 2018)

If the sidewalk will be installed additional facilities, then the dimensions of the sidewalk that should be provided can be seen in Table 2.2 and illustrated in Figure 2.1. The minimum requirements for pedestrian paths in urban areas based on land use, function and road type can be seen in Table 2.3.

Table 2.2 Determining Sidewalk Dimensions Based on Location and Maximum Pedestrian Flow

Location		*Maximum Pedestrian Flow*	*Zona*				*Total Dimensions (rounding)*
			Curb	*Facility Lane*	*Effective Width*	*Building Frontage*	
Arterial Roads	City Center	80 p/min	0,15 m	1,2 m	2,75-3,75 m	0,75 m	5-6 m
	Along parks, schools, and other major pedestrian generating centers						
Collector Roads	City Center	60 p/min	0,15 m	0,9 m	2-2,75 m	0,35 m	3,5 - 4 m
	Along parks, schools, and other major pedestrian generating centers						
Local Roads		50 p/min	0,15 m	0,75 m	1,9 m	0,15 m	3 m
Local and Neighborhood Roads (Residential Areas)		35 p/min	0,15 m	0,6 m	1,5 m	0,15 m	2,5 m

Description: If the existing land conditions have space limitations with a maximum peak hour pedestrian flow of <50 people/min, the width can be adjusted with adequate justification by taking into account the minimum pedestrian lane width requirements.
Source: (PUPR, 2018)

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

Table 2.3 Minimum Requirements for Pedestrian Path in Urban Areas

Road Function	*Road System*	*Traffic Operating Speed Limits (kmph)*	*Road Type*	*Pedestrian Path Type*	*Crosswalk Type*
Arterial & Collector	Primary	≤40	2/2 Undivided	Gated sidewalks with access to crosswalks and bus stops.	Crossing with traffic signals (pelican crossing) or non-crossing
		≤40	4/2 Undivided	Gated sidewalks with access to crosswalks and bus stops	Non-crossing (bridges or tunnels) or crossing at intersections with traffic signals
		≤60	4/2 Divided	Gated sidewalks with access to crosswalks and bus stops (different from 6/2 type)	Non-crossing (bridges or tunnels) or crossing at intersections with traffic signals
		≤80	6/2 Divided	Gated sidewalks with access to crosswalks and bus stops (different from 4/2 type)	Non-crossing (bridges or tunnels) or crossing at intersections with traffic signals
Local		≤30	2/2 Undivided	Sidewalks	Crossing (zebra cross, pedestrian platform)
Arterial & Collector	Secondary	≤30	2/2 Undivided	Sidewalks or hardened road shoulders,	Crossing (zebra cross, pedestrian platform)
		≤30	4/2 Undivided	Sidewalks	Crossing with traffic signals (pelican crossing), crossing with crosssing guarsds or non-crossing
		≤30	4/2 Divided	Sidewalks	Crossing with traffic signals (pelican crossing) with waiting stalls or non-crossing
Local		≤30	2/2 Undivided	Sidewalks	Crossing (zebra cross, pedestrian platform)

Description: Roads are secondary or primary system roads that pass through urban areas;
Source: (Ministry of PUPR, 2018)

- Level of Service of Pedestrian Facilities

To determine the level of service of pedestrian facilities, four criteria are used for comparison (Kementerian PUPR, 2014) :

1. Based on pedestrian flow

The pedestrian level of service can be defined by the pedestrian flow at the largest 15-minute interval. Which can be calculated by the formula:

$$Q_{15} = \frac{Nm}{W_{E15}} \quad (2.8)$$

Where: Q_{15} = Pedestrian flow at the largest 15-minute interval (p/min/m)
Nm = Most number of pedestrians at 15-minute intervals (people))
W_E = Effective sidewalk width (m)

The effective width of the sidewalk is formulated as follows:

$$W_E = W_T - B \quad (2.9)$$

Where: W_E = Effective sidewalk width (m)
W_T = Total sidewalk width (m)
B = The total width of the obstruction cannot be used for walking (m)

2. Based on pedestrian space

Level of service is defined by the pedestrian space during the largest 15-minute flow. To calculate the value of space for pedestrians at the time of the largest 15-minute flow the pedestrian space formula is used, then taking the value at the time of the largest 15-minute flow, the following formula will be obtained:

$$S_{15} = \frac{1}{D_{15}} \quad (2.10)$$

Where: S_{15} = Largest 15-minute flow pedestrian space (m^2 /org)
D_{15} = Density at time of greatest 15-minute flow (org/m^2)

3. Based on pedestrian speed

The speed used is the average speed of the space during the largest 15-minute flow.

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

4. Based on volume and capacity ratio

Volume is the flow that occurs at the time of the largest 15 minutes, while capacity is the maximum flow on a pavement that occurs at a certain time or can also be determined as 83 org/min/m.

The main criteria for determining the level of service is space, while speed, flow, and are additional criteria. The level of service can be seen in Table 2.4.

Table 2. 4 Levels of Pedestrian Facility Service

Level of Service	*Pedestrian Path (m2/person)*	*Average Speed (m/min)*	*Pedestrian Flow Volume (org/min/m)*	*Volume/Capacity Ratio*
A	≥ 12	≥ 78	≤ 6,7	≤ **0,08**
B	≥ 3,6	≥ 75	≤ 23	≤ **0,28**
C	≥ 2,2	≥ 33	≤ 33	≤ **0,40**
D	≥ 1,4	≥ 50	≤ 50	≤ **0,60**
E	≥ 0,5	≥ 83	≤ 83	≤ **1,00**
F	≥ 0,5	< Variable	Variable	**1,00**

Source: (PU, 2014)

In SE Menteri PUPR No. 03/PRT/M/2014 the level of service for pedestrians who only pass through the road, can be classified in levels of service A to F, all of which reflect conditions at certain service needs or flows.

RESULT

A. Sidewalk Characteristics Analysis

Based on the survey results, it can be seen that the width of both sidewalk are 1.4 m. When associated with the required sidewalk width standards according to PUPR guidelines, the sidewalks on Jalan Raya Ubud do not meet the standards. The types of obstacles found on the North and South sidewalks are almost the same, such motorcycle parking on the sidewalk. The average width of obstacles is 0.5 m for the North sidewalk and 0.45 m for the South sidewalk. Based on the analysis results, the average effective width of the sidewalk along the 200 m observation segment is 0.9 m for the North sidewalk and 0.95 m for the South Sidewalk. This is due to the presence of motorcycle parking along the sidewalk due to the absence of parking, overall width of the sidewalk cannot be used effectively by pedestrians. The condition of the sidewalk pavement in the observation segments is almost the same, where there is wavy paving and collapsed paving at several points of the observation segment. The division of zones and bicycle lanes on the sidewalk is still not fulfilled due to the absence of facility zones, the arrangement of driveways also does not meet the standards due to the lack of continuity of the sidewalks on Jalan Raya Ubud. Supporting facilities on Jalan Raya Ubud do not meet the criteria for supporting facilities, such as the absence of pedestrian crossing signs and markings on the observation segment.

B. Pedestrian Characteristics Analysis

Pedestrian characteristics reviewed include flow, speed, density, and pedestrian space conducted on weekdays and holidays.

1. Pedestrian Flow

Pedestrian flow in p/m/min was obtained from the number of pedestrians passing through the observation segment divided by the average effective width of the sidewalk during the 15 min time interval. The average flow on the North sidewalk was 324 people/hour on weekdays, and 363 p/h on holidays. The average flow on the South sidewalk was 189 p/h on weekdays, and 201 p/h on holidays. The highest flows tend to occur in the afternoon, both on weekdays and weekends.

In the morning, the peak flow hours are obtained at the same time. On the North Sidewalk, it's found that the largest flow in the morning peak hour occurs at 09.00-10.00 on weekdays, amounting to 212 p/m/h, on holidays amounting to 181 p/m/h. On the South sidewalk, in the morning peak hour of the largest flow on weekends occurs at 08.45-09.45 amounting to 104 p/m/h and on weekdays it occurs at the same time at 08.45-09.45 amounting to 110 p/m/h. At noon the peak flow on the North sidewalk occurs at different times where on weekends 13.15-14.15 amounting to 572 p/m/h while on weekdays it occurs 14.00-15.00 amounting to 486 p/m/h. On the South sidewalk, it is found that the afternoon peak hour of the largest flow on weekdays is at 14.00-15.00 amounting to 279

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

p/m/h, on weekends at 11.30-12.30 amounting to 267 org/m/hour. On the North sidewalk, the largest flow in the afternoon occurs at different times, namely at 16.45-17.45 amounting to 520 p/m/h, where on weekends at 16.30-17.30 amounting to 744 p/m/h. On the South sidewalk, it is found that the afternoon peak hour of the largest flow occurs simultaneously at 16:15-17:15 amounting to 389 p/m/h during weekdays, and on holidays amounting to 351 p/m/h. The overall largest flow occurs in the afternoon, because tourists move around more in the afternoon.

2. Space Mean Speed of Pedestrians

The data used to analyze the average speed of the pedestrian space is pedestrian travel time data. Therefore, a pilot survey is first carried out in the hope of obtaining speed parameters at the research location with 95% accuracy specifications. To calculate the average speed of the pedestrian space using Formula 2.4. For example, the calculation of the average speed of the pedestrian space on the North sidewalk 08.30-08.45 WITA on weekdays is as follows:

$\sum 1/Vi = 1/14{,}21 + 1/13.67 = 0{,}019$ m/mnt

The number of pedestrian travel time data is 2-3 data per 15 min so the space mean speed (Vs) is:

$$Vs = \frac{1}{\frac{1}{n}\sum_{i=1}^{n}\frac{1}{Vi}} = \frac{1}{\frac{1}{2}\ x\ 0{,}019} = 105{,}52\ m/min$$

The same calculation method was used for the following sections. The following shows the average speed of pedestrian space at each peak hour on Jalan Raya Ubud:

Table 3.1 Average Speed of Pedestrian Space Largest 15 min Flow

Sidewalk	*Time*	*Average VS (m/min) During Weekdays*	*Average VS (m/min) During Holidays*
North	Morning	103,80	85,26
	Afternoon	77,10	54,76
South	Evening	71,90	43,88
	Morning	103,56	83,26
	Afternoon	71,96	74,29
	Evening	61,99	67,60

Table 3.1 shows the average speed of the pedestrian space at each time division. On both sidewalks the average speed of the largest space in the morning both on weekdays and holidays. The average speed of the largest space is obtained in the morning because in the morning the volume of pedestrians is lesser, making it easier to move at a higher speed. In the afternoon, the average pedestrian speed decreased due to the increase in pedestrian volume.

3. Pedestrian Density

Pedestrian density is calculated using Formula 2.5 density is obtained from the quotient between pedestrian flow and the average speed of the pedestrian space. For example, the calculation of pedestrian density at 9:00-09:15 AM on weekdays on the North sidewalk:

- Average flow (Q) : 3 p/m/mnt
- Everage speed of space (Vs) : 100,23 m/mnt
- Pedestrian density (D) : 3/100,23 = 0,032 p/m^2

The complete pedestrian density calculation results can be seen by the following that shows the results of the pedestrian density calculation for each sidewalk during the peak hour.

Table 3.2 Pedestrian Density During Peak Times on Weekdays

Sidewalk	*Time*	*Averge VS (m/min)*	*Flow (person/m/hour)*	*Flow (person/m/minr)*	*Pedestrian Density (person/m^2)*	*Rounding (person/100 m2)*
Nortrh	Morning	103,80	212	3,53	0,034	3
	Afternoon	77,10	486	8,10	0,105	11

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

	Evening	71,90	520	8,67	0,121	12
South	Morning	103,56	110	1,83	0,018	2
	Afternoon	71,96	279	4,65	0,065	6
	Evening	61,99	389	6,48	0,105	10

Table 3.3 Pedestrian Density During Peak Times on Holidays

Sidewalk	*Time*	*Averge VS (m/min)*	*Flow (person/m/hour)*	*Flow (person/m/min)*	*Pedestrian Density (person/m^2)*	*Rounding (person/100 m2)*
Nortrh	Morning	85,26	181	3,02	0,035	4
	Afternoon	54,76	572	9,53	0,174	17
	Evening	43,88	744	12,40	0,283	28
South	Morning	83,26	104	1,73	0,021	2
	Afternoon	74,29	219	4,45	0,060	6
	Evening	67,60	343	5,85	0,087	9

Based on Table 3.2, and Table 3.3, identical conditions are obtained. The density is getting bigger where the biggest density on the North and South sidewalks occurs in the afternoon..

4. Pedestrian Space

Pedestrian space is calculated using Formula 2.6 For example, the calculation of pedestrian space at 09:00-09:15 WITA on the North sidewalk during weekdays is as follows:

- Pedestrian density (D) : 0,0318 p/m2 ≈ 3 p/100m^2
- Pedestrian space (S) : 31,47 m^2/p

The following shows the results of the calculation of pedestrian space for each sidewalk during peak times.

Table 3.4 Pedestrian Space During Peak Hours on Working days

Sidewalk	*Time*	*Pedestrian Density (person/m2)*	*Rounding (person/100 m2)*	*Pedestrian Space (m2/person)*
Nortrh	Morning	0,034	3	29,378
	Afternoon	0,105	11	9.519
South	Evening	0,121	12	8,297
	Morning	0,018	2	56,485
	Afternoon	0,065	6	15,476
	Evening	0,105	10	9,562

Table 3.5 Pedestrian Space During Peak Hours on Holidays

Sidewalk	*Time*	*Pedestrian Density (person/m2)*	*Rounding (person/100 m2)*	*Pedestrian Space (m2/person)*
Nortrh	Morning	0,035	4	28,262
	Afternoon	0,174	17	5,744
South	Evening	0,283	28	3,539
	Morning	0,021	2	48,035
	Afternoon	0,060	6	16,694
	Evening	0,087	9	11,556

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

C. Pedestrian Facility Service Level Analysis

As the main criteria for determining the level of service of pedestrian facilities used pedestrian space because with known pedestrian space can be known whether a pedestrian facility has a density problem or not and to determine the pedestrian space required data flow and average speed of pedestrian space. The level of service of pedestrian facilities based on space is calculated at the time of the largest 15-minute flow. The following shows the level of service of pedestrian facilities for each sidewalk during peak hours on both weekdays and holidays.

Table 3.6 Level of Service of Pedestrian Facilities During Peak Hours on Weekdays

Sidewalk	*Time*	*Pedestrian Space (m2/person)*	*Pedestrian Facility Service Level*
Nortrh	Morning	29	A
	Afternoon	10	B
South	Evening	8	B
	Morning	56	A
	Afternoon	15	A
	Evening	10	A

Table 3.7 Level of Service for Pedestrian Facilities at Peak Hours on Holidays

Sidewalk	*Time*	*Pedestrian Space (m2/person)*	*Pedestrian Facility Service Level*
North	Morning	28	A
	Afternoon	6	B
South	Evening	4	C
	Morning	48	A
	Afternoon	20	A
	Evening	12	B

From the data obtained, it can be seen that the level of service of pedestrian facilities at peak hours on weekdays and holidays is almost the same. On the North sidewalk during peak hours on holidays and weekdays the level of service of pedestrian facilities is at level A in the morning, B in the afternoon and C in the afternoon, also on the South sidewalk during peak hours on holidays and weekdays the level of service of pedestrian facilities is at levels A to B at each peak hour. It can be concluded that the level of service of pedestrian facilities on Jalan Raya Ubud on weekdays is in the good category and decreases on holidays.

DISCUSSION AND CONCLUSION

A. Sidewalk Characteristics

The average effective width of the North sidewalk 0.9 m with pavement conditions of wavy and collapsed paving at several points. The average effective width of the South sidewalk 0.95 m with bumpy and collapsed paving conditions. For Supporting facilities on Jalan Raya Ubud do not meet the criteria for supporting facilities.

B. Pedestrian Characteristics

Street vendors and kiosks serve as alternative livelihoods for many low-income residents by providing affordable goods and services. When strategically located, these vendors can enhance the vibrancy and appeal of urban environments. However, the absence of designated vehicle parking, particularly for motorcycles, often leads to the use of sidewalks for parking bicycles and other vehicles. This encroachment on pedestrian spaces creates obstacles, diminishing the available walking space and reducing the overall quality of pedestrian services. Additionally, the presence of street vendors on sidewalks can force pedestrians to share traffic lanes with vehicles, thereby increasing the risk of accidents.

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 08 August 2024
DOI: 10.47191/ijcsrr/V7-i8-88, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

- The largest pedestrian flow on the North Sidewalk on weekdays, Tuesday, May 14, 2024 occurs in the afternoon with a total of 520 p/ hour with an average speed of 4.32 km / hour, a density of 12 p / 100 m^2 and a pedestrian space of 8 m^2 /p. On the South sidewalk the largest flow occurs in the afternoon with a total of 389 p / hour with an average speed of 3.72 km / h, a density of 10 p / 100 m^2 , and a pedestrian space of 10 m^2 /p.
- The largest pedestrian flow on the North Sidewalk during the holiday, Sunday, May 19, 2024, occurred in the afternoon with a total of 744 p / hour with an average speed of 2.63 km / hour, a density of 28 org / 100 m^2 , and a pedestrian space of 4 m^2 /p. On the South sidewalk the largest flow occurs in the afternoon with a total of 351 p / hour with an average speed of 4.06 km / h, a density of 9 p / 100 m^2 , and a space of 12 m^2 /p
- Overall, the highest flow occurs on the North sidewalk during holidays due to the large number of tourists traveling around on holiday afternoons.

C. Level of Service

Supporting facilities, such as electrical boxes, along with various obstacles like parked vehicles and street vendors on sidewalks, contribute to pedestrian discomfort and reduce the overall quality of the walking environment. The lack of trees further exacerbates this issue. These obstructions are often regarded as barriers to pedestrian flow. Despite these challenges, the level of service on both the North and South sidewalks during peak weekday hours is classified as "B". However, during peak holiday hours, the level of service on the North sidewalk drops to category "C", while the South sidewalk remains at category "B".

REFERENCES

1. Agah Muhammad Mulyadi, Hendra Hendrawan, Anita Vitriana, & Nugroho, A. (2022). Walkability and importance assessment of pedestrian facilities on central business district in capital city of Indonesia. *Transportation Research Interdisciplinary Perspectives*, *16*(22), 1-13.
2. BPS Kabupaten Gianyar. (2024). *Kabupaten Gianyar dalam Angka 2024*.
3. Gao, W., Qian, Y., Chen, H., Zhang, Z., Zhou, M., & Aminpour, F. (2022). Assessment of sidewalk walkability: Integrating objective and subjective measures on identical context-based sidewalk features. *Sustainable Cities and Society*, *87*(December 2022).
4. Kementrian PUPR. (2023). *Perencanaan Teknis Fasilitas Pejalan Kaki*.
5. Peraturan Menteri Pekerjaan Umum, Pedoman Perencanaan Penyediaan dan Pemanfaatan Prasarana dan Sarana Jaringan Pejalan Kaki di kawasan Perkotaan (Patent 03/PRT/M/2014), (2014).
6. Pedoman Perencanaan Teknis Fasilitas Pejalan Kaki (Patent SE Menteri PUPR No.02/SE?M?2018), (2018).
7. Putra.S, Purbanta, R., & Negara, W. (2013). Analisis Tingkat Pelayanan Fasilitas Pejalan Kaki (Studi Kasus Jalan Diponogoro depan Mall Ramayana). *Jurnal Ilmiah Elektronik Ifrastruktur Teknik Sipil*, *2*(1).
8. RakaMandi, N. B. (2022). Pedestrian Facilities as the Core of Sustainable Public Transport: A Case Study of Kuta-Bali Tourism Destination. *International Journal of Current Science Research and Review*, *5*(01 Januari 2022), 256-266.
9. Yasar, H. G. K. M. A. A.-u.-h. (2019). Effect of Sidewalk Vendors on Pedistrian Walking Speed and Lateral Position: A Study in Addis Ababa, Ethopia. *Journal of Traffic and Transportation Management*, *1*(2), 27-34.

Cite this Article: Nyoman Budiartha RakaMandi, Ni Nyoman Minati Sukardina, Alit Suthanaya (2024). Analysis of Characteristics and Service Level of Pedestrian Facilities: Case Study of Ubud Tourist Destination, Gianyar Regency, Bali Province, Indonesia. International Journal of Current Science Research and Review, 7(8), 6758-6767