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Pedestrian Way Assets Performance Analysis Based on Pedestrian Level of Service (PLOS) In Lembang Street Segment

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ABSTRACT

The pedestrian ways on Jalan Lembang is a public asset that plays a vital role in supporting public mobility. However, there are indications of problems affecting its function. The purpose of this study is to analyze the performance of the pedestrian ways based on six aspects of the Pedestrian Level of Service (PLOS) assessment. The research method used is descriptive research with a quantitative approach. Data collection techniques include direct observation and questionnaires distributed to sidewalk users. The results of the study indicate a low level of safety due to the lack of separation between pedestrians and vehicle traffic with a very poor level of service. The infrastructure and security aspects of sidewalk lighting are considered inadequate with a very poor level of service due to the potential for crime. The comfort and safety aspects are still considered very poor due to the presence of street vendors and shelters that are not friendly to the elderly and disabled users. The final aspect is violations on the sidewalk with a very low level of service due to the presence of informal businesses and semi-permanent buildings along the sidewalk. Based on the explanation of the six aspects of PLOS service, it can be concluded that the pedestrian ways on Jalan Lembang is at level E, meaning it does not meet the minimum standards of decent service.

Keywords: *Asset Performance Analysis, Pedestrian Ways, Pedestrian Level of Service, Public Assets*

ABSTRAK

Jalur pejalan kaki di Ruas Jalan Lembang merupakan bagian dari aset publik yang memiliki peran penting dalam mendukung mobilitas masyarakat. Namun demikian, terdapat indikasi permasalahan yang memengaruhi fungsinya. Tujuan penelitian ini adalah untuk menganalisis kinerja jalur pejalan kaki berdasarkan enam aspek penilaian Pedestrian Level of Service (PLOS). Metode penelitian yang digunakan adalah penelitian deskriptif dengan pendekatan kuantitatif. Teknik pengumpulan data meliputi observasi langsung dan penyebaran kuesioner kepada pengguna trotoar. Hasil penelitian yang dilakukan yakni, menunjukkan tingkat keselamatan yang rendah dikarenakan tidak adanya pemisah antara pejalan kaki dengan lalu lintas kendaraan dengan tingkat pelayanan sangat buruk. Aspek infrastruktur dan keamanan penerangan trotoar dinilai belum memadai dengan tingkat pelayanan sangat buruk karena terdapat potensi tindak kriminal. Aspek kenyamanan dan keamanan dinilai masih sangat buruk dikarenakan masih terdapat pedagang kaki lima dan tempat berteduh yang tidak ramah lansia dan pengguna disabilitas. Aspek terakhir berupa pelanggaran terhadap trotoar dengan tingkat pelayanan sangat rendah karena masih terdapat usaha informal dan bangunan semi permanen di sepanjang trotoar. Berdasarkan pemaparan keenam aspek pembentuk pelayanan PLOS, dapat disimpulkan bahwa jalur pejalan kaki di Ruas Jalan Lembang berada pada level E, artinya belum memenuhi standar minimum pelayanan yang layak.

Kata kunci: Analisis Kinerja Aset, Aset Publik, Jalur Pejalan Kaki, *Pedestrian Level of Service*, Prasarana Jalan

1. INTRODUCTION

Urban and regional development is a dynamic process that extends beyond physical expansion to encompass the increasing complexity of societal demands for public facilities and infrastructure. While studies by Bryson et al (2017) and Mukherjee et al (2023) highlight the continuous evolution of urban environments alongside socio-economic transformations, this growth often reveals a critical imbalance. As emphasized by Noring (2019), infrastructure provision frequently lags behind development, indicating a persistent gap between urban expansion and the readiness of supporting facilities.

This imbalance becomes more evident when mobility is positioned as a core component of regional development. Bezbradica and Ruskin (2020) argue that mobility is not merely a functional necessity but also a key indicator of development quality. In line with this, Asadi-Shekari et al (2014) demonstrate that population growth significantly intensifies mobility demand, thereby requiring transportation systems that are not only efficient but also inclusive and well-integrated. However, prevailing development paradigms continue to prioritize motorized transportation, resulting in an imbalanced mobility system that marginalizes non-motorized users, particularly pedestrians.

Such a paradigm raises critical concerns regarding the role of pedestrian infrastructure in urban mobility systems. Mauliani et al (2015) emphasize that true transportation accessibility must accommodate all user groups, including pedestrians. Nevertheless, Darmawan et al (2024) identify that pedestrian infrastructure is often inadequate, thereby reducing the overall effectiveness of transportation systems. This issue is further reinforced by Anapakula and Eranki (2021), who demonstrate that public transportation systems inherently rely on walking as part of first- and last-mile connectivity. Consequently, neglecting pedestrian facilities not only affects walkability but also undermines the performance of broader transport networks.

From this perspective, pedestrian pathways should not be treated as secondary or complementary infrastructure, but rather as fundamental components of urban systems. Muhammad et al (2022) and Noring (2019) argue that adequate pedestrian infrastructure is essential in achieving accessible, efficient, and sustainable cities. Moreover, the provision of well-designed pedestrian pathways is widely recognized as an indicator of governmental commitment to delivering safe and comfortable public infrastructure (Kasus et al, 2017). However, this commitment must be critically examined, as the effectiveness of pedestrian

pathways depends not only on their physical existence but also on how they are planned, managed, and regulated.

In this regard, the role of government extends beyond infrastructure provision to include comprehensive responsibilities in planning, development, maintenance, and governance. Matau et al (2023) emphasize that without continuous management and clear institutional responsibility, pedestrian facilities may fail to function optimally. Furthermore, regulatory frameworks play a crucial role in shaping the utilization and protection of pedestrian pathways. Magdalena et al (2024) argue that design standards, usage regulations, and enforcement mechanisms significantly enhance the effectiveness of pedestrian pathways as viable alternatives to motorized transport. However, in many urban contexts, weak implementation and lack of enforcement lead to the misuse of pedestrian spaces, highlighting a gap between policy formulation and practical realities.

From the user perspective, the importance of pedestrian infrastructure becomes increasingly evident in ensuring safety and comfort. Anapakula and Eranki (2021) identify sidewalks as a fundamental component of urban transportation systems, particularly in supporting first- and last-mile connectivity. Prattyni (2024) further demonstrates that well-maintained pedestrian pathways contribute to improved safety, reduced accident risks, and an increased sense of security among users. Despite these benefits, inadequate infrastructure conditions frequently expose pedestrians to higher risks, especially in areas with high mobility demand.

Therefore, pedestrian pathways should be understood not merely as physical infrastructure, but as part of a multidimensional system involving planning, regulation, and user behavior. Despite their recognized importance, there remains a lack of comprehensive evaluation regarding the performance and effectiveness of pedestrian infrastructure in many urban areas. Based on this synthesis, this study positions pedestrian pathways as a critical element within human-oriented infrastructure development and aims to analyze and evaluate their performance in supporting urban mobility while enhancing accessibility, safety, and sustainability.

Lembang street segment is a provincial street serving as a primary collector with a total length of 8.85 kilometers. It functions as a major route connecting various regions surrounding Bandung City, West Bandung Regency, and Subang Regency. The physical condition of pedestrian pathways along Lembang street segment suffers from multiple deficiencies that affect user experience. Varying sidewalk widths lead to imbalances in pedestrian flow,

especially in densely populated zones. Inconsistent elevation along the sidewalk segments also hinders accessibility, particularly for wheelchair users and the elderly (Daniel et al, 2016). Furthermore, it explains that non-standard elevation increases the risk of accidents, particularly during rain, when slippery surfaces heighten the danger. Many sidewalks are damaged or built with inappropriate materials, underscoring the urgent need for infrastructure improvements to enhance pedestrian safety along Lembang street segment. Despite its strategic role in regional connectivity, this street corridor faces numerous challenges related to infrastructure (Arifin et al, 2021).

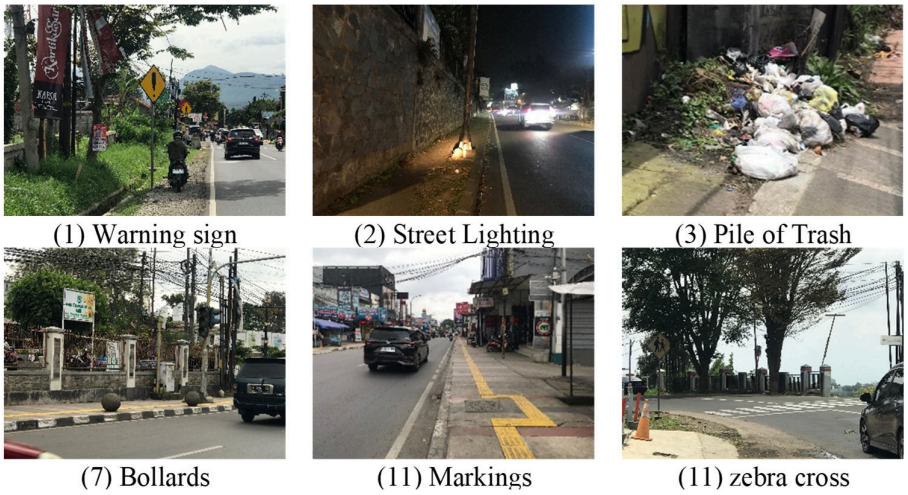

Figure 1. Pedestrian Way Illustrations along Lembang Street Segment

Facilities for pedestrians remain inadequate throughout the corridor. Warning signs that inform both pedestrians and motorists are rarely found. Inadequate street lighting during nighttime increases the risk of crime and accidents due to low visibility (Li et al, 2019). The lack of trash bins contributes to environmental degradation, as litter accumulates in several segments of the street (Aprilia et al, 2021). Moreover, the absence of bollards enables vehicles to intrude into pedestrian space. Accessibility features such as tactile paving for persons with disabilities are largely missing, reflecting a lack of inclusivity in the infrastructure design (Li et al, 2019). Even pedestrian crossings, such as zebra stripes, are often faded or missing altogether, reducing their function in safeguarding crossing pedestrians.

These systemic deficiencies not only diminish the perceived safety of pedestrians but also increase physical risk and degrade the quality of the urban environment. Previous studies have shown that the quality of pedestrian infrastructure has a direct impact on users' perceptions of comfort and safety (Ujjwal & Bandyopadhyaya, 2023).

Therefore, a comprehensive analysis of pedestrian pathway performance on Lembang street segment is necessary, employing the Pedestrian Level of Service (PLOS) approach. This framework has been widely used in prior research and has proven effective in identifying the multiple factors that influence pedestrian infrastructure performance. Through this method, it is expected that targeted recommendations can be formulated to improve the quality, safety, and usability of pedestrian pathways along Lembang street segment.

2. METHOD

This study employed a descriptive quantitative approach aimed at providing a comprehensive and objective depiction of the pedestrian path performance along Lembang street segment based on the evaluation parameters defined in the Pedestrian Level of Service (PLOS) model. This approach was selected because it enables the translation of empirical field conditions into measurable numerical data that can be analyzed statistically, allowing valid and reliable comparisons of results. A descriptive quantitative design is particularly suited to research that seeks to quantify user perceptions and physical conditions without establishing causal relationships.

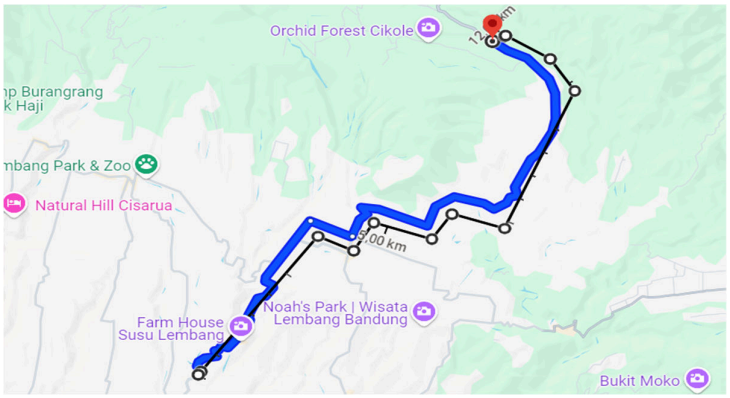

Figure 2. Lembang Street Segment

The research was conducted along Lembang street segment in West Bandung Regency. This street segment is frequently used by pedestrians, particularly due to the presence of markets, schools, commercial establishments, and public transportation access points. The study was carried out over a five-month period from January to May 2025, encompassing instrument design, field observation, questionnaire distribution, data processing, and data analysis.

The study population consisted of all users of pedestrian facilities along Lembang street segment. Given the indefinite and fluctuating number of users, an infinite population framework was applied. The sample was drawn using purposive random sampling, whereby

respondents were selected based on a predefined criterion, namely, having used the pedestrian walkway along Lembang street segment within the past month. Once this criterion was fulfilled, respondents were randomly chosen through both direct interaction in the field and online distribution of questionnaires.

Table 1. Dimension and Indicator of PLOS

Dimension	Indicator
Safety from Pedestrian Traffic Interaction (PTI)	Traffic volume and flow
	Proper marking of pedestrian way
	Buffer zone
	Unclean footpath
	Open waste bin on footpath making it unusable
Availability and Condition of Pedestrian Infrastructure (PI)	Footpath width
	Footpath height
	Condition of footpath surface
	Type of footpath surface
	Frequent change of footpath height
Pedestrian Convenience and Sense of Security (CS)	Pedestrian volume
	Roadside vending shops attracting pedestrians
	Electric pole etc. causing hindrance to walking
	Routine sidewalk maintenance
	Availability of covered dustbin at regular interval
Night Time Walking (NW)	Availability of lighting facility at night
	Regular police patrolling during night
	Availability of CCTV cameras to record crime
Encroachment on Footpath (EN)	Encroachments due to temporary vendors
	Encroachments due to shop's extension on footpath
	Illegally parked vehicles on footpath
Pedestrian Walking Comfort (PC)	Shade and trees for pedestrian
	Ramps to access elevated footpath
	Seating facility and drinking water for pedestrians

Source: Ujjwal & Bandyopadhyaya, 2023

Data collection was conducted using two primary techniques: direct field observation and the distribution of questionnaires to pedestrian users. Observations were carried out systematically using an observation checklist developed according to the indicators outlined in the PLOS framework. This checklist included aspects such as walkway width, surface conditions, the presence of protective elements (e.g., bollards), nighttime lighting, accessibility for persons with disabilities, and encroachment by parked vehicles or street vendors. Observations were conducted during the morning, afternoon, and evening to capture temporal variation in physical conditions. The questionnaire was constructed based on six core dimensions of the PLOS model, as developed by Ujjwal & Bandyopadhyaya (2023) Each

dimension contained several indicators expressed as statements rated on a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

The research instruments underwent content validation by academic supervisors and a readability test with trial respondents before being distributed widely. Data obtained from the questionnaires were analyzed using descriptive statistics. Mean scores for each dimension were computed and classified into five service quality categories: very good (4.20–5.00), good (3.40–4.19), fair (2.60–3.39), poor (1.80–2.59), and very poor (<1.80). Observational data were analyzed by assigning scores to each indicator based on field conditions, converting the scores into a five-point scale aligned with the same service quality categories.

To determine whether user perceptions varied by time of use, particularly between morning–afternoon and evening–night users, the Mann–Whitney U Test was employed. This non-parametric test was chosen due to the non-normal distribution of perception data, making parametric tests inappropriate. The significance value obtained from this test provided the basis for determining whether differences in perception were statistically meaningful, depending on the time of use.

Table 2. Pedestrian Service Level Scheme

Total Score	Level of Service	Interpretation
> 25	A	Very Good
22 – 25	B	Good
18 – 21	C	Fair
14 – 17	D	Poor
10 – 13	E	Very Poor
< 10	F	Inadequate

Sumber: (Ujjwal & Bandyopadhyaya, 2023)

The final PLOS value was obtained by summing the average scores from the six dimensions, using both observational and questionnaire data. This total score was then classified according to the service level scheme. These results were then analyzed and interpreted in connection with the observed physical conditions and potential technical improvements necessary to enhance pedestrian services in the area.

3. RESULTS AND DISCUSSIONS

Pedestrian Way Asset Performance Analysis Based on Pedestrian Level of Service (PLOS) in Lembang Street Segment

The evaluation of pedestrian pathway quality along Lembang street segment was conducted using the Pedestrian Level of Service (PLOS) framework, which consists of six key

dimensions. Each dimension was assessed through two methodological approaches: direct field observation and user perception surveys conducted via questionnaires.

The scores obtained from both observation and perception were then averaged to determine the overall level of pedestrian service in each dimension. This dual-method approach provides a more comprehensive understanding of actual infrastructure conditions as well as the lived experiences of pedestrians. The table below summarizes the average scores for each dimension based on observation, perception, and the resulting combined score:

Table 3. PLOS Level in Lembang street segment

PLOS Dimension	Observation Results	User Perception	Mean	PLOS Level
Safety from pedestrian traffic interaction (PTI)	3	2,52	2,76	E (Very Bad)
Availability and condition of pedestrian infrastructure (PI)	2	2,59	2,29	
Pedestrian convenience and sense of security (CS)	1	2,87	1,94	
Night time walking (NW)	1	2,35	1,67	
Encroachment of footpath (EN)	1	2,50	1,75	
Pedestrian walking comfort (PC)	1	2,51	1,76	
Pedestrian Level of Service (PLOS)	**9**	**15.34**	**12.17**	

Before analysis, the questionnaire underwent testing. A validity test using Pearson correlation confirmed that all 36 items were valid, with correlation values ranging from 0.213 to 0.837 and significance values well below 0.05. The Reliability Test yielded a Cronbach's Alpha of 0.967, indicating high internal consistency and reliability. A Normality Test was conducted, which showed that the data were not normally distributed ($p < 0.05$). Consequently, general overview of pedestrian performance perceptions based on the time of use was obtained through a descriptive analysis of the respondent total perception scores, grouped into two time categories: morning to midday and afternoon to evening. After the normality test indicated that the perception data were not normally distributed, a non-parametric Mann-Whitney U test was applied to test the hypothesis regarding whether there is a significant difference in user perceptions of pedestrian pathway performance between the two time periods.

Table 4. Descriptive Statistics of Total Scores Based on Time of Use

	N	Minimum	Maximum	Mean	Std. Deviation
Morning – Afternoon	65	63.00	180.00	102.0462	39.63246
Evening – Night	47	64.00	130.00	78.9787	11.95551
Valid N (listwise)	47				

Descriptive results indicate that the highest mean perception score was recorded in the morning to midday group, with a value of 102.0462 and a standard deviation of 39.63246. In contrast, the afternoon to evening group had a lower mean of 78.9787 and a much smaller standard deviation of 11.95551. The minimum and maximum values in the morning to midday group also reflect a wider range, spanning from 63 to 180, while the afternoon to evening group ranged only from 64 to 130.

Table 5. Ranks by Time of Use (Total Scores)

Waktu	**N**	**Mean Rank**	**Sum of Ranks**
Morning-Afternoon	65	62. 7	4047.50
Evening – Night	47	48.52	2280.50
Total	112		

The ranks values do not originate directly from the raw score data, but rather reflect the relative positions of each score when all scores from both groups are combined and ranked in order. The Mann-Whitney U Test then utilizes the sum of ranks from one of the groups (typically the smaller or first group) to compute the U statistic, which is ultimately used to determine whether there is a statistically significant difference between the two groups.

The test results indicate that the morning to midday group had a mean rank of 62.27 with a sum of ranks totaling 4047.50, whereas the afternoon to evening group had a mean rank of 48.52 with a sum of ranks totaling 2280.50. These figures suggest that, overall, perceptions of pedestrian walkway performance were higher in the morning to midday group.

Table 6. Mann-Whitney U Test Results Based on Time of Day

	PLOS
Mann-Whitney U	1152.50
	0
Wilcoxon W	2280.50
	0
Z	-2.213
Asymp. Sig. (2-tailed)	.027

a. Grouping Variable: Waktu Penggunaan

Based on the results of the difference test, the *z*-value was found to be -2.213 with a significance level of 0.027 < 0.05, indicating a statistically significant difference in perception between the performance of pedestrian pathways during the morning to midday period and the afternoon to evening period. The average score for the morning to midday timeframe was 102.0462, while the afternoon to evening timeframe had a lower average score of 78.9787. Therefore, it can be concluded that the pedestrian pathways perform better during the morning

to midday period compared to the afternoon to evening period, offering a more favorable walking experience for pedestrians.

Safety from Pedestrian Traffic Interaction (PTI)

The *Safety from Pedestrian Traffic Interaction (PTI)* dimension focuses on the level of safety afforded to pedestrians from direct interactions with vehicular traffic. Fundamentally, sidewalks serve to separate pedestrian movement from vehicular lanes, thereby reducing the risk of accidents. In practice, this dimension serves as a critical indicator of whether a pedestrian walkway is capable of protecting its users from dense, fast-moving, and aggressive traffic environments.

Figure 3. Bollards along Pedestrian Way in Lembang Street Segment

Based on field observations conducted along several segments of Lembang street segment, it was found that the sidewalks are not equipped with any protective elements that would prevent motorized vehicles from intruding into pedestrian space. There are no bollards, planter boxes, low fencing, or significant elevation differences between the sidewalks and the streetway. In some segments, there is even no clear physical boundary between pedestrian and vehicular areas. As a result, vehicles often traverse or park on sidewalks, increasing the vulnerability of pedestrians to collisions.

These findings are corroborated by survey responses, in which many respondents expressed feeling unsafe when walking, particularly when passing vehicles in busy areas such as markets, intersections, and commercial zones. Respondents also noted that drivers frequently fail to respect pedestrian space, even when it visually resembles a sidewalk. This reflects not only poor street-user discipline but also a lack of enforcement regarding pedestrian right-of-way.

Although the observation score is marginally higher compared to other dimensions, it still falls within the very poor category, as real-world conditions show that interactions between pedestrians and motorized traffic remain high and uncontrolled. The absence of designated pedestrian crossings (zebra crossings) at key locations further exacerbates this situation. As a

result, users are often forced to cross the street in an unstructured manner, exposing themselves to high collision risks especially during peak hours.

Additionally, the presence of large vehicles such as buses and trucks along the main street introduces a significant psychological burden on pedestrians. Loud noise, close proximity, and high speeds further diminish the perception of safety. This unaccommodating spatial arrangement discourages walking, particularly among vulnerable groups such as children and the elderly, who often resort to motorized transport even for short distances.

Availability and Condition of Pedestrian Infrastructure (PI)

The *Availability and Condition of Pedestrian Infrastructure (PI)* dimension is one of the principal indicators in evaluating the Pedestrian Level of Service (PLOS), as it directly pertains to the existence and physical quality of pedestrian pathways as public infrastructure. This dimension is assessed through several technical aspects, including the physical presence of sidewalks, surface conditions (smooth or damaged), effective width, the availability of guiding blocks for the visually impaired, accessible ramps for persons with disabilities, protective elements such as bollards, and supplementary facilities like seating, shading vegetation, and informational signage.

Figure 4. Pedestrian Way Surface along Lembang Street Segment

These findings are consistent with previous studies that highlight the inadequacy of pedestrian infrastructure in many urban areas. Similar to the observations along Lembang Street, Darmawan et al (2024) found that the physical presence of sidewalks does not necessarily reflect their functionality, as many are in poor condition and fail to meet safety standards. Likewise, Mauliani et al (2015) emphasize that insufficient width and discontinuity of pedestrian paths significantly reduce accessibility and usability. Furthermore, Prattyni (2024) also identifies that damaged pavement conditions such as cracks, uneven surfaces, and missing segments pose serious safety risks for pedestrians. However, compared to these studies, the condition observed in the Lembang Street segments indicates a more critical level

of deterioration, particularly due to the combination of structural damage and the complete absence of sidewalks in certain areas.

These findings are in line with previous studies that highlight the limited implementation of inclusive design principles in pedestrian infrastructure. Darmawan et al (2024) similarly found that many sidewalks in urban areas lack essential accessibility features, such as guiding blocks for the visually impaired and ramps for wheelchair users. In addition, Magdalena et al (2024) emphasize that the absence of such facilities indicates weak integration of universal design principles within infrastructure planning and regulation. Prattyni (2024) further notes that inadequate accessibility features disproportionately affect vulnerable groups, reducing their mobility and safety in public spaces. However, compared to these studies, the observed segments demonstrate a more pronounced deficiency, as accessibility elements are entirely absent rather than partially implemented, reflecting a more significant gap in achieving inclusive and universally accessible pedestrian infrastructure.

Figure 5. Pedestrian Way Width along Lembang Street Segment

A major issue identified is the insufficient effective width of the sidewalks. While visually some sidewalks may appear wide, the usable walking space is largely obstructed by large trees, utility poles, advertisement boards, and open drainage channels. These obstacles significantly restrict pedestrian movement, often forcing people to walk in single file or step onto the streetway when passing one another.

From a safety perspective, there are no bollards or physical barriers to protect pedestrians from motorized traffic. As a result, sidewalks are often misused as parking space for motorcycles and cars, especially near public facilities such as minimarkets, restaurants, and commercial stores. This absence of protective elements also affects other dimensions such as *Encroachment on Footpath* and *Pedestrian Traffic Interaction*, as there are no physical safeguards to prevent conflicts between pedestrians and vehicles.

It should also be noted that additional facilities such as benches, greenery, or wayfinding signage are almost entirely absent along the observed pedestrian route. Yet, these facilities are essential for enhancing pedestrian comfort and fostering a sense of ownership over

public spaces. For instance, the presence of shading vegetation not only provides thermal comfort but also encourages walking for short-distance travel.

Overall, the analysis of the PI dimension based on both observational data and user perceptions produced an average score of 2.29, which falls within the very poor category. Although the user perception score (2.59) is slightly higher than the observational score (2.00), this more likely reflects a level of user tolerance or adaptation to poor conditions rather than an indication of adequate infrastructure quality.

These findings provide a critical contribution that pedestrian infrastructure assessment must go beyond mere availability and incorporate condition, functionality, and inclusiveness as key performance indicators. In the context of transportation planning, this study highlights the need to reposition pedestrian pathways as core mobility infrastructure rather than supplementary elements, particularly in ensuring accessibility and safety for all users. Thus, this study offers a more comprehensive evaluation framework that integrates physical condition, service quality, and user-oriented accessibility, which is often overlooked in conventional infrastructure planning and management practices.

Pedestrian Convenience and Sense of Security (CS)

The *Pedestrian Convenience and Sense of Security (CS)* dimension is one of the key indicators in assessing the Pedestrian Level of Service (PLOS), as it reflects the subjective quality of the pedestrian experience in terms of both comfort and perceived safety. This dimension not only considers the physical conditions of the walkway, but also addresses psychological aspects such as tranquility, directional clarity, and the surrounding environment that contributes to a sense of protection from accidents and criminal threats.

Based on field observations and user perception surveys, the CS dimension received a combined average score of 1.94, with an observational score of 1 and a perception score of 2.87. This places the CS dimension in the very poor category. The extremely low observational score indicates that, objectively, the pedestrian pathways along Lembang street segment fail to meet the basic requirements of comfort and safety. These findings highlighting that relatively higher perception scores a normalization of substandard conditions. This insight challenges conventional evaluation approaches that rely heavily on user satisfaction, emphasizing the need to integrate objective performance assessments with perceptual data to avoid misleading conclusions. Consequently, this study contributes to the development of more robust and realistic evaluation frameworks for pedestrian infrastructure, particularly in identifying hidden service

In terms of physical comfort, observations reveal that uneven surfaces, narrow walkways, and numerous physical obstructions such as poles, open drainage channels, or semi-permanent structures are the primary causes of discomfort. Walkways, which are supposed to offer smooth, uninterrupted mobility, are instead riddled with physical challenges. Many respondents reported difficulties navigating these spaces, particularly when passing other users, during rainfall, or while carrying personal items.

Moreover, the absence of supporting facilities such as seating areas, weather protection (canopies or shade trees), and rest zones further degrades the walking experience. According to pedestrian planning standards, these elements are integral to the creation of inclusive and humane public spaces especially for the elderly and children. The lack of such features also worsens the experience for users with mobility constraints or special needs.

In terms of perceived safety, the situation is even more concerning. Observations indicate that there is no physical buffer or safe separation between pedestrian paths and motor vehicle lanes, meaning pedestrians are often walking dangerously close to moving traffic. Some segments lack any elevation or height differentiation between the sidewalk and the street, making pedestrians vulnerable to side-swipes by vehicles. This is exacerbated by drivers who frequently park their vehicles on the sidewalks, forcing pedestrians to step onto the street unprotected.

Additional factors that undermine safety include poor lighting conditions, a lack of signage, and the absence of surveillance or security personnel, particularly at night. Respondents noted feeling uncertain or fearful when walking along these sidewalks after dark, owing to the dark and deserted environment and the lack of monitoring systems such as CCTV or security posts. Although this insecurity is psychological in nature, it significantly influences an individual's willingness to walk in the area.

Night Time Walking (NW)

The *Night Time Walking (NW)* dimension evaluates the level of comfort and safety experienced by pedestrians when using walkways during nighttime hours. This aspect is particularly critical in areas like Lembang street segment, which remains active in the evening due to its commercial and tourist functions. The indicators assessed include lighting availability, light distribution, nighttime visibility, and user perceptions of security after dark.

Observations revealed that lighting conditions along many segments of the pedestrian walkway are extremely inadequate. Numerous areas lacked public street lighting, while others had dim or poorly distributed lights that failed to illuminate the pedestrian surface properly.

This severely compromises pedestrian safety, especially where uneven or damaged pavement exists, and is further exacerbated during the rainy season.

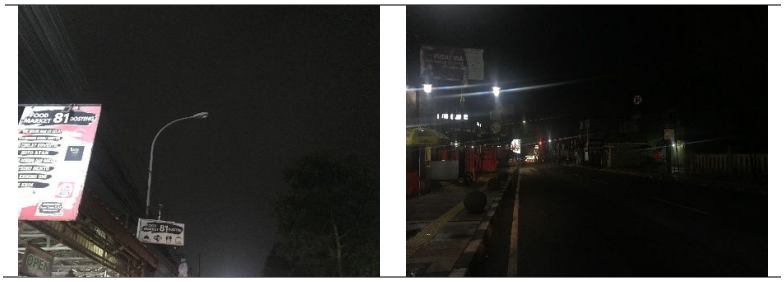

Figure 6. Night Lamp along Lembang Street Segment

Survey respondents overwhelmingly reported feeling unsafe when walking at night. The combination of poor lighting, isolated pathways, and a lack of security presence increased the perceived risk of both accidents and criminal activity. These results are consistent with previous studies that emphasize the importance of safety and security factors in determining the usability of pedestrian infrastructure, particularly at night. Anapakula and Eranki (2021) highlight that inadequate lighting significantly reduces pedestrian comfort and discourages walking activities after dark. Similarly, Prattyni (2024) identifies that the absence of proper surveillance and safety measures increases perceived risk and vulnerability among users. In addition, Magdalena et al (2024) argue that the integration of Crime Prevention Through Environmental Design (CPTED) principles is essential in enhancing pedestrian safety in urban spaces. However, compared to these studies, the findings on the Lembang Street segment reveal a more critical condition, where the combined lack of lighting, security features, and environmental design considerations results in pedestrian infrastructure that is not only suboptimal but effectively unusable during nighttime.

Encroachment on Footpath (EF)

The *Encroachment on Footpath (EF)* dimension assesses the extent to which pedestrian space is obstructed by non-pedestrian use. Such encroachments include parked vehicles, street vendors, signage, and illegal semi-permanent structures. This dimension is crucial as it directly affects the functionality and accessibility of pedestrian walkways.

Figure 7. Parked Vehicle along Lembang Street Segment

Observational data indicate that numerous sections of the footpath are frequently occupied by parked motorcycles and cars, especially near commercial zones and public services. Additionally, informal street vendors often establish stalls on sidewalks, severely limiting the usable space for pedestrians. In many cases, the effective width of the footpath is reduced to less than one meter, forcing pedestrians to walk on the streetway, thereby increasing the risk of traffic accidents.

Survey respondents confirmed these findings, reporting that they frequently encounter obstructions on the sidewalks, particularly in the afternoon and evening when street activity intensifies. The scoring for this dimension is as follows:

Temuan ini konsisten dengan studi sebelumnya yang mengidentifikasi regulasi dan penegakan hukum spasial yang lemah sebagai faktor kunci yang berkontribusi terhadap penyalahgunaan infrastruktur pejalan kaki. Magdalena dkk. (2024) menekankan bahwa tidak adanya zonasi yang jelas dan mekanisme penegakan hukum yang tidak memadai seringkali menyebabkan perambahan trotoar oleh aktivitas informal. Demikian pula, Mauliani dkk. (2015) menyoroti bahwa tanpa pemisah fisik seperti tiang pembatas atau penghalang, ruang pejalan kaki sangat rentan terhadap pendudukan oleh kendaraan dan pedagang kaki lima. Lebih lanjut, Darmawan dkk. (2024) berpendapat bahwa kontrol regulasi yang tidak efektif mencerminkan masalah tata kelola yang lebih luas dalam pengelolaan infrastruktur perkotaan.

Namun, dibandingkan dengan studi-studi tersebut, kondisi yang diamati pada segmen Jalan Lembang menunjukkan tingkat kegagalan regulasi yang lebih nyata, di mana gabungan tidak adanya intervensi desain fisik dan tindakan penegakan hukum memungkinkan perambahan terus berlanjut secara sistematis, menunjukkan kesenjangan yang lebih dalam antara niat perencanaan dan implementasi dalam praktik..

Pedestrian Walking Comfort (PC)

The *Pedestrian Walking Comfort (PC)* dimension evaluates the overall walking experience in terms of ergonomic and environmental factors. These include surface smoothness, walkway width, shelter from weather conditions, presence of resting facilities, aesthetics, and psychological comfort.

Field inspections revealed that many parts of the walkway are uneven, cracked, and poorly maintained, requiring pedestrians to navigate cautiously. Moreover, there is a complete absence of shade trees, benches, or canopy structures, leaving users exposed to direct sunlight

or rain. The visual quality of the walkway is also low, cluttered with utility poles, overhead cables, and uncontrolled advertisements.

Survey participants expressed discomfort when walking distances exceeding 500 meters, citing narrow pathways, physical obstructions, and a lack of resting points. The walkway is clearly not designed for sustained walking or for users with special needs, such as the elderly or people with disabilities.

These findings confirm that pedestrian comfort is not a design consideration in the current walkway system along Lembang street segment. To enhance this dimension, physical repairs should be complemented with the integration of greenery, street furniture, and aesthetic elements that encourage walking as a pleasant activity. Adopting the *complete streets* approach would ensure a more inclusive, human-centered, and sustainable urban mobility environment.

hese findings are consistent with previous studies that emphasize pedestrian comfort as a critical determinant of walkability and overall urban mobility quality. Mauliani et al (2015) highlight that factors such as walkway width, surface condition, and the availability of supporting amenities significantly influence pedestrians' willingness to walk. Similarly, Anapakula and Eranki (2021) argue that environmental and ergonomic aspects such as shading, resting facilities, and visual quality—play a vital role in shaping user experience and sustaining walking activity over longer distances. In addition, Prattyni (2024) identifies that poor maintenance and the absence of pedestrian-oriented design elements can reduce both physical and psychological comfort, particularly for vulnerable groups.

However, this study provides a unique contribution by demonstrating that deficiencies in pedestrian comfort are not isolated issues but occur simultaneously across multiple dimensions, including physical condition, environmental quality, and spatial design. This integrated perspective reveals that pedestrian discomfort along the Lembang Street segment is systemic rather than incidental. these findings highlight the need to move beyond basic infrastructure provision toward a more holistic, user-centered approach that incorporates comfort, aesthetics, and inclusivity as essential components of pedestrian network design. By emphasizing the adoption of the complete streets approach, this study contributes to advancing planning frameworks that position walking not only as a mode of movement, but as a safe, comfortable, and desirable urban experience.

4. CONCLUSION

Based on the research discussion presented, it can be confirmed that the hypothesis stating the low performance of pedestrian pathways along the Lembang Street segment is supported. This is evidenced by findings across all aspects of the Pedestrian Level of Service (PLOS), which fall within very poor to low categories, including safety, security, comfort, infrastructure, and the level of sidewalk encroachment. Overall, the analysis indicates that the pedestrian pathway is classified at Level E, meaning it does not meet the minimum acceptable service standards. This finding reinforces the presence of fundamental issues in both the functionality and quality of pedestrian infrastructure along the Lembang Street segment.

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