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# Study of Pedestrian Path Comfort Evaluation in Campus Environment of Institut Teknologi Sumatera

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**ABSTRACT**

Pedestrian paths serve as crucial arteries within university campuses, facilitating the movement of students, faculty, and staff. However, suboptimal pedestrian path conditions can hinder comfort, safety, and overall well-being, potentially discouraging walking and promoting motorized vehicle usage. This study delves into the evaluation of pedestrian path comfort and safety at the ITERA campus, employing a mixed-methods approach that encompasses direct observation and interviews with campus users. Findings reveal that the current state of ITERA's pedestrian paths falls short of providing an optimal environment for pedestrians. While the arrangement of trees contributes to a sense of security, the absence of pavement material and insufficient shade-providing vegetation detract from the overall pedestrian experience. Moreover, the lack of seating and road crossing markers further diminishes comfort. Zone C, in particular, stands out as a problematic area due to high pedestrian traffic. Respondents' perspectives reinforce the importance of both physical and atmospheric factors in shaping pedestrian path comfort. Physical attributes such as pavement quality, accessibility, vegetation, cleanliness, and safety were consistently highlighted as crucial elements. Additionally, respondents emphasized the influence of atmospheric factors, including the presence of seating and road crossing markers, on their overall comfort level. The findings of this study underscore the need for comprehensive improvements to enhance the pedestrian experience at ITERA campus. Addressing the identified physical deficiencies, such as the lack of pavement and inadequate shade, is paramount. Furthermore, incorporating seating and clear road crossing markers would significantly enhance comfort and safety. By prioritizing both physical and atmospheric factors, ITERA can create a more pedestrian-friendly campus environment that promotes sustainable transportation choices and contributes to the well-being of its community.

**Keywords:** Evaluation, Comfort, Pedestrian Path, ITERA

## 1. Introduction

In Indonesia in general and Lampung Province in particular, there are still pedestrian problems that have not been resolved optimally. This is the cause of the problem of infrastructure development in urban areas that have not been comprehensive. Many pedestrian paths still do not meet the standard requirements. In Indonesia, pedestrian paths often have multiple functions. In addition to pedestrian access, a lot of pedestrian paths are used as a street selling area, a place to patch tires, and some even build small shops in the pedestrian path area. So that it can interfere with the comfort of the pedestrians who cross the pedestrian route [1]. The word pedestrian is often misinterpreted by the public because many think that pedestrians are sidewalks and paths

for pedestrians. But many parties make it the subject, namely pedestrians. In the current era of urban planning, pedestrian paths have a role in creating a social and human environment [2]. Pedestrians are humans who move in a space to get to the place to be addressed and vice versa. Pedestrian paths can be used in urban community activities in everyday life. For example, activities carried out in the pedestrian path are walking to get to a place, can be used as a place to sit back and relax, and as a public gathering place in the middle of the city [3].

According to Permen PU No.03/PRT/M/2014, the pedestrian path is part of the road used for pedestrians whose area will be calculated based on the dimensions of the human body when walking with goods or not and when standing still or moving. The main facility infrastructure for pedestrians is in the form of a path for pedestrians. While the pedestrian path facilities are in the form of supporting facilities such as complementary buildings, directions or information, and other supporting facilities that can create safety and comfort for pedestrians. These facilities and infrastructure have the general function of facilitating the movement of pedestrians smoothly, easily, safely, comfortably, etc. including for people with disabilities who cross it. In addition, there are facilities that are not mentioned in the ministerial regulation, including sidewalks, street furniture lanes, signs, green areas, ramps, street lights, security guardrails, and bus stops or shelters [4]. Pedestrian paths are essential urban infrastructure that significantly influence the quality of urban life. Serving as spaces for movement, social interaction, and recreation, they contribute to the overall livability and sustainability of cities[5]. While their importance is recognized, challenges such as inadequate design, maintenance, and encroachment often hinder their optimal function[6]. The concept of pedestrian paths encompasses a range of spaces, from sidewalks and pavements to plazas and malls [7]. The ideal pedestrian path should be accessible, safe, and comfortable, accommodating diverse user needs[8]. Research has emphasized the importance of factors such as width, surface quality, lighting, and the presence of amenities in creating pedestrian-friendly environments [9]. Studies have highlighted the multifunctional role of pedestrian paths, extending beyond mere movement corridors. They can stimulate economic activity, improve public health, and enhance the aesthetic appeal of urban areas. However, conflicts with other land uses, including street vending and vehicular traffic, can compromise pedestrian comfort and safety[10]. To evaluate the effectiveness of pedestrian paths, various criteria have been proposed, including accessibility, safety, comfort, and functionality [11]. These criteria can be used to assess the quality of existing pedestrian paths and inform the design of new ones. Pedestrian paths are vital components of the urban environment. Their proper planning, design, and management are essential for creating cities that prioritize the needs of pedestrians and promote a high quality of life [12]. Pedestrian paths are public facilities that must exist in every place and one of them must be found in the campus area [13]. This is because the pedestrian path on campus is a means for students / people who walk around the campus area. Pedestrian paths can be in the form of sidewalks, sidewalks, pavements, pathways, plazas and malls [14]. Institut Teknologi Sumatera, known as ITERA, was established on October 6, 2014 and is still being built today. During the construction of buildings in ITERA, pedestrian paths are also under construction. A pedestrian path is a form of physical infrastructure designed for use by humans who walk or pedestrians [15]. In this case, there are four key factors that also need to be considered and affect the distance traveled by people on foot, namely time, comfort, availability of motorized vehicles, and land use patterns [16].

The There are significant challenges for pedestrian infrastructure in Indonesia, especially within the ITERA campus. The design of pedestrian paths must be carefully considered and meet optimal standards. Problems such as inadequate design, safety concerns, and disruption from non-pedestrian activities are common, especially in new campuses that are still in the development stage. Existing research highlights the role of pedestrian paths within the ITERA campus environment with different user conditions and activity dynamics. with different user conditions and activity dynamics than urban sidewalks. While the knowledge on pedestrian walkways continues to grow, research specifically addressing the conditions and challenges faced by those walking on Indonesian campuses is lacking. Traffic and diverse user needs, requires focused investigation. In addition, while previous studies have examined the physical characteristics of pedestrian pathways, there is a limited understanding of how these factors influence pedestrian experience and behavior in the ITERA campus environment. In addition, the current student population may be a differentiating factor in evaluating the current student population compared to the past, where the current student population was dominated by Gen Z students. This study aims to fill this gap by examining pedestrian routes at Institut Teknologi Sumatera

(ITERA). ITERA, a fast-growing university in Lampung Province, Indonesia, is an ideal case study to explore the challenges and opportunities for pedestrian infrastructure in the campus environment. By assessing current conditions, identifying user needs, and proposing potential improvements, this research contributes to the development of evidence-based strategies for the improvement of pedestrian infrastructure in existing campus environments in Indonesia. The results of this study have the potential to inform policymakers, urban planners, and campus administrators at ITERA and beyond in their efforts to create safer, more convenient, and pedestrian-friendly environments.

## 2. Method

This research employs a combination of quantitative and qualitative methods, adopting a descriptive approach. This research method provides an overview of the comfort experienced by pedestrians, both when walking individually and when walking in groups. The rationale for employing qualitative methods is to elucidate the comfort factor of the pedestrian path in the ITERA area, which is not traversed by a considerable number of individuals, particularly during the daytime. In the descriptive method, the data collected will be analyzed and interpreted with simple purposive sampling by comparing the differences and similarities of data and path users. The purpose of this method is to provide a systematic, accurate, factual, and reliable explanation of facts that can be observed and cannot be quantified.

### 2.1. Data Collection Methods

Data on the comfort of pedestrian paths were observed directly by researchers. The location is divided into several zones to be a comparison of comfort. In addition to direct observation, other data obtained from the collection of questionnaires user perceptions pedestrian path through google form distributed to 55 students. Data is said to be valid if those who fill in the data are at least 30 respondents because the results of the test reach a normal curve [17]. The research location takes place on the campus of Institut Teknologi Sumatera which is shown in Figure 1.


**Figure 1** Research location map

### 2.2. Data analysis method

The data on pedestrian path comfort and feedback from users will be subjected to a comprehensive analysis, with the findings subsequently compared with relevant standards and guidelines. This comparative analysis aims to establish a comprehensive evaluation framework for stakeholders involved in the development and maintenance of pedestrian infrastructure. By benchmarking the findings against established benchmarks, this study seeks to contribute to a broader understanding of infrastructure development within the campus environment and inform strategies for improvement.

## 3. Result and Discussion

### 3.1. ITERA Campus Area Pedestrian Path Facilities

I Institut Teknologi Sumatera campus is equipped with pedestrian pathways that facilitate the integration of various campus activities. Consequently, specific areas within the campus have been selected for comprehensive analysis. Figure 2 offers a visual representation of these zones. This study encompasses three distinct areas: Zone A encompasses the main gate, Building A, Building B, the gallery, the BKL canteen, and the dormitory. Zone B includes Buildings C and D, the road intersection, Building E, the public lecture hall 2, the road roundabout, and Building F. Zone C comprises the basketball court, the RK canteen, the public lecture hall 1, the Engineering Laboratory 2, the Engineering Laboratory 5, the OZT laboratory, the road roundabout, and the west gate.

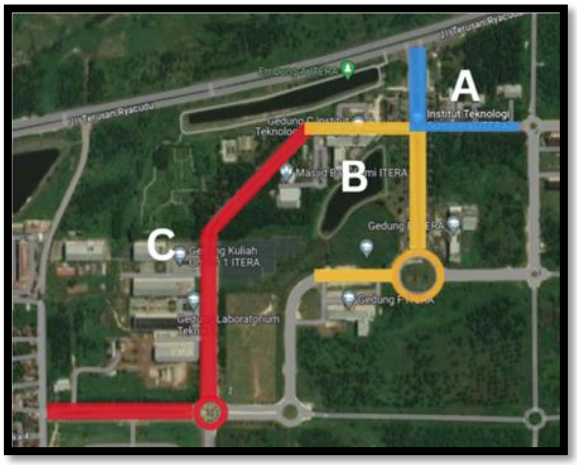


**Figure 2** Pedestrian path zone map

### 3.2. Zone A Facility Condition

As illustrated in Figure 3, the pedestrian pathways in Zone A remain disparate and disorganized. Figure 4(a), illustrates that the walkway surrounding the main entrance is constructed with concrete, a material that is both practical and conducive to pedestrian traffic. Furthermore, the pedestrian path surrounding the main entrance is unobstructed, functioning not only as the primary thoroughfare for pedestrians but also as a gathering point for students. Furthermore, as illustrated in Figure 3(b), the absence of a designated pedestrian path on campus forces pedestrians to traverse the main road shoulder, which is also utilized by motorized vehicles. Consequently, pedestrians are compelled to utilize the highway to reach their intended destination. Figure 4(c), illustrates that the pathway situated in front of the dormitory is commendable, as it is furnished with a sidewalk constructed of paving blocks. However, the absence of vegetation surrounding the sidewalk gives rise to the sensation of heat when traversing it.

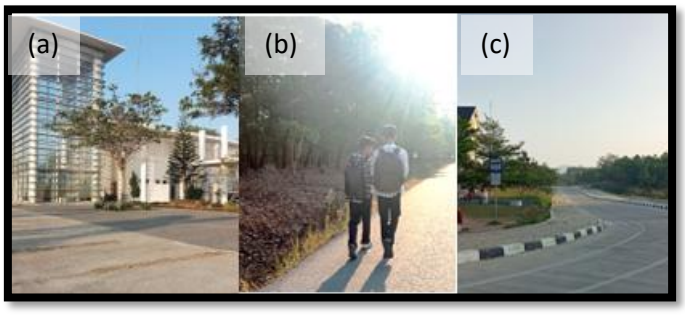


**Figure 3** (a) Pedestrian path near the campus entrance (b) Pedestrian path to the BKL cafeteria (c) Pedestrian path in the dormitory area

### 3.3. Zone B Facility Condition

As illustrated in Figure 4(a), the pedestrian path in Zone B is observed to be in a satisfactory condition, offering a relatively comfortable and unobstructed passage. The materials utilized in the construction of the pedestrian path within this zone are concrete and paving blocks. However, the concrete surface of the pedestrian path is in poor condition due to its rough texture, which causes significant friction when walking. This area also features supporting vegetation and seating areas along the pedestrian path, providing additional temporary resting points. In zone B, as illustrated in Figure 4(b), there is no designated pedestrian path, and thus pedestrians utilize the highway as a walking area. Figure 4(c) depicts the condition of the pedestrian path that has been equipped with sidewalk facilities.

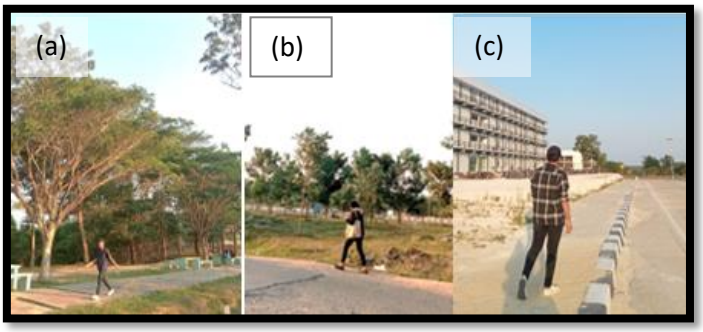


**Figure 4** (a) Pedestrian path in building area E (b) Pedestrian path in building area C (c) Pedestrian path in building area F

### 3.4. Zone C Facility Condition

Figure 5(a) illustrates the conditions in zone C, which are less comfortable and less safe for pedestrians due to the absence of a sidewalk along the route connecting the C & D Building to the engineering laboratory building. This lack of infrastructure makes pedestrians feel unsafe, as they are at risk of being hit by motorized vehicles. Figure 5(b) illustrates the condition of the pedestrian path in the area in front of the OZT building, Engineering Laboratories 1 & 2, and GKU 1. The pedestrian path is constructed with paving material. Additionally, Figure 5(c) depicts a pedestrian path situated adjacent to the west gate of Zone C. This path is characterized by abundant vegetation, which provides a cooling effect when traversing it. Figure 5(d) illustrates a unique signage system designated for this pedestrian path. However, the path's condition is less than optimal, lacking a defined surface and proper maintenance. Consequently, during precipitation events, the lack of a paved surface and the presence of mud and slippery conditions pose a significant hazard to users.

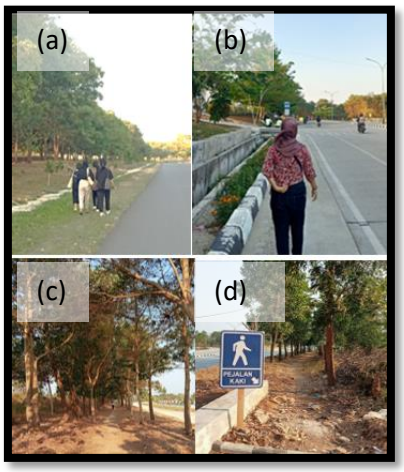


**Figure 5** (a) Pedestrian path to the engineering laboratory building (b) pedestrian path in front of the OZT laboratory building (c) pedestrian path at the west gate (d) pedestrian path conditions that do not yet have pavement material

### 3.5. ITERA Area Pedestrian Path Activity

The Institut Teknologi Sumatera (ITERA) campus is predominantly utilized by students, with a smaller proportion of faculty and staff utilizing the pedestrian paths. These pathways serve a dual purpose, facilitating both circulation and social interaction. Through observations and interviews with campus users, it was revealed that the pedestrian path located in Zone A is utilized as an impromptu performance space for dance exhibitions by ITERA students. While the pedestrian paths at ITERA offer insight into their potential to accommodate a diverse range of activities, further development is essential to fully realizing this potential. Specific areas requiring attention include accessibility, safety, comfort, multifunctionality, and maintenance. By addressing these areas, ITERA can create pedestrian paths that better serve the needs of its campus community and enhance the overall campus experience.

### 3.6. Comfort of ITERA Area Pedestrian Path Users

The results of a questionnaire to 55 respondents who assessed the convenience of pedestrian facilities on the ITERA campus obtained the following results:

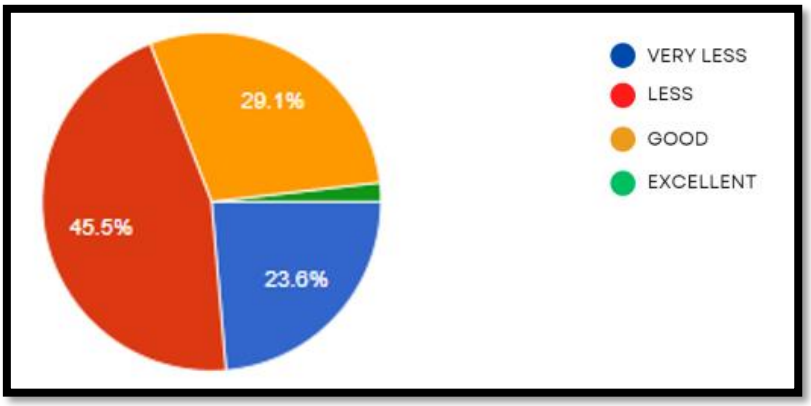


**Figure 6** Diagram of respondents' assessment of the current condition of pedestrian paths

Based on the data shown in Figure 6, it can be explained that as many as 45.5% and 29.6% of respondents answered that the pedestrian path at ITERA was in a very bad condition when viewed and used by pedestrians. And as many as 29.1% of respondents said that the condition of the pedestrian path was good because in some parts of the zone there were pedestrian paths whose shape and atmosphere were quite adequate. 1.8% of respondents thought that the pedestrian path was very good. Based on the results of the respondents' evaluation, it can be seen that the condition of the pedestrian zone is still not good and needs to be improved.

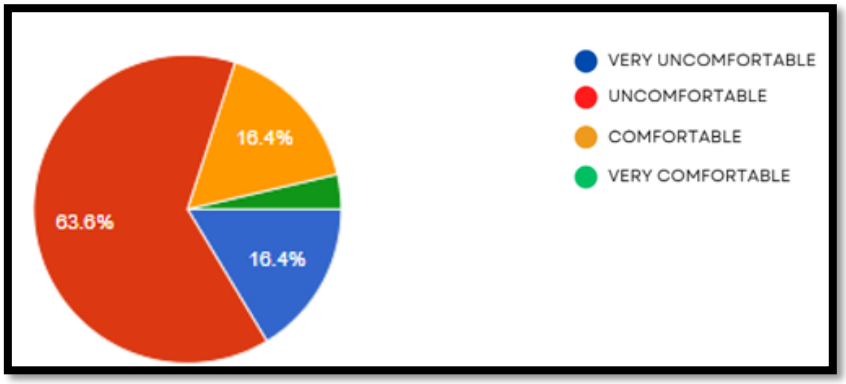


**Figure 7** Diagram of respondents' assessment of walkway comfort

Based on the data shown in Figure 7, it can be explained that the comfort when going through the pedestrian path at ITERA is 63% of respondents answered less comfortable. Even as many as 16.4% of respondents answered very uncomfortable because many pedestrian path facilities at ITERA were inadequate so that the level of comfort was very bad for its users. A positive assessment of respondents who stated that the pedestrian path was comfortable at 16.4% and very comfortable at 3.6%. From the data above it can be concluded that the pedestrian path in ITERA have not met comfort standards based on user perceptions.

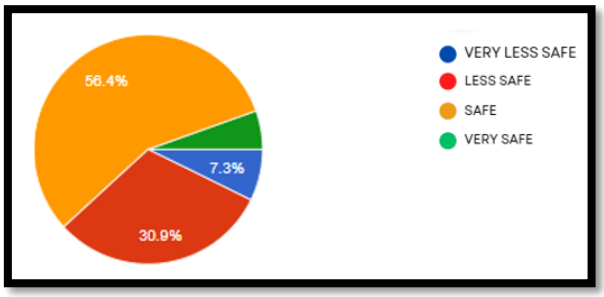


**Figure 8** Diagram of respondents' assessment of walkway safety

Based on the data shown in Figure 8, it can be explained that as many as 56.4% of respondents said the pedestrian path was still safe when passed and 30.9% of respondents said it was less safe because there were several pedestrian paths that did not exist so that pedestrians passed through the shoulder or roads that should not be passed by pedestrians. 7.3% said the pedestrian path while the remaining 5.4% of respondents said that the pedestrian path was very safe. from the data obtained shows that the pedestrian path has fulfilled user safety but needs to be improved especially in areas where there are no pedestrian facilities.

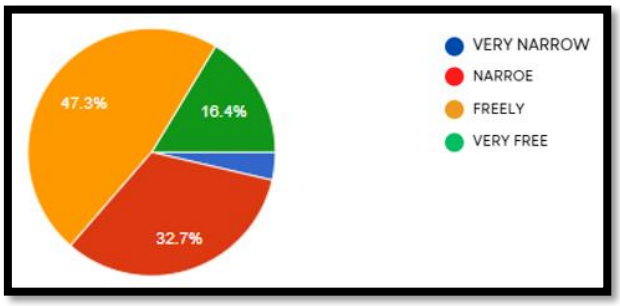


**Figure 9** Diagram of respondents' assessment of walkway circulation

Based on the data shown in Figure 9, it can be explained that as many as 47.3% of respondents said that the pedestrian circulation was quite free when passed by pedestrians. However, as many as 32.7% of respondents said that the pedestrian circulation was still narrow so that it was less free while passing through the existing path, as many as 16.4% of respondents stated that the pedestrian circulation was very wide because there was still a lot of empty land on the side of the road shoulder that could be used for walking. while the remaining 3.6% of respondents said that the circulation was very narrow. from the data obtained it can be said that the circulation of the pedestrian path is sufficient to accommodate users.

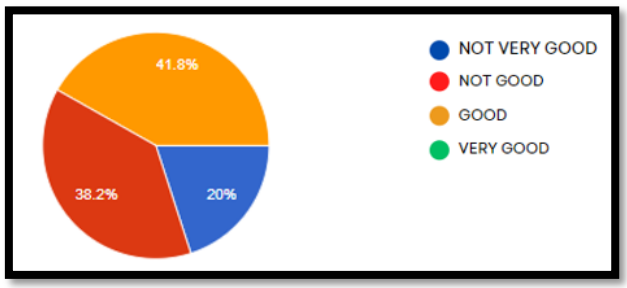


**Figure 10** Diagram of respondents' assessment of the condition of pedestrian path vegetation

Based on the data shown in Figure 10, it can be explained that 41.8% of respondents said that there was already vegetation in some areas of the pedestrian path so that it made the area shady. However, 38.2% of respondents said it was not good because the vegetation planted did not shade the pedestrian area so that it felt hot when passed during the day. 20% of respondents stated that the vegetation was very poor. based on the data above and in accordance with field data, it shows that the pedestrian path as a whole does not yet have shady vegetation considering that ITERA is a new campus so that the vegetation planted has not grown shady in all areas. it is necessary to arrange vegetation that is designed for pedestrians so that it not only becomes shady but becomes the aesthetics of the campus area.

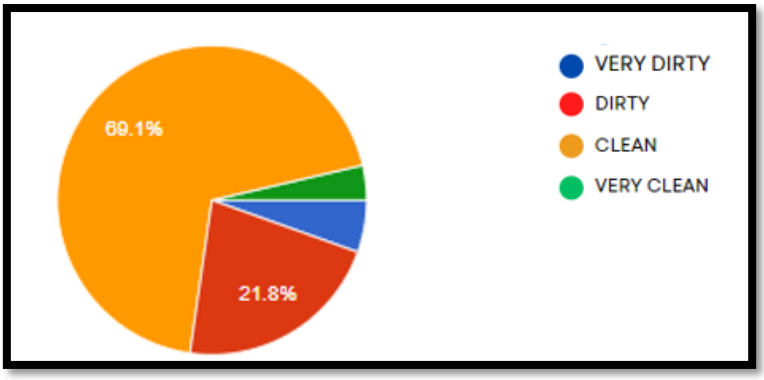


**Figure 11** Diagram of respondents' assessment of walkway cleanliness

Based on the data in Figure 11, it can be explained that the pedestrian paths are mostly clean and only about 21.8% of respondents stated that they are dirty because some paths still have dry leaves scattered because they are not reached by janitors or because the wind is strong so that the leaves of the vegetation fall off quickly. other respondents of 5.3% stated that the pedestrian paths were very dirty while the remaining 3.8% stated that they were very clean. Based on the data obtained and then adjusting the facts in the field, it can be concluded that the overall cleanliness condition of the pedestrian path is clean considering that there are janitors who routinely clean the pedestrian path, as for respondents who consider that the pedestrian path is still dirty, it shows that there are still some areas that are close to vegetation and there are many dry leaves falling.

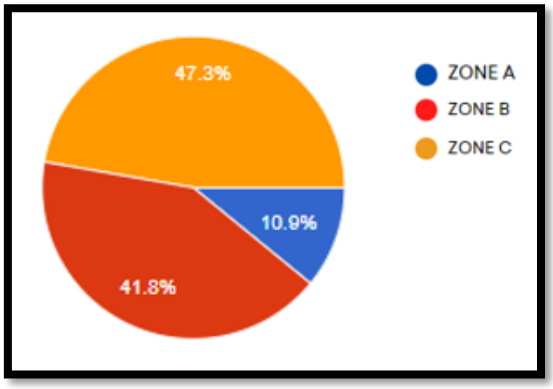


**Figure 12** Diagram of respondents' assessment of the overall condition of pedestrian paths in each zone

Overall, the road conditions described in Figure 12 show that, the assessment of Zone C which has the highest percentage of respondents, namely 47.3% of respondents, said that in this zone pedestrian users feel uncomfortable from the 7 aspects above and inadequate sidewalks. Then, the second uncomfortable pedestrian path is in Zone B as many as 41.8% of respondents answered in this zone because activities are often passed so that the comfort of shade vegetation is inadequate. And as many as 10.9 respondents said that in Zone A the pedestrian path has many adequate facilities, such as free space, sidewalks, and shade vegetation.

### 3.7. Comfort of ITERA Area Pedestrian Path Users

Figure 13 shows that 94.55% of respondents expressed their desire to have shade trees along the walkway to improve pedestrian comfort and reduce the heat of the sun during the day. This finding is in line with existing pedestrian walkway design principles, which emphasize the importance of vegetation in providing shade, reducing heat stress, and creating a more aesthetically pleasing environment. In addition, 76.36% of respondents requested seating facilities, such as park benches, for this purpose. The provision of seating along pedestrian paths is essential to enhancing comfort and relaxation among users, especially for those with limited mobility. In addition, 62.82% of respondents requested informative signage. Clear and well-placed signage plays an important role in guiding pedestrians, ensuring safety, and improving the overall user experience. The survey results further showed that 43.64% of respondents wanted wider pedestrian paths. Wider paths can accommodate increased pedestrian traffic, reduce congestion, and provide a more comfortable and inclusive environment for all users. In addition, 36.36% of respondents requested safety barriers that separate pedestrians from vehicular traffic. The implementation of physical barriers, such as curbs or bollards, is essential to protect pedestrians from vehicle hazards and ensure their safety. Finally, 27.27% of respondents requested paved pedestrian paths. Paved walkways offer a smooth, stable, and accessible walking surface, especially during inclement weather conditions.

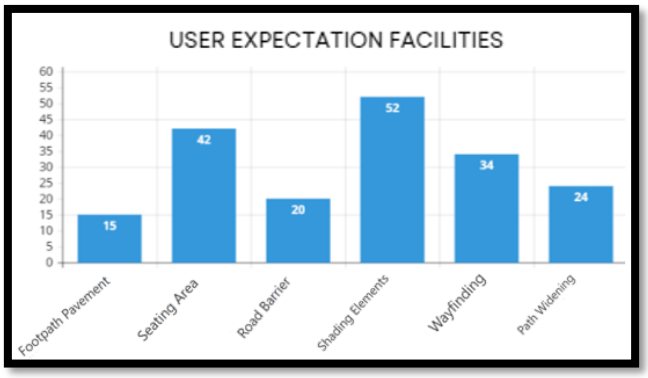


**Figure 13** Diagram of respondents' assessment of expected pedestrian path conditions

## 4. Conclusion

An evaluation of the pedestrian walkways within the campus of Institut Teknologi Sumatera (ITERA) revealed deficiencies in comfort and safety. The lack of paving materials and the design of sidewalks and road dividers indicate safety deficiencies, while the lack of supporting facilities such as benches, trash cans, information boards, and consistent shade vegetation in each pedestrian area are factors that need to be addressed. Respondents were negative about the overall safety and comfort of ITERA's pedestrian walkways. However, positive aspects were also recognized, including the existing tree planting that needs to be further developed, the sense of safety among pedestrians, and the cleanliness and spaciousness of the sidewalks. Zones B and C were identified as less comfortable due to the lack of facilities that support pedestrian activity such as shade, seating, and informative signage along the sidewalk. By prioritizing safety improvements, enhancing comfort and accessibility, improving signage and wayfinding, and incorporating user feedback, ITERA can transform the pedestrian network into a safe, comfortable, and accessible environment that fosters a sense of well-being and inclusivity among its diverse campus community. This effort is in line with ITERA's commitment to creating a sustainable campus that prioritizes the needs of the entire ITERA academic community.

## 5. Acknowledgements

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