International Journal of Architecture and Urbanism Vol. 08, No. 02 (2024) 239 – 253

International Journal of Architecture and Urbanism

Journal homepage: https://talenta.usu.ac.id/ijau

Strategy To Create a Green Campus Through Sustainable Transportation According To UI Greenmetric at Medan State Polytechnic Campus

Afdhal Hubbiq*[1], Bahrul Anif [1], Nasfryzal Carlo[1], Al-Busyra Fuadi[1]

[1]*Master of Civil Engineering, Faculty of Engineering, Universitas Bung Hatta, Padang, 25133, Indonesia*

*Corresponding Author: afdhalhubbiq@gmail.com

ARTICLE INFO

Article history:
Received 6-5-2024
Revised 23-7-2024
Accepted 13-8-2024
Available online 31-8-2024

E-ISSN: 2622-1640
P-ISSN: 2622-0008

How to cite:
Hubbiq A, et al. Strategy To Create a Green Campus Through Sustainable Transportation According To UI Greenmetric at Medan State Polytechnic Campus. International Journal of Architecture and Urbanism. 2024. 8(2):239-253.

http://doi.org 10.32734/ijau.v8i2.16353

ABSTRACT

Medan State Polytechnic (Polmed) plans to become a green campus in 2025. In this study includes the readiness of Polmed to the Greenmetric UI Innovation indicator in the category of transportation, primary data collection, secondary is analyzed using qualitative and quantitative methods. Based on the campus area of 84,420.74 m², the campus population consisting of 6,748 people which includes the distribution of staff and academics. The number of students, lecturers including education staff and administrative staff in 2022 was 478 people. In 2023 research data based on Greenmetric UI indicators that the availability of environmentally friendly transportation systems in the Polmed campus area is still low, namely the absence of zero emissions policy for motorized vehicles and there is no reduction in private vehicles in the Polmed campus area. The program to reduce the parking area in the campus environment for the past 3 years has reached a reduction in the parking area by 10-30%. Although there are pedestrian paths, only a few areas are considered safe, comfortable and still not suitable for people with disabilities. From the overall indicator obtained a score of 725 from 1,800 with a percentage of 40.28% in the transportation category. To increase this percentage can be done by implementing the use of electric vehicles. Likewise with redesigning the parking area by making a multi -floor parking lot parking lot.

Keywords: indicators, Polmed, transportation, UI greenmetric

1. Introduction

Universitas Indonesia (UI) is one of the pioneers in the green campus program in 2010. Universitas Indonesia created a ranking program known as the UI GreenMetric World University Ranking which was then used as a measuring tool for campus sustainability efforts. The goal is to create a survey to describe programs and sustainability in universities around the world [1]. Polmed is educational institutions in North Sumatra and estimates that it will continue to develop into a vocational college by adopting an environmentally friendly campus development policy and sustainable development. Polmed's strategic plan is to become an integrated campus in 2025 [2]. Polmed has received an invitation letter for the UI GreenMetric National Workshop for Polytechnics in Indonesia on May 15, 2023, which aims to increase awareness of the importance of environmental sustainability among universities [14].

2. Method

The data analysis method is adjusted to the formulation of the problem transportation systems in the polmed campus area. By using qualitative and quantitative analysis approaches explained below:

2.1 Qualitative Analysis

Qualitative research is scientific research in which a series of activities (processes) gather information from conditions as they are (reasonable) in an object, based on theoretical and practical points of view to answer a problem [3]. Qualitative analysis is a way of describing the situation as it is in the field when conducting a survey, so that it is in accordance with the objectives of this research, by describing or describing the actual situation and then identifying the availability of transportation systems based on the indicators in the UI GreenMetric Guidelines 2023.

2.2 Quantitative Analysis

Quantitative research focuses on variables and the relationship between one variable and another [4]. Examples of income, academic achievement, height, intelligence level, sales volume, and so on [5]. Flowchart is presented in figure 1.

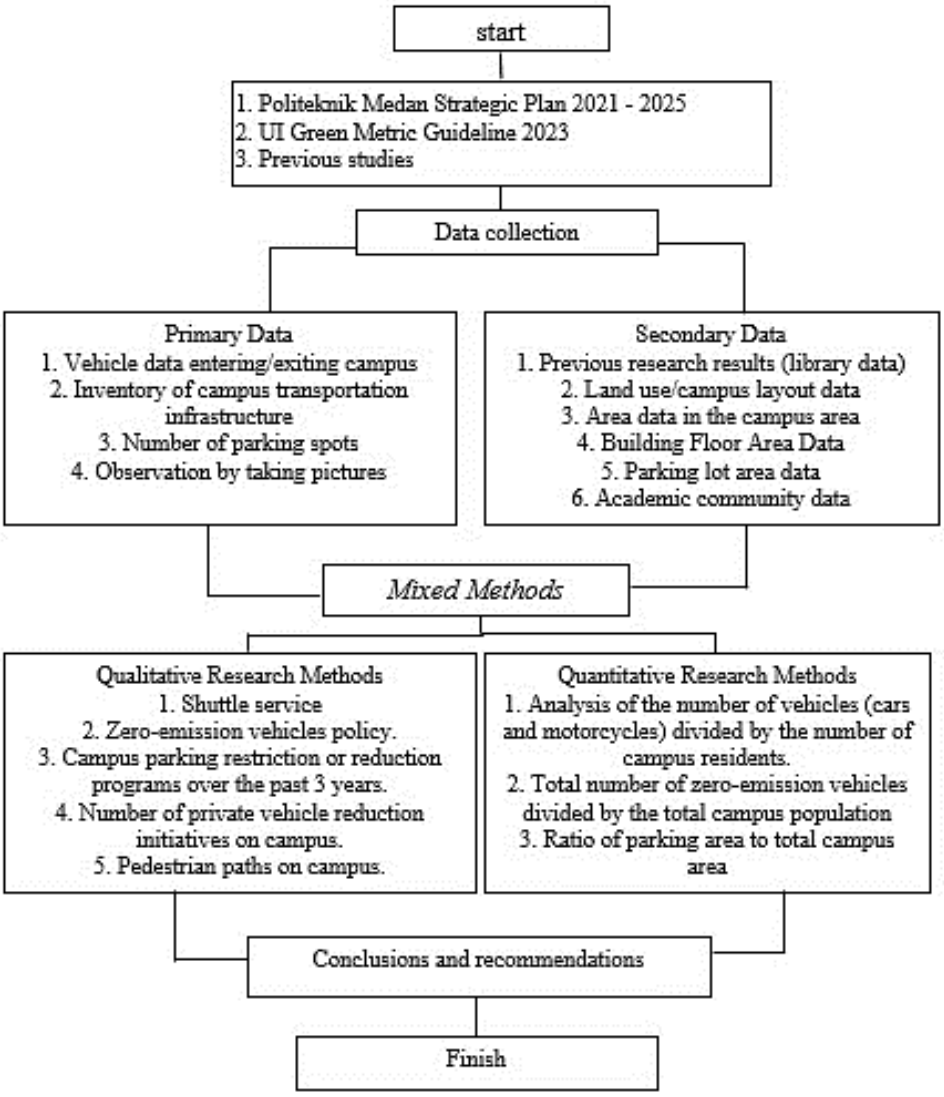


Figure 1 Flowchart

3. Result and Discussion

There are 8 indicators/criteria that will be reviewed as a basis for assessment/weighting in the transportation category contained in the 2023 UI GreenMetric Guideline. As a basis for calculating the assessment in the Transportation category contained in the 2023 UI GreenMetric Guideline, data on existing measurements of Polmed campus land is required. The results of land measurements on the Polmed campus are attached in table 1 below:

Table 1 Polmed Campus Land Area

No	Measured Land Area	Area (m^2)
1	Building	29.052,06
2	Facility :	
	Parking	8.738,03
	Tuesdayr	2.125,04
	Sidewalk	884,38
	Road	9.897,91
3	Non Green Open Space	14.207,30
4	Green open space	19.516,03
	Polmed Campus Land Area	**84.420,74**

The following 8 indicators will be calculated and assessed based on their suitability to the conditions of the Polmed campus based on the UI GreenMetric Guideline 2023:

3.1 Car and motorcycle users divided by campus populations (TR 1).

From the results of a survey conducted in the field, the total average of motorized vehicles, both four-wheeled such as cars, buses, and so on, and two-wheeled, namely motorbikes, that entered the Polmed campus area was 6,776 vehicles. Based on data obtained from the campus personnel department, the Academic Department of Academic Year 2022/2023. The number of students entering the morning and evening of 6,270 people. The number of teachers and staff is 478 people. The total campus population is 6,748 people [11].

To calculate the TR 1 value, it can be calculated using the following formula:

TR 1 = (Total number of cars and motorbikes / number of campus residents)
= 6,801/6,748
=f 1.008

With a result of 1.008, the TR 1 value is included in the assessment range ≥ 1. The results of the Polmed campus assessment on Car and motorcycle users divided by campus populations with a score of 0 points and are shown in table 2.

Table 2 TR 1

No	Categories and Indicators	Mark	Score	Weighting
5	**Transportasi (TR)**			**18 %**
TR 1	**Car and motorcycle users divided by the number of people on campus**	**200**		
	≥ 1		0	
	> 0,5 – 1		0,25 x 200	
	> 0,125 – 0,5		0,50 x 200	
	> 0,045 – 0, 125		0,75 x 200	
	< 0,045		1,00 x 200	

Sumber : UI *GreenMetric Guidelines* 2023

3.2 Shuttle service (TR 2)

From the results of the survey conducted in the field, in the Polmed campus area there are no shuttle service facilities such as paid or free buses provided by the campus for student transportation in the campus area [12]. The transportation system used in the Polmed campus area is still individual, using private four-wheeled or two-wheeled vehicles such as cars, motorbikes, bicycles or pedestrians. The value of the campus shuttle and service provided by Polmed is in the indicator (TR2). Zero emission vehicles are not possible to use with a value of 300 points, and are shown in table 3.

Table 3 TR 2

No	Categories and Indicators	Mark	Score	Weighting
5	Transportasi (TR)			18 %
TR 2	**Shuttle service.**	**300**		
	Pick-up and drop-off services are available but are not provided by Polmed..		0	
	Pick-up and drop-off services are available from other parties, they are routine and not free.		0,25 x 300	
	Pick-up and drop-off services are available and the university covers some of the costs.		0,50 x 300	
	The university provides regular and free pick-up and drop-off services.		0,75 x 300	
	Pick-up and drop-off services are vehicles.		1,00 x 300	

Sumber : UI *GreenMetric Guidelines* 2023

From the results of research in 2021 at the UIN Alauddin Makasar campus, campus residents still tend to use internal transportation in the UIN Alauddin Makasar campus area, especially on campus 2, they are still individuals or mostly use private vehicles and there is no use of campus shuttles in mobilizing campus community activities as a whole. internal, whether in the form of a campus bus or other transportation, there are only campus buses that serve to pick up employees at certain times such as entry and exit times from work which connects campus 1 and campus 2 on a point to basis which is external mobility which is equipped with 1 (one) bus stop unit as a transport point or pick-up point [6].

3.3 Zero Emission Vehicle (ZEV) Policy at Campus locations (TR 3).

From surveys conducted in the field, there is no zero emission policy in the Polmed campus area, because only a few students use emission-free vehicles, namely bicycles, and the campus also does not provide special parking spaces for bicycle users and other emission-free vehicles that can be used. as a means of transportation within the campus environment [13]. So the ZEV Policy on campus (TR 3) is included in the ZEV indicators available, but not provided by the university with a weight of 100 points, and shown in table 4.

Table 4 TR 3

No	Categories and Indicators	Mark	Score	Weighting
5	Transportasi (TR)			18 %
TR 3	**Kebijakan ZEV di kampus.**	**200**		
	ZEV not available		0,00	
	The use of neither nor		0,25 x 200	
	ZEV exists and is available, but is not provided by the university		0,50 x 200	
	ZEV available, provided by the university and chargeable		0,75 x 200	
	ZEV exists and is provided by the university for free		1,00 x 200	

Sumber : UI *GreenMetric Guidelines* 2023

The results of research at the UNTIRTA campus, namely the ZEV policy implemented by the campus, is to provide free bicycle service makes the environment reduce pollution [7].

The development of the environmentally friendly vehicles category in the polmed area is an effort to make Polmed a green campus. So the direction of development of the ZEV policy indicator on campus (TR 3) is presented in the following data:

Objective: Availability of a sustainable transportation program implemented by the Polmed campus as an effort to create a green campus, To reduce air pollution in the Polmed campus area.

Campus Development Directions: Issuance of Director's instructions/Director's decision to all Polmed campus community members to use environmentally friendly transportation, Providing electric bicycles/motorbikes for security officer operations in the Polmed campus area, Provision of free bicycles.

Benefits for campus: As a stimulus for campus residents to reduce the use of daily motorized vehicles to campus, to make campus air pollution-free and a better quality of life..

3.4 Number of ZEVs divided campus populations (TR 4)

From results the survey conducted in the field, the total number of ZEVs is 17 bicycles. Based on data obtained from the academic divisions of the campus in the 2022/2023 academic year. So the total campus population is 6,748 people and the TR4 value can be calculated:

TR 4 = (Total number of ZEV / number of campus residents)
= 17/6,748
= 0.0025

With a result of 0.0025, the TR 4 value is included in the assessment range of > 0.002 to ≤ 0.004, the Polmed campus assessment on the indicator of the number of ZEVs divided by the number of campus population obtained a value of 50 points as shown in table 5.

Table 5 TR 4

No	Categories and Indicators	Mark	Score	Weighting
5	**Transportasi (TR)**			**18 %**
TR 4	**Number of ZEV divided campus populations.**	**200**		
	≤ 0,002		0,05 x 200	
	> 0,002 until ≤ 0,004		0,25 x 200	
	> 0,004 until ≤ 0,008		0,50 x 200	
	> 0,008 until ≤ 0,02		0,75 x 200	
	> 0,02		1,00 x 200	

Sumber : UI *GreenMetric Guidelines* 2023

From the results of research at the Sebelas Maret (UNS) campus, the use of bicycles for the academic community is a priority. This can be seen from the provision of facilities that support bicycle use. This facility is the availability of bicycle parking in building 3 of the Faculty of Engineering. Apart from that, we also provide toilets with showers (especially all toilets on the 1st floor of each building in the Faculty of Engineering) to support cycling and walking activities to campus [8].

3.5 Base parking ratio to total campus area (TR 5).

From the survey carried out in the field, the Polmed campus parking lot is still in the form of parking pockets located in several places. After measuring and then adding up one parking lot to another, the basic parking

area ratio is 8,738,029 m². And the total campus area is 84,420,774 m², so the TR 5 value can be calculated using the following formula:

TR 5 = (Basic parking area ratio)/(Total campus area) x 100 %
= 8,738,029/84,420,774 x 100 %
= 10.4 %

With a result of 10.4%, the TR 5 value is included in the assessment range of > 7 – 11% which can be seen in table 6. The results of the campus assessment on the indicator of the basic overall obtained a score 50 points.

Table 6 TR 5

No	Categories and Indicators	Mark	Score	Weighting
5	**Transportasi (TR)**			**18%**
TR 5	**Ratio of basic parking area to campus area**	**200**		
	> 11 %		0,00	
	> 7 – 11 %		0,25 x 200	
	> 4 – 7 %		0,50 x 200	
	> 1 – 4 %		0,75 x 200	
	< 1 %		1,00 x 200	

Sumber : UI *GreenMetric Guidelines* 2023

The availability of parking space for four-wheeled vehicles is 4,319,196 m², with an average parking capacity of 420 vehicles. The availability of parking space for two-wheeled vehicles is 4,418,832 m², with an average capacity of 2,900 vehicles that can be parked. So the availability of parking space for the total land area is 10.4%. It can be seen in figure 2 of the Polmed campus parking area.

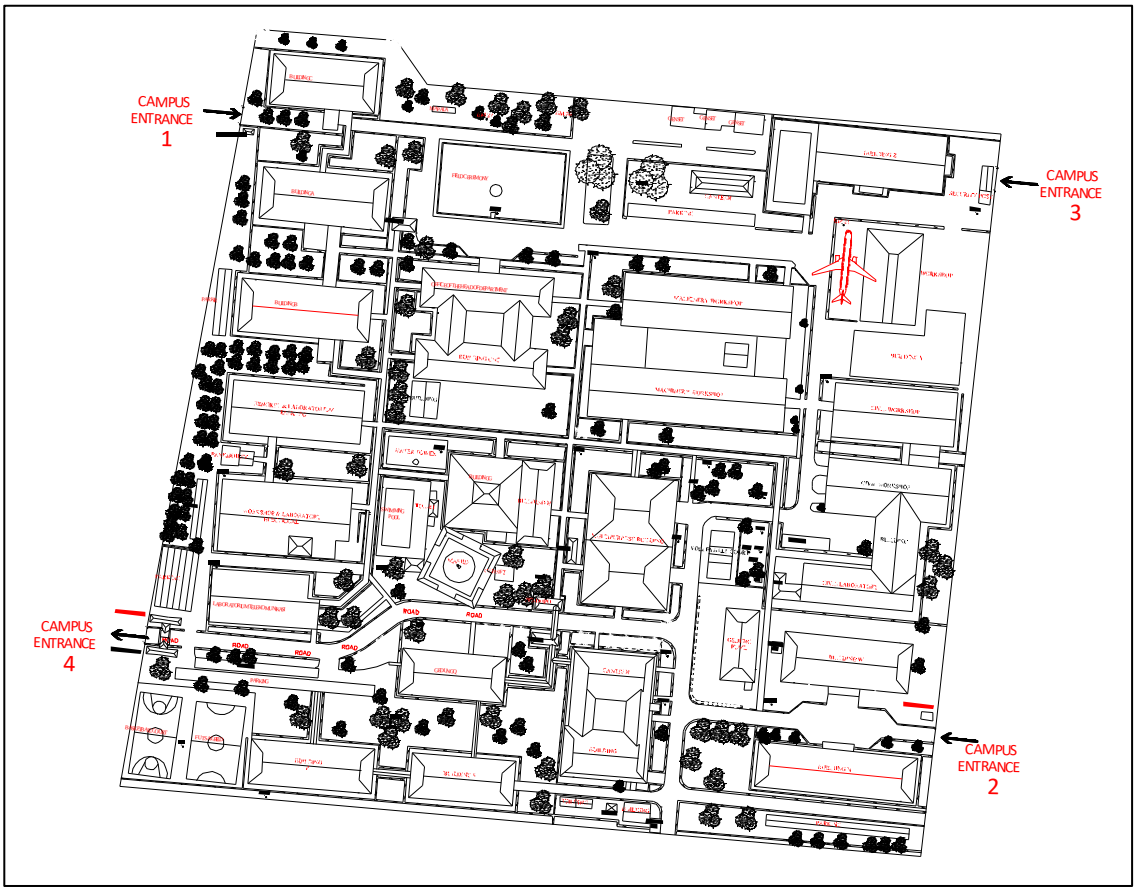


Figure 2 Polmed campus parking area

3.6 Campus parking area reduction program for the last 3 years (2020 to 2022) (TR 6).

From the survey conducted in the field, there has been a policy of a parking area reduction program on the Polmed campus for the past 3 years. With the Director's Circular Letter No: B/6PL5/TU.00.03/2022 "concerning Guidelines for Orderly Traffic, Entry and Exit Lanes and Vehicle Parking Systems in the Medan State Polytechnic Environment". This is a program that can limit the number of parking areas, so the value for the indicator of reduction program past 2020 - 2022 TR 6 resulted in reduction in parking area of 10-30% with a value of 150 points and presented in table 7.

Table 7 TR 6

No	Categories and Indicators	Mark	Score	Weighting
5	**Transportasi (TR)**			**18 %**
TR 6	**Program to over past 2020 - 2022**	**200**		
	Not available		0	
	The programs currently being prepared are feasibility studies and promotions.		0,25 x 200	
	This program resulted in a reduction in parking area of less than 10%		0,50 x 200	
	This program results in a reduction in parking area of 10 - 30%		0,75 x 200	
	The program results in a reduction in parking areas of more than 30% or a reduction in parking areas reaching the limit		1,00 x 200	

Sumber : UI *GreenMetric Guidelines* 2023

Development of the environmentally friendly transportation category in Polmed campus area is an effort to make Polmed a green campus. Development of indicators for reduction program 2020 - 2022 and presented as follows:

Objective : Availability of a sustainable transportation program implemented by the Polmed campus as an effort to create a green campus, Reduced motor vehicle users in the Polmed campus area, To reduce air pollution in the Polmed campus area.

Campus Development Directions: Issuance of Director's instructions/Director's decision to all Polmed campus members to use public transportation, due to the lack of parking space on the Polmed campus, Determining the availability of parking spaces centrally, not in the form of parking pockets, Redesign the parking area by creating multi-storey parking/vertical parking to reduce the parking area below/ground parking. It can be seen in figure 3 of the Polmed campus parking area and Parking Placement Plan Multilevel/vertical parking.

Benefits for campus: Increase in green open land in the Polmed campus area, If campus air is pollution-free, the quality of life will be better.

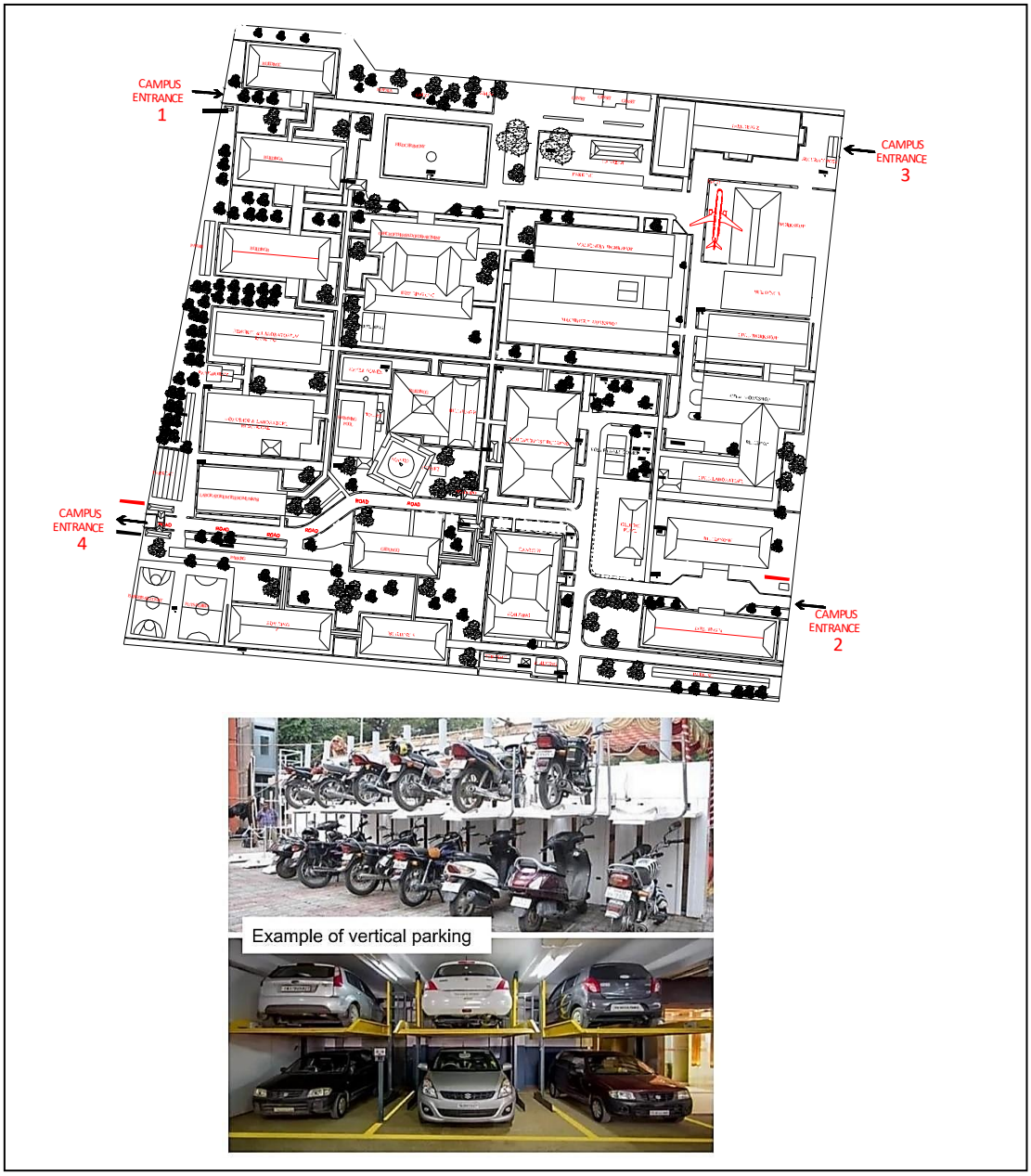


Figure 3 the Polmed campus parking area and Parking Placement Plan Multilevel/vertical parking

3.7 Initiative to reduce private vehicles on campus (TR 7).

The results of the survey conducted in the field have not had any initiative on. So TR value is 7 with a value of 0 points and is presented in table 8.

Table 8 TR 7

No	Categories and Indicators	Mark	Score	Weighting
5	Transportasi (TR)			18%
TR 7	**There is an initiative to reduce**	**200**		
	no initiative		0	
	1 initiative		0,25 x 200	
	2 initiative		0,50 x 200	
	3 initiative		0,75 x 200	
	> 3 initiative or initiative is no longer necessary		1,00 x 200	

Sumber : UI *GreenMetric Guidelines* 2023

From the results of his research at the University of West Attica, the first independent Solar Electric Vehicle Charging Station in Greece has been developed called "CARPORT" which is a wall-mounted charging station. Characteristics include a 5kWp charge controller and a Battery (12V) with a nominal capacity of 16.8 kWh [9].

The development categories is an effort to make Polmed a green campus. So the development directions in indicators for the number of private vehicle reduction initiatives on campus (TR 7) that researchers can provide are as follows:

Objective : Availability of sustainable transportation initiatives implemented by the Polmed campus as an effort to create a green campus, Reduced use of motorized vehicles that use fossil fuels in the Polmed campus area in the short term, Promote the use of public transportation, To reduce air pollution in the Polmed campus area.

Campus Development Directions: Implementation of tariffs (paid parking) for 4-wheeled and 2-wheeled vehicles that use fossil fuels parked on the Polmed campus, Provide free parking specifically for electric vehicles and provide recharging stations specifically for electric cars for free.

Benefits for campus: Increasing green open space in the Polmed campus area to support. If campus air is pollution-free, the quality of life will be better

3.8 Pedestrian path on campus (TR 8).

From surveys conducted in the field, the Polmed campus has provided pedestrian paths. The available pedestrian paths are in the form of walkways and sidewalks. The walkway covers an area of 2,125,040 m² with a road width of 2.1 m which can be accessed in both directions, then has a concrete roof covering with a height of 2.5 m so that pedestrian path users are protected from rain or the hot sun [16]. For sidewalks covering an area of 884,377 m² with a road width of 1.5 m, there is no roof covering available so that the entire available pedestrian path cannot be considered comfortable and safe. The width the sidewalk must be at least 150 cm, because the sidewalk must meet the total lane requirements for two pedestrians holding each other or two pedestrians passing each other without touching each other.

The pedestrian paths available on the Polmed campus do not meet the standards for pedestrian paths according to the based on UI GreenMetric 2023. According to the based on UI GreenMetric 2023, there are notes that must be paid attention to for pedestrian paths, namely:

For sufficient vehicle and pedestrian path, handrail. In the comfort of the area of light height difference and slope to walk next to the sidewalk, as a closed area, using soft materials such as rubber, wood, etc. Location information and directions are available, For people with disabilities, floors and guide blocks that have appropriate designs, for pedestrians with physical disabilities.

The pedestrian paths on the Polmed campus are interconnected between lecture buildings and other supporting buildings for lectures. Separated from four-wheeled and two-wheeled vehicle lanes so that it is safe for users, but does not yet meet the disabled facilities. Referring Regulation Public Works the general principles facility planning". The pedestrian paths available in the Polmed campus area have met the aspects of system integration, starting from environmental planning. Fulfilling continuity origin with the destination, and vice versa. The campus has not met the accessibility aspect, where the planned facilities can be accessed. So TR 8 is included in the available pedestrian paths with a value of 75 points shown in table 9. And the pedestrian path route is presented in figure 4.

Table 9 TR 8

No 5	Categories and Indicators Transportasi (TR)	Mark	Score	Weighting 18%
	Pedestrian lane campus	**300**		
TR 8	Not Available		0,00	
	Pedestrian lane are available		0,25 x 300	
	Pedestrian lane exist follow safety aspects		0,50 x 300	
	Pedestrian lane are designed for safety and comfort.		0,75 x 300	
	Pedestrian lane are available, designed for safety and comfort, and equipped with disability-friendly features.		1,00 x 300	

Sumber : UI *GreenMetric Guidelines* 2023

Figure 4 Pedestrian lane

On the Polmed campus there is a special pedestrian door available which is located at gate 4 at a distance of 474 m from the USU gate 4 bus stop, the development of transit areas or Transit Oriented Development (TOD) must pay attention to the provisions in point 3 and point 7, namely serving pedestrians to be able to reach the bus stop with a maximum distance with and connected to the place changing modes of transportation such as public transportation stops or shelters. So the pedestrian-only door does not meet the criteria of developing transit areas (TOD), because the distance from the bus stop to gate 4 of the Polmed campus exceeds the maximum distance. For campus residents who are picked up and picked up, this door is very convenient to use because it is separated by four-wheeled and two-wheeled lanes, but for campus residents who use public transportation or live in a boarding house near campus, it is closer if they enter through door 1 and door 3, Presented in figure 5.

Figure 5 Special door for pedestrians
Source: Google earth & personal documents

Development direction in category is one efforts to make Polmed a green campus. So the development directions for pedestrian path indicators on campus (TR 8) that researchers can provide are as follows:

Objective : Availability of safe pedestrian paths for safety, comfort and artistry, Availability of pedestrian paths that are friendly for people with disabilities.

Campus Development Directions: Redesign so that the pedestrian paths available on the Polmed campus pay attention to pedestrian paths in accordance with the criteria in the UI Green Metric guidelines 2023, namely: Security: equipment with sufficient light, separation between the road for vehicles and pedestrian paths, as well as several handrails, Comfort: height difference with a light slope for walking next to the sidewalk, as a closed area, using soft materials, namely rubber, wood, etc [10].

Redesign so that the pedestrian paths available on the Polmed campus can be accessed by people with disabilities. Pedestrian facilities with special needs such as: Take into account the movement space for crutches users, movement space for the blind, movement space for wheelchair users, the slope level does not exceed 8%, sloping paths must have handrails on at least one side, ramp areas must have sufficient lighting, Passing Place is available (a place to overtake/pass each other), Presented in Figure 6.

Figure 6. Direction plan for pedestrian paths
Source: https://eng.ui.ac.id/blog/politik-dukungane & Personal documents

Add additional entrances specifically for pedestrian users at gate 1 and gate 3, Presented in figure 7.

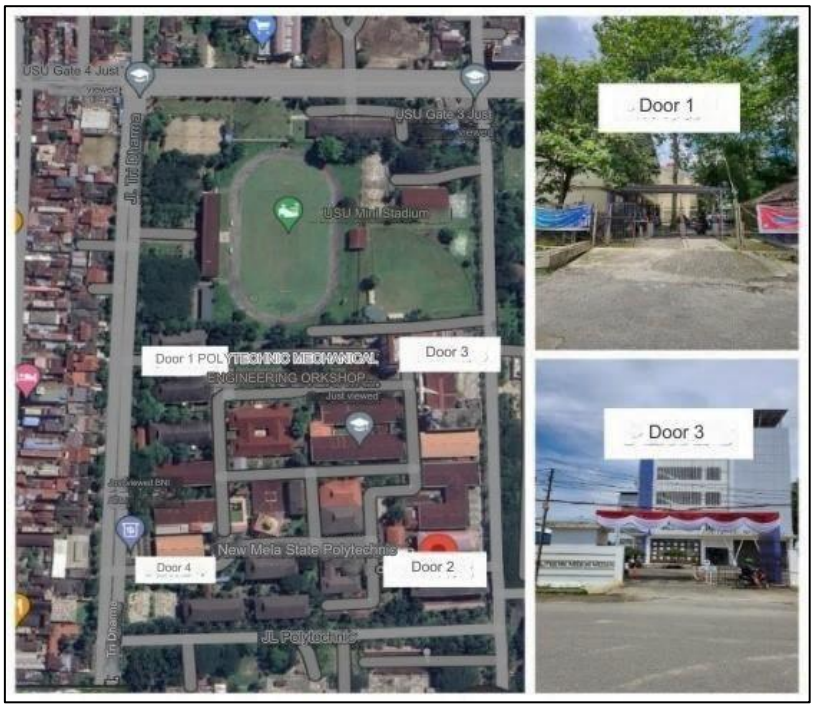


Figure 7 Directions for adding special doors for pedestrians
Source: Google earth & personal documents

Redesign the addition of roof coverings and increase the width of the sidewalks for pedestrian paths, Presented in figure 8 Directional plan for adding a roof covering and increasing the width of the sidewalk.

Figure 8 Directional plan for adding a roof covering and increasing the width of the sidewalk

Benefits for campus: There are pedestrian facilities that are friendly for people with disabilities, Adding aesthetic value to the Medan State Polytechnic campus, Encourage campus residents' interest in walking, If campus air is pollution-free, the quality of life will be better [15].

Recapitulation of the level of based on results of research in the Polmed campus area, for each indicator based on the UI GreenMatric Guideline 2023 in the transportation category, the assessment and weighting are determined as follows: as can be seen in Table 10 Assessment Results.

Table 10 Assessment Results

No	Code	Indicator	Score	Survey Value
1	TR 1	such as cars and motorbikes number of residents.	**200**	**0**
2	TR 2	Pick-up and delivery service.	**300**	**300**
3	TR 3	ZEV policy at universities.	**200**	**100**
4	TR 4	Number of ZEV divided by mountain population	**200**	**50**
5	TR 5	ratio of parking area	**200**	**50**
6	TR 6	The reduce the parking area 2020-2022	**200**	**150**
7	TR 7	There is an initiative to reduce	**200**	**0**
8	TR 8	Pedestrians lane.	**300**	**75**
			1.800	**725**

So the assessment results at the Polmed campus were based on the indicators contained in the UI GreenMetric Guidelines 2023 in the transportation category, obtaining a score of 725 out of 1,800 points or 40.28% of the total indicators. So it can be said that environmentally friendly transportation on the Polmed campus is still low because it is less than half of the total value, so it is hoped that the Polmed campus can take steps in realizing the creation of a green campus.

4. Conclusion

The results of the research that has been conducted can be concluded as follows::

The vehicle is still low, because from the results of research conducted, the Polmed campus received a score of 725 out of 1,800 points or 40.28% of the overall indicators

From surveys conducted in the field, the total average number of vehicles, whether four-wheeled, such as cars, buses, etc., or two-wheeled, namely motorbikes, entering the Polmed campus area is 6,801 vehicles, while the total campus population is 6,748 people. , there was a greater number of vehicles entering compared to the number of campus residents and that was because the Polmed campus was a place for laboratory testing services, so that many vehicles entered the Polmed campus area but were not students but users of the laboratory services.

Several indicators such as the emission-free vehicle policy have not been fulfilled and there has been no initiative so resulting value is low.

With the Director's Circular Letter No: B/6PL5/TU.00.03/2022 concerning Guidelines for Orderly Traffic, Entry and Exit Routes, and Vehicle Parking Systems in the Medan State Polytechnic Environment, the value for the program indicator for limiting or reducing parking area in campus over the 3 years (2020 to 2022) has resulted in reduction parking area of 10-30%.

5. Acknowledgements

The author would like to thank God and the author would also like to thank all parties involved in writing this, as well as those who helped in making this journal, thank you very much.

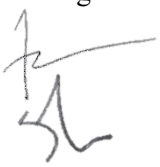
6. Conflict of Interest

Authors would like to express his give thanks to the presence to God Almighty, and the author would also like to thank all parties involved in writing this, as well as those who helped in making this journal, thank you very much.

Afdhal

The statement signed by the author shows an agreement that this information is true and accurate.

Author's name	Author's signature
Afdhal	
Bahrul	



References

[1] *UI Greenmetric Guidelines* 2023 HAL 3, https://greenmetric.ui.ac.id/
[2] Rencana Strategis Renstra Polmed, [2020 – 2024].
[3] C., Medika, Z., B., Mudjiyanto, "Tipe Penelitian Deskripsi Dalam Ilmu Komunikasi, 2018.
[4] Wahidmurni, "Pemaparan Metode Penelitian Kuantitatif," 2017, HAL. 16
[5] Ali, Muhson, "Teknik Analisis Kuantitatif", Hal. 3, 2006.
[6] Iyan Awaluddin, "Model Pengembangan Sistem Transportasi Ramah Lingkungan (Transportasi Hijau) Dalam Menunjang Mobilitas Civitas Akademik di Kampus UIN Alauddin Makasar, 2021.
[7] Rindu, T. B. et al, *"Evaluation of the Green Transportation Concept in the Sultan Ageng Tirtayasa Universitas Campus"*,2022.
[8] H., Mukaromah, "Strategi Menuju Kampus Berkelanjutan (Studi Kasus: Fakultas Teknik, Universitas Sebelas Maret)", 2020.
[9] P., Papantoniou, P., Kaldis, "*Good Transport Practices in University of West Attica*", 2020. Hal 329.
[10] Fauzi, M., Sopandi, D. B., Hartati, V.,"Perhitungan Reduksi Emisi Gas Buang Melalui Penentuan Rute Distribusi Beras di Kota Bandung", (2021).
[11] Winayati, Fadrizal, L., Virgo, T., H., "Analisi Kebutuhan Areal Parkir Gedung Fakultas Teknik Universitas Lancang Kuning", (2019).
[12] H., Mukaromah, "Strategi Menuju Kampus Berkelanjutan (Studi Kasus: Fakultas Teknik, Universitas Sebelas Maret)", (2020).
[13] Rachmaning, P., Erida P., " Analisis Transportasi Berkelanjutan di Universitas Negeri Semarang", (2021).
[14] Panji, A. R. Atik, P. Besperi," Kajian Kondisi Jalur Pejalan Kaki di Dalam Kawasan Kampus Universitas Bengkulu, (2020).
[15] Iyan Awaluddin, "Model Pengembangan Sistem Transportasi Ramah Lingkungan (Transportasi Hijau) Dalam Menunjang Mobilitas Civitas Akademik Di Kampus Uin Alauddin Makasar, (2021).
[16] Warpani, S., P., "Pengelolaan Lalu Lintas Dan Angkutan Jalan", Bandung : ITB Bandung, (2002).