Journal of Advances and Scholarly Researches in Allied Education
Vol. 19, Issue No. 6, December-2022, ISSN 2230-7540

Measuring Walkability – Analysis of Institutional Campuses

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Abstract - Walking is a significant mode of commuting on institutional campuses. The designed network of roads, footpaths, and open spaces promotes a walkable environment. This research analyzes an institutional campus layout in multiple ways – 1) Studying the plan and predicting the pedestrian and vehicular circulation pattern. 2) Observing and recording current pedestrian and vehicular circulation patterns 3) Conducting surveys and interviews of the users to understand the issues and design considerations of the campus walkability.

The research highlights the relationship between spatial configuration and walkability and how the spatial configuration can be modified to achieve a better walkable environment for the user. The study attempts to understand the characteristics of the built environment that encourage a walkable climate by analyzing users' perceptions.

The research adopts qualitative and quantitative methods to analyze walkable environments on educational campuses. Parameters for measuring walkability were listed, and a questionnaire survey was prepared to measure user perception. The research attempts to understand the walkability measures and the effect of spatial configuration on human behavior.

Keywords - walkability parameters, educational campuses, recreational spaces, footpaths, spatial configuration.

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INTRODUCTION

Walkability is a measure of commuting in a space on foot in a comfortable manner. Walkability indicates how satisfactorily the transportation system meets the needs of pedestrians. It measures how user-friendly is the environment (Clark & Yiannakoulias, 2013).

Walkability facilitates commuting, promotes physical fitness, and allows access to the entire campus on foot. Footpaths, vegetation, seating areas, and streetlights enhance the architectural quality of the space. The streets connect the recreational areas with the built structures that connect the campus. Footpaths, vegetation, seating areas, recreational areas, and facilities along streets are all factors that influence walkability. The user movement in such spaces will help improve the road networks' spatial configuration and recreational spaces. Understanding how the user perceives the built environment gives insights into the zoning of areas in a campus layout. This also helps in reorganizing vehicular and pedestrian access points in a layout.

MATERIALS AND METHODS

The case method used three diverse cases of educational campuses. The Following protocols were studied for each campus, and the observations were recorded in a tabular format and photographs.

Case study protocol -

1. A study of the location, number of entry, and exit points for pedestrian access were carried out.

2. The study of the following features of the footpaths was carried out - Material of the footpath, Width of the footpath, Height of the footpath from the road/street, quality/defects in the footpath, and Length of the walkway to the built spaces.

The overall imageability of the footpath was studied, and the movement pattern was analyzed.

A network of footpaths on the campus was drawn, and layers of vegetation, light poles, seating spaces, garbage bins, and parking were added.

Conducting a survey –

Conducting a questionnaire survey for the campus users gave a better insight into how the spaces are being used and what path they follow to reach the required destination. The questionnaire gave an idea about the most common route to enter and exit the campus, the most used recreational space, characteristics of the footpaths, and user movement.

OBJECTIVE OF THE STUDY

1. To find spatial characteristics which determine the walkability of educational spaces
2. To study the effect of spatial layout on the user to improve the walkable environment.
3. To determine the spatial performance of walkability in the institutional campus.

The question raised thus was whether spatial configuration affects the ease of walkability for the users and how. What are the walkability measures to look at for walkability in institutional campuses?

The research focuses on educational spaces to measure walkability. The study focuses on institutional campuses catering to higher secondary education and above, as the user group in focus has no restrictions on commuting on foot. The user group under the age of 16 does not commute to its maximum potential on the campus. Hence age group above 16 years was considered in this research. The results obtained from the study may differ due to the time constraint. Permission to access the selected campuses for surveys and observations can be a hurdle in concluding. The number of students attending the campus post-pandemic will affect the observations recorded.

LITERATURE REVIEW

The relationship between spatial configuration and pedestrian movement is critical in improving spatial quality. The structure's spatial layout provides several hints about the predominant user movement. The spatial arrangementsignificantly impacts how we move through spaces and what and whom we meet along the way. Existing trees and other vegetation aid the users' walking behavior. It is also worth noting that pedestrian density varies between weekdays and weekends. The previous studies concluded that people are more willing to walk for smaller blocks, pedestrian-friendly, shorter walking journeys on safer sidewalks. High-density recreation areas are identified at specific pause points. It is essential to consider safety and space coherence where space navigation from to destination varies from one to another(Vongpraseuth & Thanousorn, 2018).

The campus is divided into sections based on the density of pedestrian access observed over time. There are circulation zones that have been created to provide a clear idea of the most popular routes to travel on campus. Canteens, ample seating areas, cultural halls, and libraries impact the walkability measures observed on campus (Heitor, Nascimento, Tomé, & Medeiros, 2013). One method to analyze space's walkability is using Space Syntax tools. Space Syntax is a theory that is a tool of architecture and the built environment that seeks to explain how spatial configurations affect people's behavioral patterns. Space syntax is a collection of theories and techniques for analyzing spatial structures. Axial space, a straight sightline, and a possible path are all concepts popularized by Bill Hillier at UCL. Convex space (popularized by John Peponis and his Georgia Tech collaborators) is an occupiable void in which no line connecting two points goes outside its perimeter: all matters within the polygon are visible to all other points within the polygon(Bill Hillier, 1970 - 1980).

RESULTS

Case study 1	
Parameters	Observations
Entry and exit	Vehicles and pedestrians use the same entrance to enter the campus. There are four entry and exit points to the campus,of which two have a bifurcation of entrance by the size of the opening in the gate. (fig.1.1)
Footpath characteristics	The footpaths are at the same level as the roads within the campus. The width of the footpaths is 1.5 m. It is observed that footpaths are discontinuous. (fig.1.2a 1.2b)
Open spaces	The open space network is spread over the campus, mostly shaded partially by vegetation. Open spaces such as playgroundsand seating spaces are users' most used spaces. (fig.1.3a,1.3b)
Canopy over the footpaths	Streets and footpaths are partially shaded by vegetation.Itis also observed that some of the footpaths and seating spaces need to be more sparsely shaded by vegetation. (fig.1.4a,1.4b)
Street Elements	Street elements such as benches, Light poles,Garbage bins, and signage boards are present. (fig.1.5a,1.5b,1.5c)
Most used route	The most used routes are the ones which lead to the canteen,Basketball court, and seating spaces.
Conclusion	According to the observations, the routes to the canteen and open spaces have the most footfall throughout the day, which causes overcrowding. This affects the walkability of the streets. The need for sufficient seating spaces near the canteen affects the efficiency of commuting on foot by those routes.

Figure 1.3a

Figure 2.2b

Figure 3.5a

Figure 4.5b

Figure 5.5c

Figure 6.3b

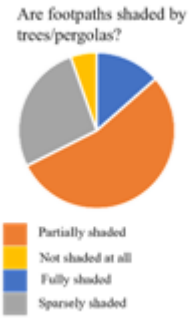
Figure 7.4b

Figure 8.1

Figure 9.4a

Figure 10.2a

SITE PLAN – CAMPUS B



Case study 2	
Parameters	Observations
Entry and exit	There are five entry/exit points to the campus, which let vehicles and pedestrians commute into the campus premises. (Fig 2.1)
Footpath characteristics	Footpaths have variable widths and are discontinuous.Most of the pedestrian routes are observed to be primarily occupied by parked vehicles. (Fig 2.1)
Open spaces	The open space network is spread over the campus with various routes reaching the desired destination. (Fig 2.1)
Canopy over the footpaths	Footpaths are sparsely shaded by vegetation. (Fig 2.1)
Street Elements	Benches and garbage bins are insufficient for the campus's footfall. However, light poles and signage boards are present on the campus. (Fig 2.1)
Most used route	The most used routes are those which lead to the canteen,library, and open space(pavilion). (Fig 2.1)
Conclusion	Sparsely shaded pedestrian streets affect the walkability of the campus. The parked vehicles on the streets affect the efficiency of commutes on foot and create overcrowding. The open spaces are not used to their maximum potential, as vegetative shading is insufficient. (Fig 2.1)

Figure 2.4b

Figure 2.5a

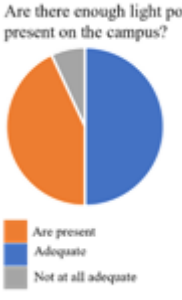


Figure 2.5b

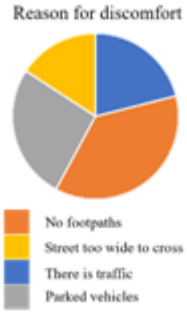
Figure 2.1

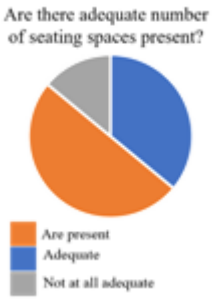
Figure 2.2a

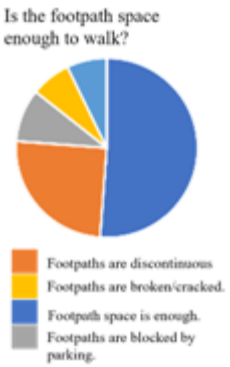
Figure 2.2b

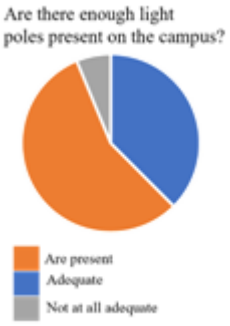
Findings from research questionnaire -

The below bar graphs show the collective data about the most used spaces on the campus.

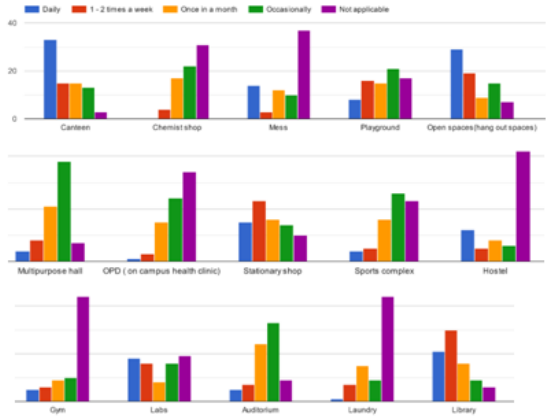








What kind of areas do you visit every day?

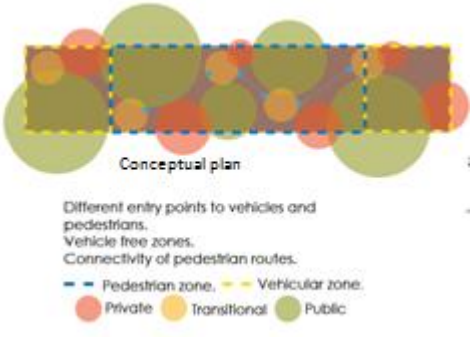


Recommendations to consider while designing a walkable campus –

Campus 1 – Planting shade-giving trees along the seating spaces and pedestrian routes. Identifying high pedestrian use loops and further designing them according to their function. Such as, a road leading to the canteen area can have seating spaces incorporated into the footpath design to minimize overcrowding acting as a spillover space for the canteen. Identifying the most frequently used routes and incorporating design strategies to maximize the walkability of a campus.

Campus 2 – Segregation of pedestrian and vehicular routes aids the walkability of the spaces and avoids overcrowding and traffic. Dedicated parking spaces that do not overlap with pedestrian routes will assist campus walkability. Partially shaded seating spaces/footpaths aid in the walkability of campus.A good lighting network

Shaded seating spaces.



Bifurcation of pedestrian and vehicular access.

along the pedestrian routes will helpthe campus's walkability.

CONCLUSION

This research gathers more specific information from user groups and the environment in an institutional campus context, where pedestrians are predominantly students, professors, and staff. Spaces such as the canteen/mess, hostel facilities, sports facilities, library, and medical shop are the most used spaces daily; hence walkability to these spaces should be enhanced. The routes leading to spaces with the most footfall should be designed considering the walkability parameters for an institutional campus. The case studies infer that the footpath width should be constant along with a designed footpath network throughout the institutional campus.One of the research findings suggests thatmore commuters use a well-shaded footpath.A well-shaded footpath or pedestrian route avoids the harsh sunlight and ensures safety while commuting on foot; hence, vegetative or designed shading devices are essential to consider while assessing walkability. Vegetative shading, pergolas, and overhangs are some elements that enhance the walkability of the spaces. The case studies infer that vehicular traffic, unplanned parking spaces, absence of signages, and inadequate seating spaces lead to an unsatisfactory commuting experience on campus. Restricting vehicular access at specific areas on a campus aids campus walkability and avoids overcrowding and traffic while commuting. Bifurcating the campus footprint into vehicular access and pedestrian access areas will enhance the institutional campus's walkable environment. The study infers that adequate street furniture acts as a pause point as well as aids the visual quality of the footpaths. Spaces such as pavilions, benches, and drinking water facility aid in the walkability of the

campus.The findings of this study will assist campus planners and designers in making an institutional campus more walkable, allowing individuals to enjoy walking on campus.

ACKNOWLEDGEMENTS

I, Vaidehi Deshpande, express my sincere gratitude to all the people who helped me complete my study.\

I also want to thank my peers for supporting me in my brainstorming sessions which helped me do my research activities.

I would also like to thank my mentor Prof. Vaishali Anagal, for guiding me throughout my research and supporting and encouraging me with her valuable knowledge and suggestions.

I want to thank Dr. B N College Architecture for accommodating my research and helping me.

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