R4TLI
ISSN: 2513-2504

A NOVEL FRAMEWORK TO ANALYZE THE WALKABILITY OF CITY CENTERS

Supuni Nissanka[1], Amila Jayasinghe[2]
Department of Town & Country Planning, University of Moratuwa, Sri Lanka.
[1]nissankasm1997@gmail.com,[2]amilabj@uom.lk

ABSTRACT - Many studies utilized the 'Walkability Index' to measure the level of the walkability of cities predominately based on street conditions and road infrastructure availability while giving limited attention to factors such as urban morphological conditions and proximity to activities and services. Accordingly, this study develops a framework to measure walkability in the city centers' by accessing the multidimensional aspects including walking conditions on streets, density, functional mix, accessibility, and proximity to services. The proposed framework was tested in 10 small and medium towns in Sri Lanka and quantified the level of their walkability. The city of Panadura becomes 1st in rank and Kaluthara, Gampaha, Moratuwa, Horana, Piliyandala, Homagama, Negombo, Bandaragama and Mathugama become 2nd, 3rd, 4th, 5th, 6th,7th,8th, 9th and 10th respectively according to this analysis. The study concludes that the proposed framework could be beneficial for transport planners, transport Engineers, and urban planners as they can effectively quantify the level of walkability in town centers.

Keywords: Walkability; Transport Planning; Urban Planning; Land Use; Proximity

1. INTRODUCTION

The walkable city concept has become a popular academic and professional discourse with regards to the future of cities. Walkability has always been correlated with human health and well-being, and urban design and planning greatly consider the walking behavior of people in cities [1]. Based on the literature review, the study revealed that there are mainly three groups of criteria utilized for measuring walkability in recent studies. Those are walking conditions on streets based on the 'Walkability Index' [2] urban morphological conditions [3], and spatial proximity for activities and services [4]. Most walkability studies are mainly focused on only a single dimension thus there are limited number of studies that are focused on multidimensional aspects [5]. Therefore, this study aims to significantly address the following two important research gaps found in recently published research. First, there is still no standard framework to measure walkability considering multidimensional aspects including street conditions, density, functional mix, accessibility, and proximity to services. Secondly, no or very limited research has been done to assess the level of walkability in city centers in small and medium towns in Sri Lanka by considering the urban morphological conditions. Thus, it is important to assess and rank the degree of walkability in Sri Lanka's small and medium towns, taking into account a variety of factors such as street conditions, density, functional mix, accessibility, and proximity to services.

2. MATERIALS AND METHODS

This study consists of four stages. The first stage of the study, authors surveyed the literature on methods that are utilized to measure the level of walkability and which variables are affecting walkability. In the second stage, a quantitative framework was developed to measure walkability in the city center accessing the multidimensional aspects including walking conditions on streets, density, functional mix, accessibility, and proximity to services. In the third stage, walking conditions on streets, urban morphological conditions, and proximity of services were mapped and calculated for 10 case study of towns. Furthermore, the study analyzed the walkability of each town by comparing each criterion. And based on the z-score cumulative value of each criterion, this study developed a walkability index. Furthermore, measure the actual walkability level of case study of towns and ranked them. Finally, the study compares and contrasts the findings of the study with reference to the current literature.

Figure 1. Selected attributes under each criteria

2.1. Proposed Framework

The proposed conceptual framework can be interpreted in Figure 2.

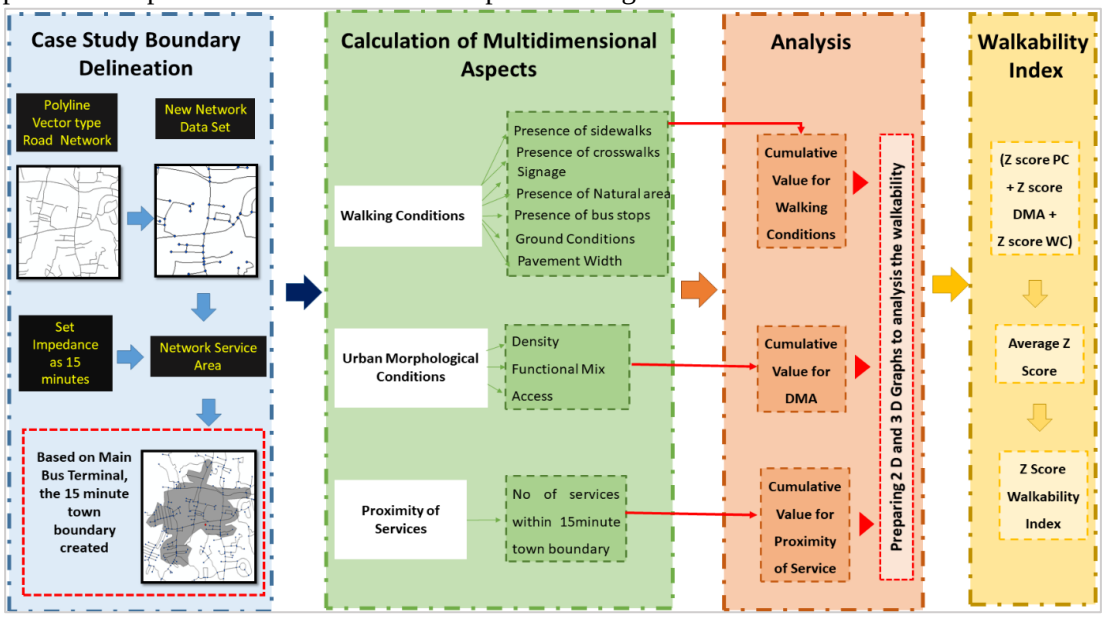

Figure 2. Proposed Framework

First, 15-minute town boundaries for 10 case study towns were delineated. The "Network Service Area" analysis was done to determine the 15-minute walkable distance / area based on the main bus terminal of the case study town. Second, multidimensional aspects were calculated based on attributes of walking conditions on streets, urban morphological conditions (DMA- density, functional mix, accessibility), and proximity to services. Finally, based on z scores of the proximity of services, walking conditions on streets, and DMA; the z score walkability index was calculated for selected towns and ranked them.

$$\textbf{Walkability Index} = [(z - WC) + (z - DMA) + (z - PC)]$$

Z = the z score for each criterion
WC = Cumulative Z score for Walking Conditions
DMA = Cumulative Z score for DMA
PC = Cumulative Z score for Proximity of Services

3. RESULTS AND DISCUSSION

According to the z score Walkability Index, Panadura has obtained the highest value which implies the highest walkable town among the other case study towns. And Mathugama has obtained the lowest value which

implies the lowest walkable town among other case study towns. The z score Walkability Index for each town helps in understanding which among the towns has the highest and lowest Walkability Index by accessing the multidimensional aspects including street conditions, density, functional mix, accessibility, and proximity to services.

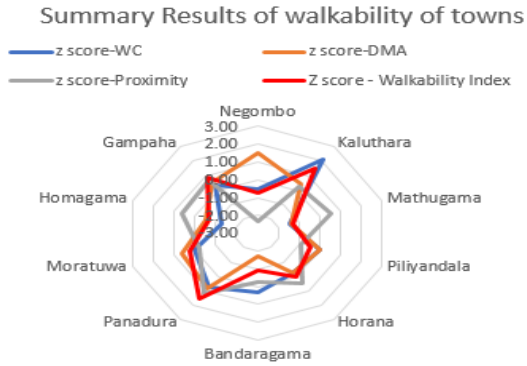

Figure 3. Summary Results of Walkability Index

Table 5.Walkability Index calculation

Town	z score-WC	z score-DMA	z score-Proximity	Avg z score	z score - Walkability Index	Walkability Rank of town
Negombo	-0.53	1.48	-2.31	-0.45	-0.751	8
Kaluthara	2.09	0.41	0.24	0.91	1.512	2
Mathugama	-1.41	-1.39	0.52	-0.76	-1.257	10
Piliyandala	0.03	-0.02	-0.88	-0.29	-0.485	6
Horana	-0.26	-0.24	0.50	0.00	-0.004	5
Bandaragama	0.33	-1.71	-0.27	-0.55	-0.912	9
Panadura	0.71	0.87	1.16	0.91	1.515	1
Moratuwa	0.00	0.65	-0.24	0.14	0.230	4
Homagama	-1.26	-0.56	0.59	-0.41	-0.680	7
Gampaha	0.31	0.49	0.70	0.50	0.832	3

4. CONCLUSION

This study has developed a framework to assess the walkability in city centers with a multidimensional aspect including walking conditions on streets, density, functional mix, accessibility, and proximity to services. Accordingly, a walkability index was developed based on the z scores of walking conditions, DMA, and proximity of services. Based on the variation of these factors, the proposed framework can be said to be effective. Finally, the study concludes that the proposed framework could be beneficial for transport planners and urban planners as they can effectively quantify the level of walkability in town centers.

REFERENCES

1. Saadawy, N. A., & Hady, S. I. A. (2022). Gated Community Walkability Design Efficiency Model. *Civil Engineering and Architecture*, 10(5A), 189–213. https://doi.org/10.13189/cea.2022.101410
2. Krambeck, H. V. (2006). The global walkability index (Thesis, Massachusetts Institute of Technology). Massachusetts Institute of Technology. Retrieved from https://dspace.mit.edu/handle/1721.1/34409
3. Dovey, K., & Pafka, E. (2020). What is walkability? The urban DMA. *Urban Studies*, 57(1), 93–108.
4. Noworól, A., Kopyciński, P., Hałat, P., Salamon, J., & Hołuj, A. (2022). The 15-Minute City—The Geographical Proximity of Services in Krakow. *Sustainability*, 14(12), 7103.
5. Erturan, A., & Aksel, B. (2022). Multidimensional analyses of walkability in city centers by using mobile methodologies: Beşiktaş and Delft experiences. *URBAN DESIGN International*. https://doi.org/10.1057/s41289-022-00209-6