

Towards Safe Streets: The relationships between Physical Attributes of Streets and Perceptions of Pedestrian Safety in Kandy, Sri Lanka

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Abstract

Each year, over 1,000 pedestrians on Sri Lankan streets and more than 270,000 on world's streets lose their lives and some are left with permanent disabilities. Compared to other road traffic fatalities and injuries, pedestrian accidents are seen as significantly high. Therefore, the pedestrian safety is a major issue on streets, and it has to be addressed in a serious manner. Safety being a basic need of every human being, it is essential that the built environment facilitates the safety needs. In here, Architecture and Urban Design would play a vital role in ensuring both physical as well as psychological safety of users. Cities, being the containers of large populations, naturally involve with the gathering of large numbers of people on streets, hence it is crucial to guarantee the safety of the pedestrians in cities.

This paper explores the links between perception of safety and physical attributes of pedestrian spaces. It identifies the legitimate physical attribute combinations that help to ensure the safety within pedestrian space with the aim of mitigating and preventing the pedestrian accidents. This reviews the significant theories related to the field of architecture and urban design and the key attributes such as built form, planning and layout, ambience and functions used to facilitate the safety. The study engages with examining of variables of perceived safety and physical attributes of pedestrian areas, by appropriately using qualitative and quantitative research methods and, studying the city of Kandy as a case.

The study concludes that the perception of safety of a pedestrian depends not merely on the physical aspects of pedestrian space, but also on the positive combinations of physical and psychological attributes.

Keywords: Perception of safety, Pedestrian space, Physical attributes, City of Kandy, Sri Lanka

Introduction

As a world-wide trend, cities are being developed in order to facilitate the people who live, work and entertain in the city premises. In cities, the pedestrians are one most important and key component through which the city image and its character is generated based on the type of activities that the people engaged with, and the places where they hang around.

In addition, the place where pedestrian activities happen can be identified and simply defined as 'pedestrian space'. Accordingly, pedestrians are the most vital component of an active city where agglomeration of diverse and dynamic activities take place while serving extensive users and being the engine of the city's activeness. The key forms of pedestrian space where people walk, sit, shop, play or interact are identified as sidewalks, alleys, lanes.

Unfortunately, the pedestrians are rarely the subject of careful planning and design of streets and usually it regulates itself or is an effect of building an extensive system of road network.

In Sri Lanka, most populated cities like Colombo, Kandy and Galle and core areas of other towns are formed mostly with busy commercial and transportation oriented activities. That is because, aforementioned cities and majority of the towns have been planned and arranged where all the needy activities are met and concentrated into one central point rather decentralizing. Accordingly, each space in the city has a particular hierarchical value as well as magnitude of usage. Compared to American or European contexts, most Asian and Sri Lankan cities have less attention and concern on the pedestrian spaces causing unsafe, unsecured and uncomfortable conditions. As streets cover massive part of any city, sidewalks as the pedestrian space are considered to be well designed and constructed according to appropriate standard/s and maintenance mechanisms. Condition of the pedestrian space consists of many physical attributes that impact directly and indirectly on safety of pedestrians.

In known terms, safety means the feeling of secure, being without physical and psychological harm. "Feeling safe is to feel protected. It is a feeling of well-being which can envelop a family, a community, a neighborhood and a city. Its composition is hard to decipher, but it is an all-encompassing feeling of calm which is often as invisible as clean unpolluted air and, inversely, when fear and anxiety take its place, that feeling is as palpable as though it was a physical reality." (Patel, 1998)

Lack of safety on streets can be casual due to the absence of physical protection such as physical harassments, threats from automobile accidents, injuries by uneven sidewalks, edges etc. as well as absence of mental protection such as unpleasantness, suspicion or distrust to walk through. "Feeling safe is crucial if we hope to have people embrace the city space. In general life and people themselves make the city more inviting and safe in terms of both experienced and perceived security" (Gehl, 2010)

Accordingly, this paper focuses on the physical attributes of streets which impact on the perception of safety while establishing a research position, highlighting the research gap in combinations of independent physical attributes to ensure the safety within pedestrian spaces. Along with that, this paper aims to;

- (a) Investigate the physical factors of streets that people prefer as safe focusing on its built form, planning, ambience and the functions which disclose the most **legitimate attribute combinations** in creating safer pedestrian spaces to overcome with the solutions for negative physical attributes for a better city life,
- (b) Identify the potentials and design strategies to improve perception of safety within the streets to rebuild the strong discussion between user and space,
- (c) Reveals the relationship between perception of safety and physical attributes of pedestrian spaces,
- (d) Studying a case where the sense of unsafe is present and understand about creating safer pedestrian spaces in urban design to gain its maximum utilization as well as a crime friendly situation reducing the crime chain.

Literature Review

Respectively, in the attempt of orienting cities as pedestrian friendly cities rather than automobile oriented cities, it's important to verify and validate the contribution of physical attributes of pedestrian spaces towards perception of safety.

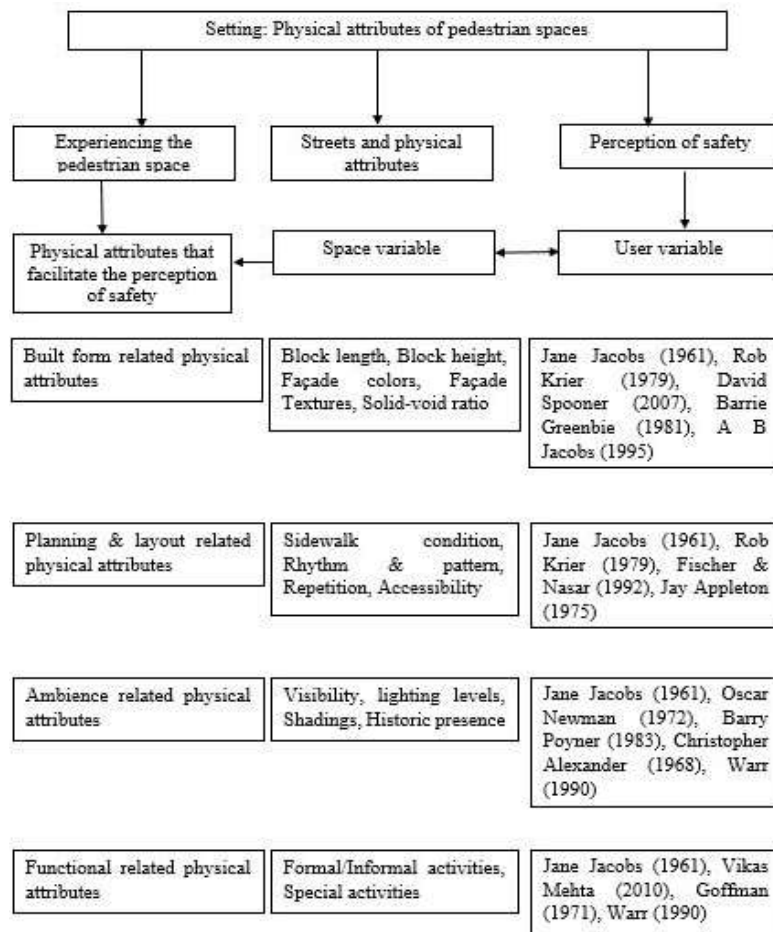


Fig. 1: Theoretical Backbone of the study

Source: Author

- As above, the theoretical framework which is developed through the literature review is used to study the pedestrian space and safety, and fifteen physical attributes are selected under four key categories namely; built form, planning & layout, ambience and functions.
- Some attributes like Block height, façade colors, façade textures, solid-void ratio, rhythm & pattern, repetition and historic presence are not addressed towards the perceived safety by some theoreticians. Some scholars discuss these attributes in city planning theories. However, the research studies on the contribution of these physical attributes towards the perception of safety are somewhat scarce.

Methodology

I. Site selection criteria- Kandy

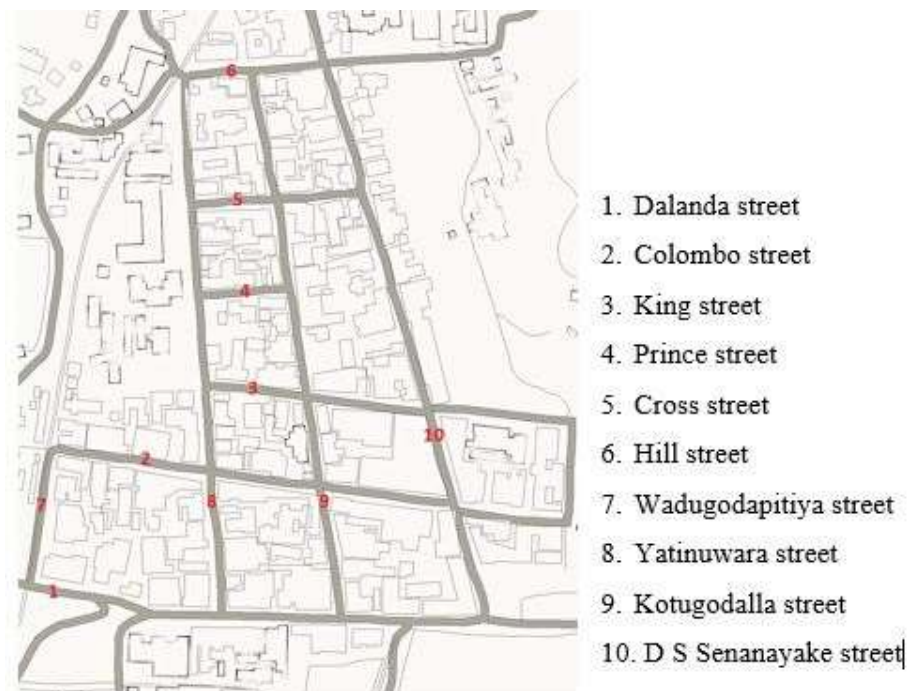


Fig. 2: Kandy Grid City

Source: Author

Kandy is an ancient heritage city which considers as the second major city of Sri Lanka. Many people visit the city due to its Archeological/heritage value, significant climatic conditions and the consistency of sacred places and activities. Also, Kandy city is consisted with multi – religious and ethnic backgrounds and vast cultural diversity.

Asserting the suitability of Kandy city as a case to this research, there are ten streets within the city itself which are commercial oriented and have diverse pedestrian flow and density, complex vehicle movement patterns, identical building/façade and space character, inherent commerce based functions and significant religious as well as cultural composition under key planning and building regulations.

II. Flow of the Study

Stage 1 – As the key objective, the legitimate combinations of physical attributes that facilitate the perception of safety will be understood. In the first stage, people have been asked to indicate their opinion on the safety (as safe, as unsafe, neutral) in selected ten streets.

Randomly selected participants (six from each street) of above the age of fifteen from the case location were given questionnaires. One sample from each street is a tourist to avoid familiarity and to obtain more qualitative data.

Stage 2 - In the stage two, shop owner from each street is interviewed to verify and validate previously collected data. Purpose of these questionnaires and semi – structured interviews are to reveal the safety levels of each street to conduct a comparative study. All the streets were studied to review both positive and negative physical attributes using participants and personal observations, photographic survey, counting survey and interviews to pedestrians, permanent shop owners and temporary business people.

While conducting the research, following limitations is taken in to consideration.

- a) Perception of safety is a feeling that depend on many aspects like age, gender, race, culture etc. (Mehta, 2013) Besides the user experience in perception of safety has a diversity from a person to another (Tuan, 1977) . But this study is limited to the physical attributes of pedestrian space as the dependent factor of perception of safety.
- b) The questionnaires are limited to the different segments of commercial oriented streets in Kandy grid city.
- c) People believe that the streets which are close to the sacred area as safe spots.
- d) Any of ten streets were not arranged according to the present street design guidelines due to an ancient city, therefore comparative study has to be carried out.
- e) Samples were picked to cover the all segments of streets but tourists were considered only the immediate atmosphere of the particular streets when answering the questions.

Analysis

1. Following summery charts were used per each street to present the data extracted from pedestrians.

Sample No.	User Response			Sample No.	User Response			Sample No.	User Response		
	Safe	Neutral	Unsafe		Safe	Neutral	Unsafe		Safe	Neutral	Unsafe
Sample 1	Safe			Sample 1	Safe			Sample 1	Safe		
Sample 2			Unsafe	Sample 2			Unsafe	Sample 2			Unsafe
Sample 3		Neutral		Sample 3		Neutral		Sample 3		Neutral	
Sample 4			Unsafe	Sample 4			Unsafe	Sample 4			Unsafe
Sample 5			Unsafe	Sample 5			Unsafe	Sample 5			Unsafe
Visitor/Tourist			Unsafe	Visitor/Tourist			Unsafe	Visitor/Tourist			Unsafe
Overall opinion			Unsafe	Overall opinion			Unsafe	Overall opinion			Unsafe

Colombo Street

Cross Street

Dalada Veediya

Fig. 3: User response in three case streets

Source: Author

2. Analyzed responses of selected users for the questionnaires and semi-structured interviews as follow,
 - i. Dalanda Street is perceived by many visitors and shop owners as **safest** street which is taken into the study as a pedestrian space with **positive** physical attributes.
 - ii. Colombo Street and Prince Street are perceived by many samples and shop owners as **unsafe** street which has negative physical attributes.
 - iii. Kotugodalla Street is accepted by pedestrians as safe but deviate with the ideas of shop owners and the **2015 police crime map** shows many burglary and theft cases along this street.
- iv. Wadugodapitiya Street is perceived as unsafe by the pedestrians but shop owners admit it as safe because the police station is pretty close to the street. There were no crime incidents happened within this street.
- v. User responses on Yatinuwara Street, D S Senanayake Street, Hill Street, Cross Street and King Streets are relatively dull. Yet these streets can be considered as safe streets according to answers of pedestrians.

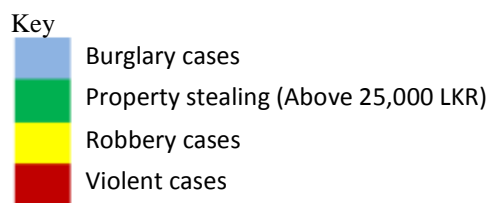


Fig. 4: Crime map of Kandy grid city -2015
 Source: Crime division, Kandy police station

3. Space Data Analysis Results

- I. Space data were analyzed using colored maps which are highlighting the unsafe spots and zones and further analysis were done using the photographs taken.
- II. Summary data of overall physical attributes of pedestrian spaces which extracted by walking observations and photographic surveys
- III. High color tones represent the positive attributes and low color tones represent the negative physical attributes in final summery chart.



Fig. 5: Space data findings of each street
Source: Author

(Rational – If a street contains more than 50% of blocks exceeding the 20m length, it considers as a street with long block lengths.

If a street contains more than 50% of blocks exceeding two stories or higher, it considers as a street with tall blocks.

Solid-void ratios – if 1:1(approximately), consider as more void

If > 1:1 consider as more solid

Physical Attributes	Positive	Comments & Colour Codes		Negative
Block Length	Short		Long	
Block height	Tall		Short	
Façade Colours	Contrast		Dull	
Façade Textures	Textured		Plain	
Solid - Void Ratio	More Void		More Solid	
Sidewalk Condition	Safe		Unsafe	
Accessibility	High		Low	
Rhythm & Paitern	Yes		No	
Repetition	Yes		No	
Natural & Artificial Lighting	Sufficient		Insufficient	
Shadings	Sufficient		Insufficient	
Visibility / Surveillance	High		Low	
Historic presence	More than 25%		Less than 25%	
Formal / Informal Activities	Mix primary use		Only commercial	
Special Functions	Yes		No	

Fig. 6: Key for the color codes of Summary chart of the Analysis
Source: Author

Key Physical Attribute	Data Variable		Overall Comment for Places									
	No.	Design Feature	Dalada Veediya	Colombo Street	Kings Street	Kumara Veediya	Cross Street	Hill Street	Wadugodapitiya Veediya	Yatinuwara Veediya	Kotugodella Veediya	D.S. Senanayake Veediya
01 Built form Related Physical Attributes	1	Block Length										
	2	Block height										
	3	Façade Colours										
	4	Façade Textures										
	5	Solid - Void Ratio										
02 Planning & Layout related Physical Attributes	6	Sidewalk Condition										
	7	Accessibility										
	8	Rhythm & Pattern										
	9	Repetition										
03 Ambience Related Physical Attributes	10	Natural & Artificial Lighting										
	11	Shadings										
	12	Visibility / Surveillance										
	13	Historic presence										
04 Functional Related Physical Attributes	14	Formal / Informal Activities										
	15	Special Functions										

Fig. 7: Summery chart of physical attributes of each street
Source: Author

Discussion

In order to conclude the findings of the research conducted, the main objective is to investigate the relationship between perception of safety and physical attributes of pedestrian spaces and identify the legitimate physical attribute combinations to ensure the safety within pedestrian spaces. Accordingly, the two main variables have been tested against perceived safety and physical attributes of pedestrian spaces with reference to the Kandy city.

Respectively, fifteen attributes are identified and analyzed within the research area, which categorized under four key physical attributes considering built form, planning and layout, ambience and functions.

Analyzed space data is indicated in a summery chart to come up with an evidence based conclusion on the physical attributes that facilitates the perception of safety. Following conclusion has been made by observing the summery chart.

- Perception of safety of a pedestrian is not just depending on the physical safety of the pedestrian space or the sidewalk. It is affected by other physical attributes as well. That is because the pedestrians have perceived some streets as safe even its sidewalk condition is not good enough or well-maintained and uncomfortable which reflects unsafety.
- At least there should be positive physical attributes from all four key categories which are built form, planning and layout, ambience and functions. Because the streets which are perceived as unsafe by pedestrians missing physical attributes from one or few categories.
- At least there should be a combination of any ten positive physical attributes as representing key categories to ensure the perception of safety. That is because the positive application of built form related attributes basically provide **attraction**, planning and layout related attributes provide **comfort** and both ambience and functional related physical attributes provide **confidence** which are essential factors in ensuring the safety. Therefore, representing key attributes is a must.
- Hence a historic city has been selected as case of this research, it can be clearly identified that the historic presence is vital to ensure the safety which causes to generate (a) rhythm (b) pattern and (c) repetition. Besides contrast/vibrant colors and textures of facades are totally effective in ensuring the perception of safety in pedestrian spaces. That is why, almost all perceived safe streets are positive application of façade colors, textures, rhythm, pattern and repetition with a high historic building percentage.
- Besides positive application of solid-void ratio and diversity of functions are essential in facilitating the safety.

- Some streets are accepted by pedestrians as safe but not the shop owners. The reason is, these streets contain essential positive physical attributes to accept it as safe by pedestrians. But lack of lighting and visibility make it victimize to the thefts and burglaries. Besides long block lengths and improper building setbacks create many unsafe spaces along those streets. According to the previous crime experience, shop owners do not accept the street as safe. (Maruthaveeran & van den Bosch, 2014) It elaborates that the previous crime experience (direct or indirect victimization) and prior information about crime, impact on perceived safety.
- Some of the streets do not contain essential positive physical attributes. Therefore, pedestrians perceived that particular street as not safe. But, the mix of uses and activities/spaces which are located close to police station, sense the street safe and protected from crimes resulting shop owners perceived it as safe.

Considering the above findings, it is clear that there is a direct and strong relationship between perception of safety and the physical attributes of pedestrian spaces. Also, there should be minimum fulfilments of set of positive attributes in order to ensure the safety within pedestrian spaces. These attributes have been differed with the city character, its history, culture and magnitude of functionality. But, at least, there should be a combination of some particular positive attributes to facilitate the perception of safety in a highly functional and historic city such as Kandy.

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