

# PHYSICAL ATTRIBUTES OF PEDESTRIAN SPACE THAT FACILITATE THE PERCEPTION OF SAFETY: WITH SPECIAL REFERENCE TO KANDY GRID CITY

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## **Abstract**

*This paper explores a link between pedestrian space based safety facilitating strategies formulated for urban settlements.*

*Pedestrian spaces which can be simply address as streets and alleys are major elements of a city. City image and the level of city functionality depend on frequency of these pedestrian spaces.*

*Perception of 'safety', which is the physical and psychological feel of protection, is a key factor that attracts human being into spaces to behave among them. Positive physical attributes of the pedestrian spaces are extremely effective in ensuring the safety within them.*

*Most architectural and urban design theorists discuss the independent physical attributes that facilitate the safety but usually there is combination of a set of attributes contributing towards the term. The research systematically reviews these attributes to formulate the legitimate combinations to facilitate the safety. The study was launched in Kandy grid city that contains several streets and alleys network. Kandy city is an ancient city with a significant culture, tradition and ethnic.*

*Study results the least combinations of set of attributes to facilitate the perception of safety as representing all four key attributes extracted from literature search strategy which are built-form, planning and layout, ambience and functions.*

**KEYWORDS:** perception of safety, pedestrian space, physical attributes, Kandy, sidewalks and streets

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## Introduction

Pedestrian spaces are the key components of a city, which reflects the city image and user frequency of these pedestrian spaces, enhancing the city functionality. Twenty four hour operating cities can identify as full functional cities where the pedestrian activities are happening during all day. In Sri Lankan context Colombo can be identify as a high functional city, which is the major commercial oriented city due to the night time activities. Comparatively, most other cities are low functional.

Most cities were planned and arranged by considering the vehicular traffic due to the rapid urbanization and increasing busy lives of people. Therefore the pedestrian spaces were neglected in many cities creating unsafe conditions for user. Although the sidewalks and its conditions are consider as the pedestrian space, there are many physical attributes that impact indirectly on safety of pedestrian spaces.

“A city sidewalk by itself is nothing. It is an abstraction. It means something only in conjunction with the buildings and other uses that border it, or border other sidewalks very near it.”As Jacobs (1961) stated, sidewalk has a relationship with the bordering buildings and edges. Therefore safety of pedestrian spaces are also influenced by the positive attributes of these adjacent building as well as the immediate conditions of the sidewalk. The intention of the study is to identify these attributes and how to combine them in a positive way to ensure the safety in pedestrian spaces as well as the attributes that significant to an ancient city.

## Perception of 'Safety'

Simply, safety means feeling secure without psychological harm and being secure without physical harm.

In simpler term, 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 peace, 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)

Safety is a basic need of every human being and built environment is the result of fulfilling safety. Therefore, architecture and urban design has a great role in providing both physical and psychological safety. Cities are the most vital expansions of the built environment that beginning from the individual dwellings. Unlikely the individuals or families, Cities and the pedestrian spaces are the behaving spots of large amount of users. Therefore, it's important to ensure the safety within city spaces to achieve a successful remedy.

## **Pedestrian space**

Pedestrian spaces can be simply defined as the space for pedestrians. Pedestrians are the most vital component of an active city. Streets, sidewalks, alleys, lanes can be identify as the elements of pedestrian spaces.

The term 'pedestrian environment' refers to the areas of the street where people walk, sit, shop, play or interact – outside of moving vehicles. Generally speaking, this refers to sidewalk areas between the proper line, the curb and the crossing areas at intersections. However, the pedestrian environment can also include the portions of the street normally associated with the vehicular traffic-such as during street fairs or farmer's market, or the entire street on small streets such as alleys or pedestrian pathways (Better street plans: policies and guidelines for the pedestrian realm, 2010)

Studies related to pedestrian spaces of cities formulated since the 1960s were heavily influenced by many architects and city planners. Jane Jacobs was such a pioneer who advocate the need for cities to develop a social framework in which the city dwellers become natural guardians of their own neighborhood and become 'watch dogs' to identify the strangers. She proposes how to ensure their presence of people in the pedestrian spaces addressing the theories of natural surveillance and 'eyes upon the street'. Besides she discussed the importance of positive applications of attributes like short block lengths, sidewalks, consistent building setbacks, mixed primary use and mingling of old buildings. She has argued about the demarcation of private and public areas, residents and stranger's eyes upon the street and the frequented activities of streets to watch on factors should be fulfilled to ensure the safety on streets. Although the theories of Jacobs are effective in residential cities, there is a need of reinterpret the physical attributes for the visitor's cities like Kandy. Furthermore, inappropriate applications of consistent building setbacks and short block lengths may create unsafe pockets and dead end alleys, which will act as hideouts for some antisocial affairs. If there are some entry points, which seem to be accessible, it should act as a link between streets, alleys and lanes.

Lynch (1960) argues that people in pedestrian spaces orient themselves by means of mental maps. Legibility is the central notion of his theory that has also identify as the imageability and visibility, which align with the arguments of Jacobs (1961). According to Lynch (1960) accessibility is a time issue, but also depends on the "attractiveness" and the identity of the itineraries. According to the fear of crime model by Fisher & Nasar (1992), Pedestrian spaces should be accessible for all, including the rich with alternative road network to ensure the safety. Although the alternative road network disturb the concept of imageability, the idea is important in ensuring the safety. These arguments are effective in establishing a strong city image to enhance the walkability of cities but not to address the correlation with the perceived safety of the pedestrians, which is a fundamental requirement towards functional cities.

Architect Oscar Newman has presented a **CPTED (Crime Prevention through Environmental Design)** and Defensible space concept with collaborations of criminologist C Ray Jeffrey in 1972. These concepts were mostly discussed about prevent the crime phenomena within the city community based on large housing estates rather than the pedestrians including visitors of the city. But he was highlighted the physical design applications of territoriality and surveillance as contributing to a secure environment, both internally and externally. Newman

deviates from Jacobs by considering much about housing projects rather than streets, but aligned with Jacobs's arguments through his major ideas of territoriality, natural access control and surveillance. Surveillance can be considered as a positive method, which can be simply addressed as an ability to observe or as a level of visibility, which is mentioned by Jacobs as an 'eyes upon the street'. To ensure the safety of pedestrian spaces via surveillance both day and night activities should happen in streets with a watchful eye of others unless, surveillance will not be happening. Territoriality is important in considering the housing projects, which prevent access of strangers into them and to stay safe with familiar figures. But considering the city as a whole it's not an adequate solution to apply territorialism for a place where equipped by strangers as well as residents. In that point Newman's idea deviates from Jacobs. However, she has mentioned that the public and private areas need to be demarcated clearly without bringing territorialism into cities. CPTED concept has been discussed by many city planners, architects and designers over the years.

Noted planner Alexander (1968) argued on his study of street crime in Oakland, CA and stated that *"The physical environment can exert a direct influence on crime settings by delineating territories, reducing or increasing accessibility by the creation or elimination of boundaries and circulation networks, and by facilitating surveillance by the citizenry and the police."* His arguments are aligning again with the Jacobs, Lynch and Newman's theories. All these arguments are rounding through some major ideas like surveillance, accessibility, visibility etc.

By touching a different area, Krier (1979) has presented the planning methods for pedestrian spaces using the repetition, rhythm, patterns, solid-void ratio and visibility through his concept 'urban space'. Besides he has also discussed the building morphology that clarifies the appropriate applications of buildings in urban pedestrian spaces to attract people towards them. These factors do not impact directly in perception of safety, but are important in enhancing the activities on streets to continuous surveillance.

Mehta (2013) presented an informative overview about the street and their design for successful sociability. His arguments are not focused solely on physical design, instead, it considers a wide variety of humanistic thoughts and observations like the ways of people experience the pedestrian spaces with the building heights, roof angles and land use etc. Although his discussions led towards the user perception of pedestrian space with those physical designs, the relationship between physical environments and safety has not been addressed directly. Attractiveness is a single phenomenon that enhances the functions of the pedestrian spaces.

## **Research position**

In the attempt of orienting the cities as walkable cities rather than vehicle oriented cities it's important to reassess the **contribution of physical attributes of pedestrian spaces towards perception of safety.**

The study was done by focusing on four aspects of physical attributes of streets, which impact on perception of safety. Much literature has discussed the different areas independently such as social variables, environmental variables, city neighbourhoods, which impact on perception of safety. But there are less literatures focusing physical attributes independently as well as discussing the combinations of them to ensure the safety within pedestrian spaces. Therefore, the previous literature by great authors, city planners and architects were used to filter the physical attributes of pedestrian space to build a theoretical framework for the study. The

research aims to reveal the **legitimate combinations** of selected fifteen physical attributes towards the term 'perception of safety'.

Theories by Jacobs (1961), Krier (1979), Cullen (1995), Appleton (1975), Newman (1972), Gehl (2010), Mehta (2006, 2013) were used to filter the physical attributes which facilitate the perception of safety. The study investigates the perception of safety against physical attributes of pedestrian spaces. The historical building presence of the streets was used as a special attribute due to an ancient city.

### Theoretical framework

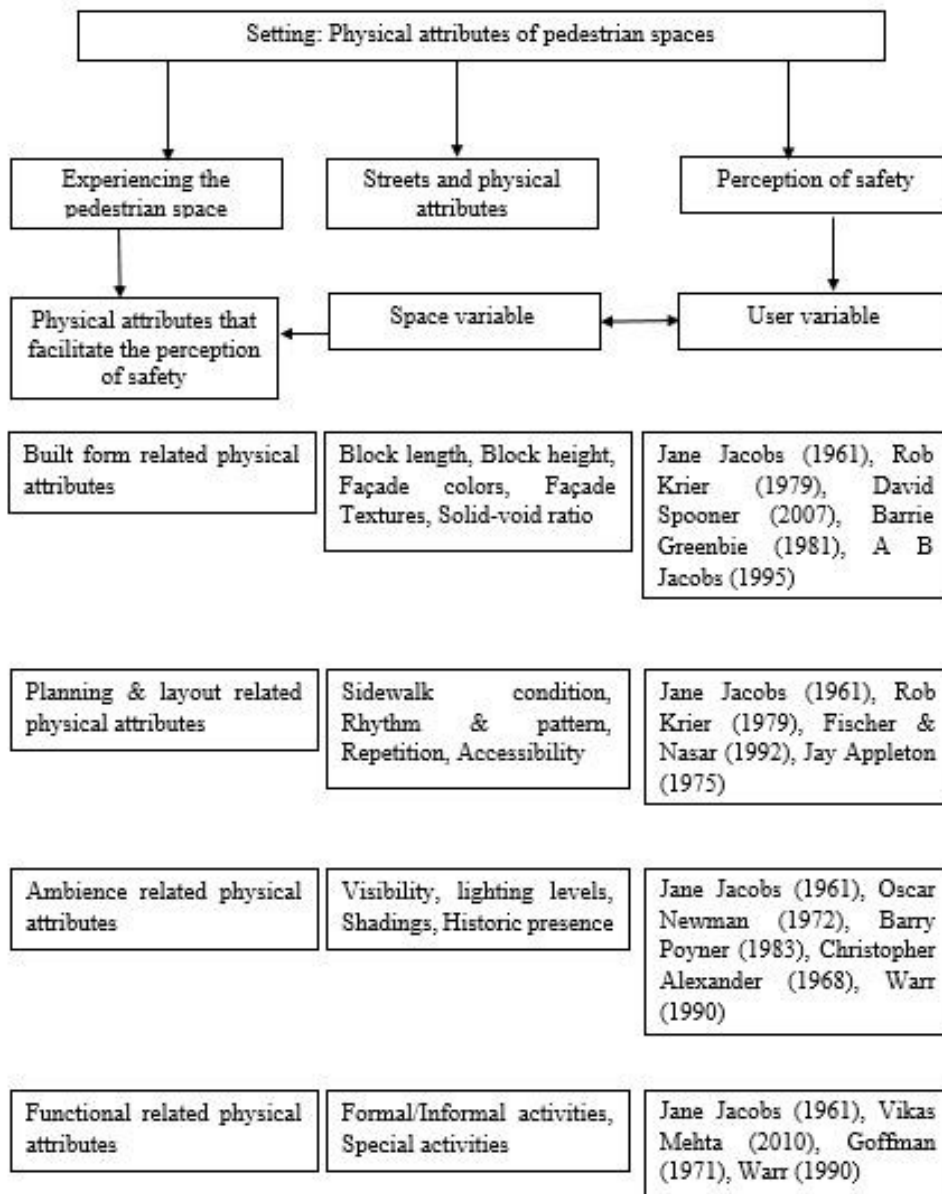


Fig 2: Theoretical Framework

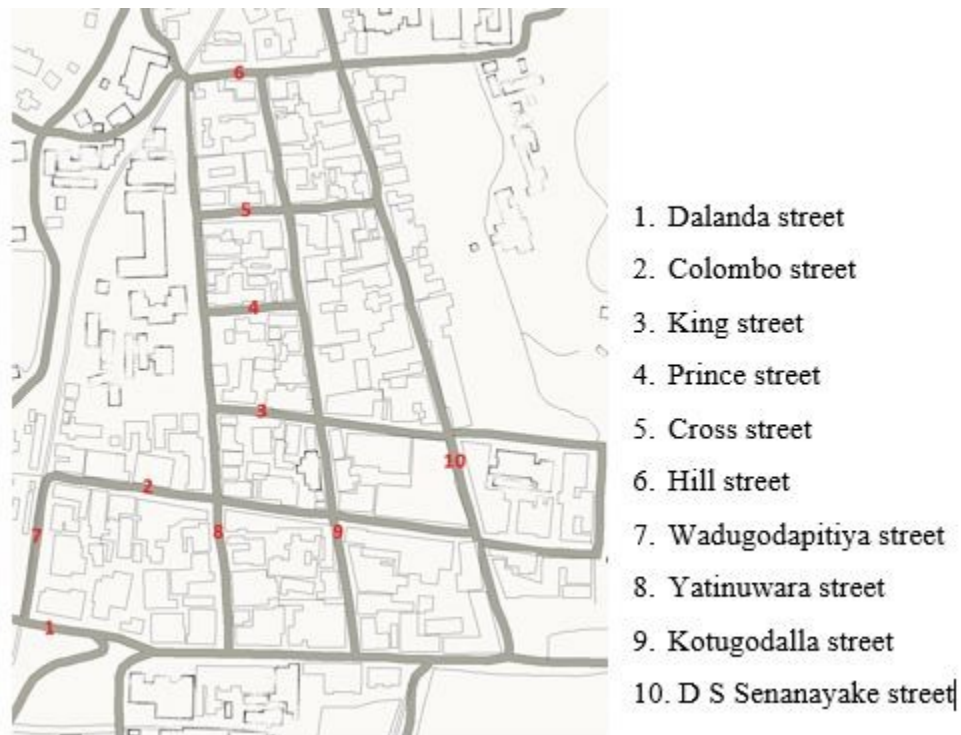
- Above theoretical framework was formed by studying the pedestrian space based theories by famous theoreticians and the fifteen physical attributes were selected to

carry out studies 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 were not addressed towards the perceived safety by previous theoreticians. Others were discussed in city planning theories. But the researches about the contribution of these physical attributes towards the perception of safety are scarce.

## Data and Methodology

Kandy



**Fig 3:** Grid city and main ten streets

Kandy city is an ancient heritage city, which can be considered as the second major city of Sri Lanka. Many people visit the city due to its climatic comfort and the consistency of sacred places. Kandy city has a solid combination of religious and cultural diversity. Kandy city is also called as a grid city due to its formation of streets. There are ten streets within the city and almost all streets are commercial oriented. Kandy city is heavily dense with compacted buildings, pedestrians as well as vehicular traffic.

### Aims and objectives

- The study aims to investigate the physical factors of streets that people prefer as safe focusing on its built form, planning, ambience and the functions, which reveal the



most **legitimate attribute combinations** in creating safer pedestrian spaces to overcome with the solutions for negative physical attributes for a better city life.

- Identify the potentials and design strategies to improve perception of safety within the streets to rebuild the strong discussion between user and space.
- Reveals the relationship between perception of safety and physical attributes of pedestrian spaces.
- Point out the negative aspects of particular case studies, which create sense of unsafeness in human mind and provide knowledge about creating safer pedestrian spaces in urban design to gain its maximum utilization as well as reduction of the crime friendly situation in city planning to reduce the crime chain.

### **Method of study**

**Stage 1** - Major research objective is to understand the legitimate combinations of physical attributes that facilitate the perception of safety. Initially, people were asked to indicate their opinion about the safety (as safe, as unsafe, neutral) on all ten streets of Kandy city. The selected participants (six from each street) were randomly selected. All the participants were above the age of 15 years. A tourist was selected from each street to obtain qualitative data due to their unfamiliarity of the place.

**Stage 2** - At the second stage, shop owners from each street were interviewed to further analyze the collected data. The purpose of these questionnaires and semi – structured interviews are to carry out a comprehensive study on revealing the most safe and unsafe streets. All the streets were studied to review the negative and positive physical attributes using photographic survey, counting survey and observations.

### **Method of data collection, tools and implementation**

There are two main data variables, which are user variable and space variable. (Perception of safety and physical attributes of pedestrian spaces) Space variables are tangible parameter, which requires quantitative data. Therefore photographic surveys, counting surveys and observatory findings were used to extract data.

User variables are intangible parameter, which requires qualitative data. Therefore, the questionnaires and semi – structured interviews were used to extract data. All the data were collected during the usual working hours on weekdays.

### **Limitations**

- Perception of safety is a feeling that depends on many aspects like age, gender, race, culture etc. (Mehta, 2013)Therefore, the user experience in perception of safety differs 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.
- The questionnaires are limited to the different segments of commercial oriented streets in Kandy grid city.
- People believe that the streets which are close to the sacred area as safe spots.
- Any of ten streets were not arranged according to the present street design guidelines due to its historic background. Therefore, a comparative study has to be carried out.

- Samples were picked to cover all segments of streets but tourists were considered only the immediate atmosphere of the particular streets when answering the questions.

### Data presentation and analysis

- Following summary charts were used per each street to present the data extracted from pedestrians.

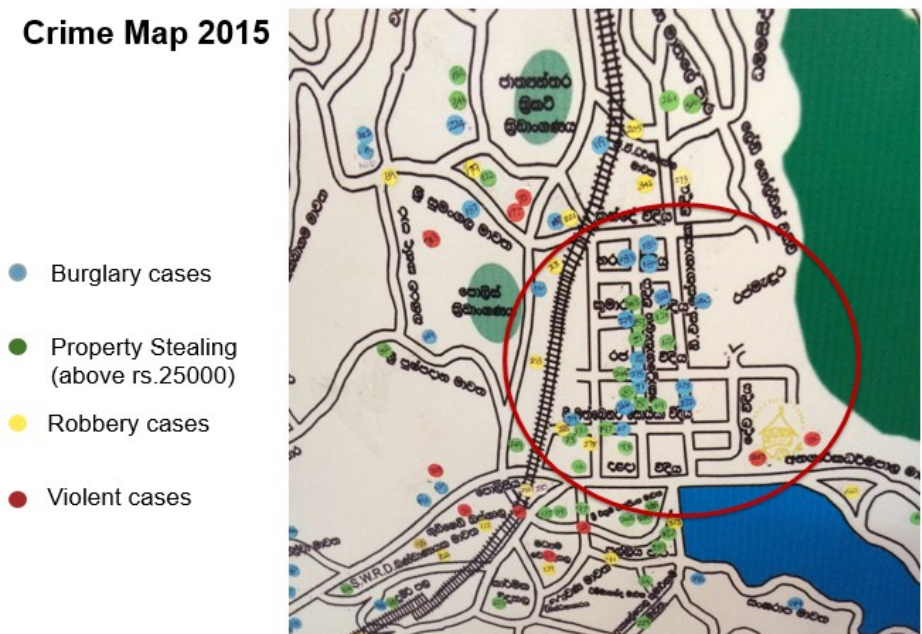
Sample No.	User Response			Sample No.	User Response			Sample No.	User Response		
	Safe	Neutral	Unsafe		Safe	Neutral	Unsafe		Safe	Neutral	Unsafe
Sample 1				Sample 1				Sample 1			
Sample 2				Sample 2				Sample 2			
Sample 3				Sample 3				Sample 3			
Sample 4				Sample 4				Sample 4			
Sample 5				Sample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

Fig 4: User data of each street

### Results of questionnaires and semi-structured interviews

- Dalanda Street is perceived by many samples and shop owners as **safest** street, which can be taken into the study as a pedestrian space with **positive** physical attributes.
- Colombo Street and Prince Street are perceived by many samples and shop owners as unsafe street, which has negative physical attributes.
- 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.

### Crime Map 2015



Source – Crime division, Kandy Police Department

Fig 5: Crime map 2015



- The pedestrians perceive Wadugodapitiya Street as unsafe, 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.
- User responses on Yatinuwara Street, D S Senanayake Street, Hill Street, Cross Street and King Streets are relatively dull but these streets can be considered as safe streets according to the answers of pedestrians.
- Space data were analyzed using colored maps, which highlights the unsafe spots and zones. Further analysis were done using the photographs taken.



**Fig6:** Space data for each street

overall physical attributes of pedestrian spaces, extracted by walking observations and photographic surveys

- High color tones represent the positive attributes and low color tones represent the negative physical attributes in final summery chart.

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

If a street contain more than 50% of blocks exceeding two stories or higher, it consider 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 & Pattern	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 7: Key for the color codes of summary chart

SUMMARY CHART												
Key Physical Attribute	Data Variable		Overall Comment for Places									
	No.	Design Feature	Dalada Veediya	Colombo Street	Kings Street	Kumara Veediya	Cross Street	Hill Street	Wadugodapiya 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										
03 Ambience Related Physical Attributes	9	Repetition										
	10	Natural & Artificial Lighting										
	11	Shadings										
04 Functional Related Physical Attributes	12	Visibility / Surveillance										
	13	Historic presence										
04 Functional Related Physical Attributes	14	Formal / Informal Activities										
	15	Special Functions										

Fig 8: Summary chart of physical attributes of each street

## Conclusion

The research objective was 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 them. Therefore the two main variables were tested against each other, which are perceived safety and the physical attributes of pedestrian spaces in a historic city like Kandy. Fifteen different attributes were studied within the research area, which

were categorized under four key physical attributes considering built form, planning and layout, ambience and functions.

Analyzed space data were indicated in a summery chart to come up with evidence based conclusion about the physical attributes that facilitate the perception of safety. Following conclusion can be made by studying the summery chart.

- Perception of safety of a pedestrian is not just depending on the physical safety of the pedestrian space or sidewalk. It is affected by other physical attributes as well. Because the pedestrians have perceived some streets as safe even the sidewalk condition is not safe.
- 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 that are perceived as unsafe by pedestrians lack physical attributes from one or few categories.
- At least there should be a combination of any ten positive physical attributes to represent all four key categories to ensure the perception of safety. The positive application of built form related attributes basically provide **attraction**. Planning and layout related attributes provide **comfort**. Both ambience and functional related physical attributes provide **confidence**. However, these are essential factors to ensure the safety. Therefore representing all four key attributes is a must.
- Hence a historic city has taken into the study, it can be clearly identified that the historic presence is vital to ensure the safety that caused to generate rhythm, pattern and repetition. Furthermore, contrast/vibrant colors and textures of facades are totally effective in ensuring the perception of safety in pedestrian spaces. Almost all perceived safe streets are positive application of façade colors, textures, rhythm, pattern and repetition with a high historic building percentage.
- 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 this street contains 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 spots along those streets. According to the previous crime experience, shop owners do not accept the street as safe. Scholarly artides mentioned that the previous crime experience (direct or indirect victimization) and prior information about crime, impact on perceived safety. (Maruthaveeran & van den Bosch, 2014)
- Some streets do not contain the essential positive physical attributes therefore pedestrians perceived it as not safe. But the mix use and located close to police station make the street protect from crimes. Therefore, shop owners perceived it as safe.

Considering the above findings, it's clear that there is a strong relationship between perception of safety and the physical attributes of pedestrian spaces and there should be minimum fulfilments of set of positive attributes to ensure the safety within pedestrian spaces. These attributes can differ with the city character, history and culture. But there should be a combination of some particular positive attributes to facilitate the perception of safety in a historic city like Kandy.

### **Future studies**

Further studies can be directed towards following areas according to the findings in this research.

- The study reveals that the façade colors and textures are effective in ensuring the safety through increasing the activities. Therefore, a deep study can be launch focusing the façade articulation and the perception of safety.
- Hence the study emphasize that the historic presence is vital in perceived safety, a study can be launch on safety factors in historic cities concentrating its significant culture, tradition and social behavior.
- Great authors like Kevin Lynch, Rob Crier etc. has already discussed about the rhythm, pattern and repetition factors in city planning and a research can be direct towards the revealing connection between city aesthetics and the perception of safety.

Above studies related to the safety and adjoining fields will be valuable to study, due to the fact that safety is an essential factor in creating people oriented cities in urban design. Therefore it's important to apply positive design attributes in street designs since streets are the skeletons of the city structure. This study will contribute in using the positive application of physical attributes in future city planning and in re-arranging the negative attributes of present cities.

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