Built Environment and Walkability: Investigating Urban Design Qualities by Serial Vision Method at Itahari Chowk

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Abstract

The current state of Itahari chowk reflects the challenges of urban development and the prioritization of vehicular traffic. The study examines the connection between the built environment and walkability, utilizing Itahari chowk as a study area. This paper aims to quantify the degree of walkability in relation to built environment while comprehending how the built environment affects people's walking habits and how aspects of walkability related to urban architecture are related to physical attributes. The study employs a thorough analysis of walkability coverage across four distinct spots within Itahari chowk using Gordon Cullen serial vision method. This method rooted in urban design principles evaluates four crucial qualities: Imageability, Enclosure, Transparency and Human Scale. To further refine the assessment, interview was conducted to gauge the perception of users. Respondents were asked to rank the urban design qualities based on their perceived importance and ranking data were used to determine weightage for each quality. By integrating the weighted evaluation criteria in the walkability coverage obtained through the serial vision method, a more accurate representation of actual walkability experience emerged. The findings obtained from theoretical method (serial vision method) and people's perception (ranking method) were compared and discuss. The results of this analysis showed that people's perceptions of walkability were different from the theoretical method. The study will be beneficial to pedestrian design professionals and academic interested in this topic. Ultimately the general public will be benefit from more walkable and user-friendly street.

Keywords: *Built environment, Itahari chowk, Walkability, Serial vision method, Urban design qualities*

Introduction

In the realm of urban planning and architecture, the concept of walkability has emerged as a pivotal factor in shaping cities that are vibrant, sustainable, and conducive to the well-being of their inhabitants (Cullen, 1961; Gehl, 2010; Jacobs, 1961). With growing concerns about urban congestion, pollution, and sedentary lifestyles, designing streetscapes that promote higher walkability has become an imperative for fostering healthier and more livable urban environments. Southworth (2005) defines walkability as "the extent to which the built environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort, and offering visual interest in journeys throughout the network". "Walkability is a quantitative and qualitative measurement of how inviting or un-inviting an area is to pedestrians. Walking matters more and more to towns and cities as the connection between walking and socially vibrant neighborhoods is becoming clearer. Built environments that promote and facilitate walking – to stores, work, school and amenities – are better places to live, have higher real estate values, promote healthier lifestyles and have higher levels of social cohesion" (Jacobs, 1961). The ease and safety with which individuals can walk in a specific region is referred to as walkability. Sidewalks, crosswalks, and other pedestrian-friendly features encourage people to walk to work, school, or other destinations in a walkable environment. An unwalkable environment, on the other hand, may contain broad streets, extensive parking lots, and other car-centric features that discourage walking and make it difficult or dangerous for pedestrians to move about. Jane Jacobs' revolution in urban studies, which began in the 1960s, is largely responsible for the phrase "walkability." Because of the advantages that walking provides for our health, economy, and environment, it has gained popularity recently. Since the middle of the 20th century, most cities in the world have been designed on the car-centric urban design philosophy, which has a negative impact on the essence of pedestrian/walkable friendly design. A shared interest in walkable neighborhoods has brought together the professions of urban design and

public health during the past few years. One of the key factors that influence walkability is the built environment.

The built environment refers to the human-made physical surroundings in which we live, work, and play. It includes buildings, roads, bridges, parks, and other public spaces, as well as the infrastructure that supports them, such as water and sewage systems. The built environment is a critical factor in shaping the quality of life and well-being of individuals and communities. It is the circumstances that have been created by humans and is frequently used in a variety of fields, including anthropology, landscape architecture, public health, and urban planning. Numerous built environment characteristics have been cited as encouraging people' walking habits.

Since walkability is a multidisciplinary issue, it is a complicated organization in achieving a generic technique that guides walkability in a built environment, evaluates the condition of the environment on the basis of walkability, and clearly informs variables that influence walkability. However, "Walkability studies have provided enough evidence through statistical analysis that walking behavior is related to the condition of the built environment" (Choi, 2012).

However, physical features individually may not tell us much about the experience of walking down a particular street. Specifically, they do not capture people's overall perceptions of the street environment, perceptions that may have complex or subtle relationships to physical features. The urban design literature points to numerous perceptual qualities that may affect the walking environment (Ewing & Handy, 2009). Out of these various perceptual qualities, four major urban design qualities are Imageability, Enclosure, Transparency and Human Scale. Imageability is a feature of a location that makes it memorable and identifiable, such as the utilization of landmarks or iconic structures. While enclosure is the degree to which streets and public places are delineated and enclosed by buildings and other structures, providing pedestrians with a sense of shelter and enclosure. Similarly human scale refers to the size and proportions of buildings and other objects in the environment that should be adjusted to the needs and abilities of pedestrians rather than automobiles. And transparency is the degree to which buildings and other structures allow views into and out of the place, generating a sense of openness and safety.

Many studies show the relation between built environment and walkability. But detail study was done by Suzan Shrestha as part of his 2020 Deakin University thesis project. Shrestha (2020) in his works seeks to approach and investigates alternative techniques of objectively assess seemingly subjective characteristics of urban design in relation with their influence in walkability. It tries to establish a simpler approach that many show the range of walkability through simultaneous qualitative and quantitative analysis because existing research methods of an objective analysis of the urban environment is regard to walkability are rather difficult.

Ewing and Handy (2009), focus on problem of evaluating urban design feature related to walkability, which they claim are often difficult to measure but are critical for developing livable and sustainable citizen. To address these issues, they suggest a methodology for measuring six urban design qualities related to walkability: Imageability, Enclosure, Human Scale, Transparency and Complexity. Michael Southworth (2005), examines pedestrian demands in urban and suburban settings, with an emphasis on the performance factors and criteria for walkable city. This explores the difficulty of developing walkable cities in the United States, where more than half of the typical American metropolitan was designed to automobile dominated stands. Therefore, it's clear that the connection between the built environment and walkability can differ from one location to another. This highlights the importance of studying how the built environment influences walkability in a way that's specific to each area.

Objectives

This paper aims to achieve two primary objectives. Firstly, it seeks to determine the level of walkability in relation to the built environment at the intersection of Itahari Chow. Secondly, it aims to identify the subjective characteristics of the built environment using quantitative methods (Serial vision method). Additionally, the article aims to compare the outcomes of a theoretical approach with the perceptions of individuals regarding walkability. This comparative analysis will provide insights into the extent to

which the built environment influences walkability at the intersection of Itahari Chowk. This research carries important practical implications as it informs urban planners and designers how to increase walkability, contributes to academic discourse by introducing new research methods, and ultimately recommends streets that it is pedestrian-friendly, and compliments pedestrian-friendly streets.

Study Area

Itahari was chosen as the research area, situated in the eastern Sunsari district of Nepal, serving as the central hub for transportation and commerce in the Koshi Zone. Positioned around 400 kilometers east of Kathmandu, this city is strategically located along the Mahendra Highway, connecting eastern Nepal with the rest of the country. In recent times, Itahari has experienced substantial growth and development due to its advantageous location and the increasing demand for goods and services.

The current state of Itahari Chowk reflects the challenges of urban development and the prioritization of vehicular traffic. The intersection, situated at the convergence of two major highways, has experienced significant changes driven by rapid urbanization and traffic congestion. Unfortunately, the focus on accommodating vehicles has led to the neglect of walkability considerations. The road extension works carried out to alleviate traffic issues have further diminished the presence of human-scale components, thereby hindering the pedestrian experience. To address these issues and promote walkability, it is imperative to conduct in-depth studies on the various aspects of pedestrian-friendly design and integrate urban design qualities effectively. By understanding the importance of walkability with a focus on pedestrians, Itahari Chowk can be revitalized into a vibrant and pedestrian-friendly urban space.

This study focuses on this intersection where two major highway Mahendra Highway and Koshi Highway are intersected. Figure 2 shows the transformation of this intersection in different time period.

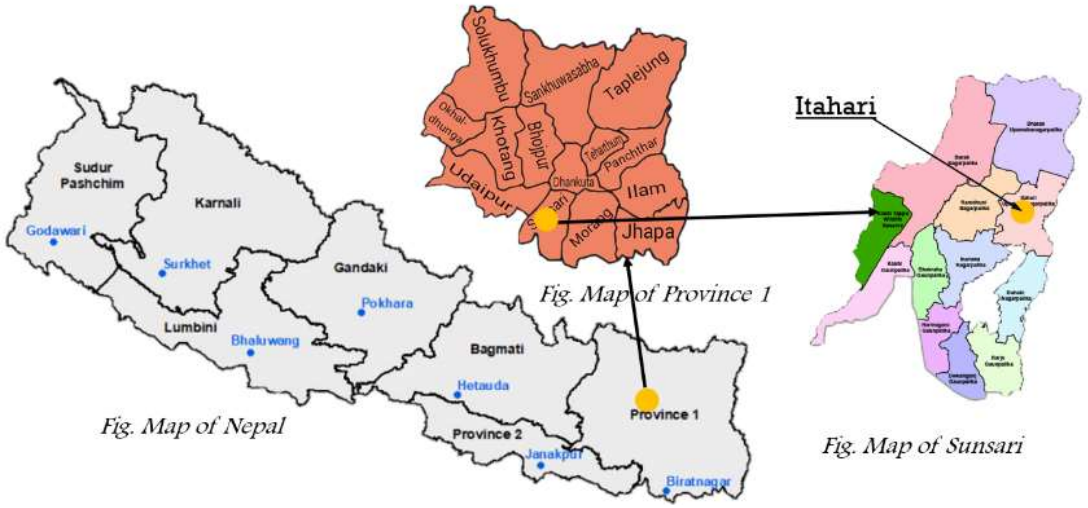

Figure 1: Location map of Itahari

Fig. 2032 B.S. Itahari

Fig. Before Democracy

Fig. During Jana Aandolan

Fig. 2070 B.S. Itahari

Fig. During road expansion

Fig. Present Itahari

Figure 2:Transformation of Itahari chowk

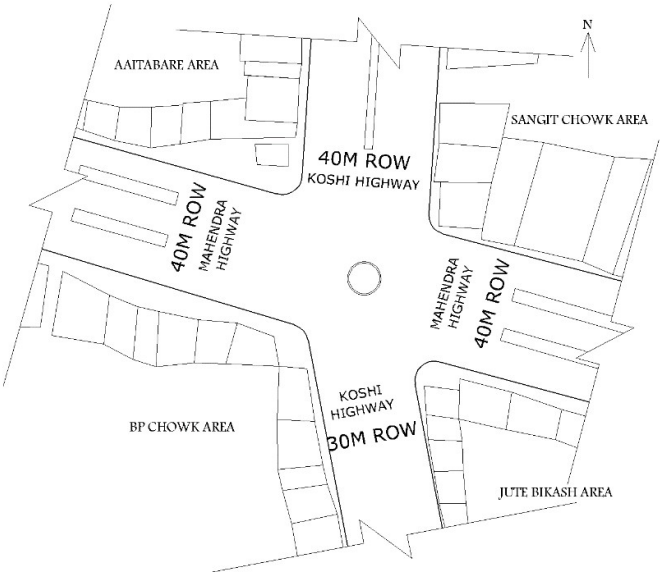

Figure 3 Master plan of Itahari Chowk

Methodology

The research methodology employed in this paper adopts a mixed-method approach, integrating both qualitative and quantitative methods to examine relation between built environment and walkability, with a specific focus on Itahari Chowk. As walkability inherently involves subjective perceptions, the study sought to objectively evaluate the subjective perceptions of individuals by first gathering qualitative data and subsequently interpreting it through a qualitative lens.

To begin, the existing walkability degree was assessed quantitatively using the serial vision method developed by Gurdon Cullen. Gordon Cullen popularized serial vision as a visual method of urban planning in his 1961 book “The Concise Townscape”. According to Cullen, the "art of relationship" between the various physical components of the urban landscape is urban design. It is the skill of taking " all the elements that go to construct the built environment structures, trees, nature, water, traffic, advertisements, and so on, and to weave them in such a way that drama is produced". Instead of being presented from a bird's eye perspective, it is from the perspectives of people who are moving. This technique of visual representation can be used as a tool for analyzing, generating alternatives, and presenting a new design while also evaluating the current experience of moving around a space. It comprises of a number of hand-drawn sketches that are displayed alongside a map that shows the route taken and the vantage points used to create the sketches. The similar method was further adopted in

Evaluation experiential qualities of streetscapes (Rollo & Barker, 2013) in order to determine the green area. This method enabled a quantitative evaluation of the current walkability conditions, providing a solid foundation for further analysis.

The research employed a technique to rank the preferences expressed by respondents regarding various urban design qualities. This methodology aimed to identify the most significant qualities that influenced the respondents in their practices. Inspired by Garrett's Ranking technique, the study requested respondents to rank different urban design qualities (Imageability, Enclosure, Transparency and Human Scale) on their perceived impact, which were then converted into score values and ranked using the following formula:

$$\text{Percent position} = \frac{100\,(Rij - 0.5)}{Nj}$$

Where,

Rij = Rank given for the ith variable by jth respondents

Nj = Number of variables ranked by jth respondents

To assign scores, the study utilized Garrett and Woodworth's table (1969), which provided percentile positions converted into corresponding scores. Subsequently, the scores assigned to each factor by individual respondents were aggregated to determine the total and mean values. Factors with the highest mean values were considered the most important.

Based on the article titled "Application of Garrett Ranking Technique in Studying the Problems of Bamboo Cultivation: A Case Study of Mokokchung District, Nagaland," the Garrett Ranking Technique was utilized to determine the most significant problems in bamboo cultivation. The method involved collecting data from farmers and asking them to rank eight factors related to bamboo cultivation based on their perceived importance, from most critical to least critical. The Garrett Ranking Technique is a suitable research method for investigating the most important urban design qualities for walkability in this research. This method has already demonstrated its effectiveness in a relevant context, as evidenced by its successful application in the study of problems in bamboo cultivation.

This approach allowed for a comprehensive evaluation of the urban design qualities under investigation, facilitating the identification of the factors that exerted the greatest influence. By utilizing Garrett's Ranking technique and statistical analysis, the research methodology provided a robust framework for assessing and prioritizing the factors affecting respondents' perceptions and practices in the field of urban design.

The obtained average score serves as a weightage factor in determining the precise score for each value identified through the serial vision method. To accomplish this, the values derived from the serial vision method are first normalized and standardized to ensure a consistent scale. Subsequently, this normalized value is multiplied by the average score generated through Garrett's ranking technique. The resulting product represents the actual score assigned to each value derived from the serial vision method.

This integration of the two methods allows for a comprehensive evaluation of the values identified through the serial vision approach, considering both their priorities based on respondent rankings and their specific scores obtained through the normalized value multiplication. By combining these techniques, the research methodology ensures a robust and comprehensive assessment of the values pertinent to the study.

This approach facilitates a nuanced understanding of the values derived from the serial vision method, enabling their effective integration into the broader analysis of urban design qualities. The utilization of both Garrett's ranking technique and the normalization process provides a rigorous framework for assigning accurate scores and weightage to the values identified through the serial vision method.

A total of 40 participants were chosen for the study by purposive sampling. The selection of this specific number was determined using a formula developed by W.G. Cochran in 1953. This formula is particularly useful for estimating proportions in a sample.

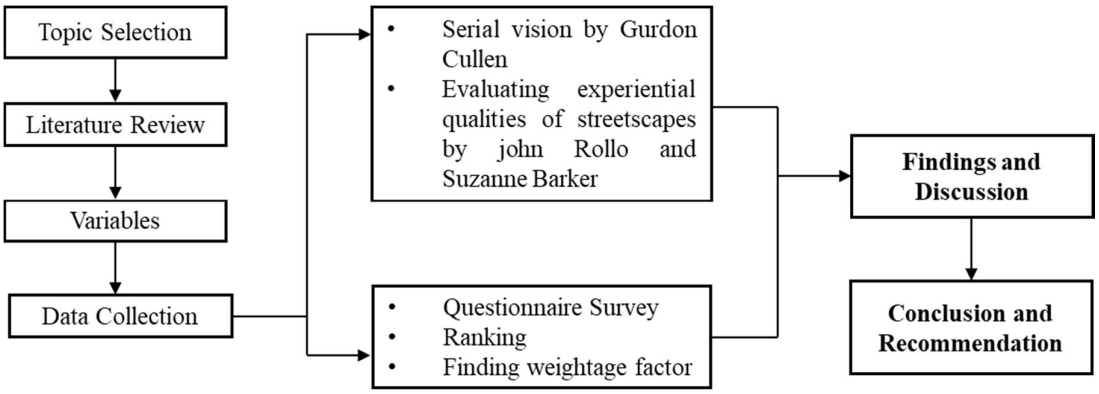

Figure 4 Research methods

For serial vision and ranking method variables that are pulled out of the literature are then used for the investigation. Not all factors are examined. The variables that relate to physical features are more objective, whereas the variables that relate to individual reaction are more subjective. Hence, variables that fall between these two and are neither more objective nor more subjective are used. These factors had to do with attributes of urban design like Imageability, Enclosure, Human Scale, and Transparency. For the purpose of determining peoples' levels of satisfaction, these urban design features are further broken down into various attributes, and statements are then generated that are specific to those attributes.

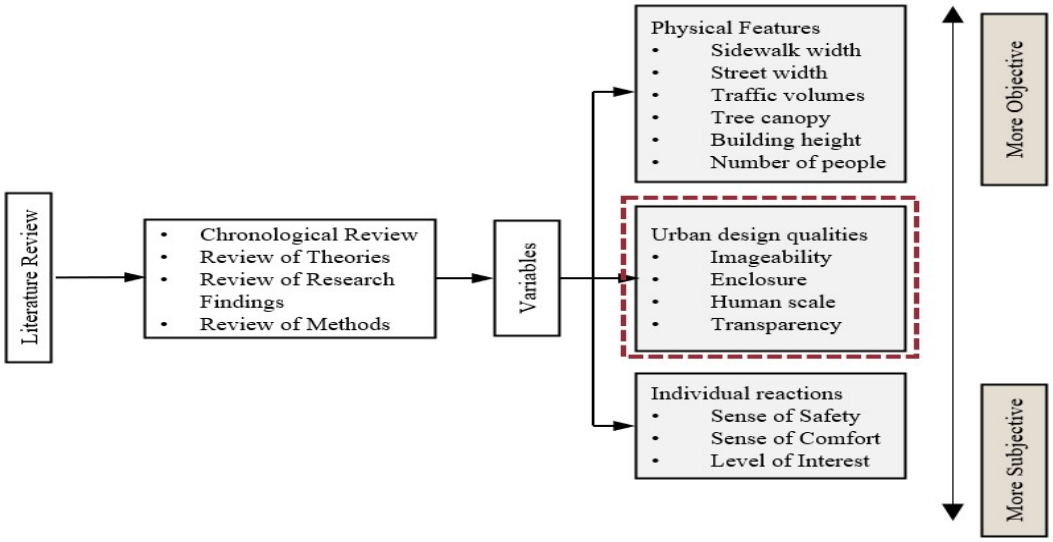

Figure 5: Variables extracted from literature

Observation and Analysis

Observation

The four-observation spot namely “Spot 1”, “Spot 2”, “Spot 3” and “Spot 4” were selected for analysis purpose. These 4 observation spots are:

- “Spot 1” toward North on N-E corner of intersection.
- “Spot 2” towards West on N-W corner of intersection.
- “Spot 3” towards South on S-W corner of intersection.

- "Spot 4" towards East on S-E corner of intersection.

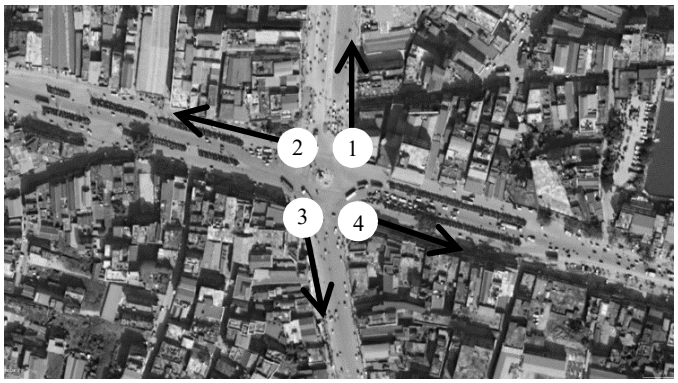

Figure 6: Itahari chowk, Numbers depicting 'Observation Spots'

Each street is photographed from the primary site so that the visible components of the street can be further studied. The study is performed separately.

Figure 7: Spot 1

Figure 8: Spot 2

Figure 9: Spot 3

Figure 10: Spot 4

Analysis by Color Mapping

The present physical attributes linked to urban design qualities have been depicted through color mapping. Table 1 displays the overall attributes of urban design at various observation spots as indicated by color mapping. Following color mapping, many physical characteristics associated with urban design qualities (Imageability, Transparency, Enclosure and Human Scale) were determined in percentage form using a 10X10 grid. On (Table 2), this calculated percentage were displayed. This demonstrates how each aspect of urban design is present in each location.

Table 1: Urban design qualities represented by color mapping at different observation spots

Urban Design Qualities	Spot 1	Spot 2	Spot 3	Spot 4
Imageability				
Enclosure				
Transparency				
Human Scale				

Mapping the coverage (total coverage of each urban design qualities). Below shows the mapping in observation spot 1 (sample).

Figure 11: Observation spot 1

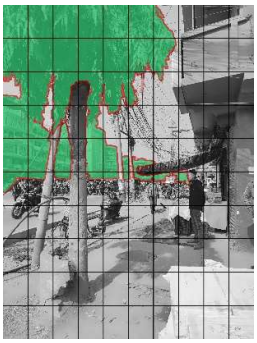

Figure 12: Imageability Coverage= 24.5%

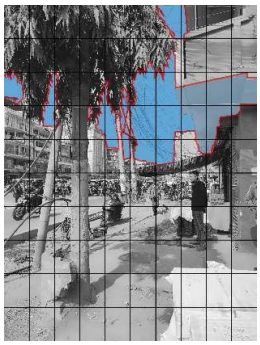

Figure 13: Enclosure coverage= 12%

Figure 14: Transparency coverage= 2.5%

Figure 15: Human Scale coverage= 5%

Similarly, as above technique, detail analysis for all of the locations was done.

Table 2: Summary of mapping.

Urban Design Qualities	Spot 1 (Coverage in %)	Spot 2 (Coverage in %)	Spot 3 (Coverage in %)	Spot 4 (Coverage in %)
Imageability	24.5%	16%	24%	4.5%
Enclosure	12%	25%	16.5%	25.5%
Transparency	2.5%	5%	2%	9%
Human Scale	5%	7.5%	7.5%	10%
Total Coverage	44%	53.5%	50%	49%

Analysis by ranking method

The respondents were requested to rank and prioritize urban design qualities based on provided statements. Such ranking methodology is commonly employed to analyze individuals' attitudes, perceptions, and priorities regarding a specific subject. To gain insights into people's perception of an area as they traverse it, the attributes employed in the serial vision method were once again utilized in the form of questions or statements.

Table 3: Collected raw data translated into English

Urban Desing Qualities	Respondent 1		Respondent 2	
	Ranking	Why 1st priority?	Ranking	Why 1st priority?
Imageability	2	It offers relief from the heat and ensures safety as well.	2	Itahari is a commercial hub. So, if you can't see the products or services properly, it's not ideal. It
Enclosure	1		4	
Transparency	3		1	

Urban Desing Qualities	Respondent 1		Respondent 2	
	Ranking	Why 1st priority?	Ranking	Why 1st priority?
Human Scale	4		3	shouldn't take much time to find the product.
Urban Desing Qualities	Respondent 3		Respondent 4	
	Ranking	Why?	Ranking	Why?
Imageability	2	If there's transparency, visibility increases. Window shopping is enjoyable. Exploring the surrounding area is interesting. If you can't see inside, it's not favorable.	3	The scale should be human-oriented because it's the central area and requires space for resting and security. Adequate lighting and resting spaces are provided, along with small plants.
Enclosure	4		2	
Transparency	1		4	
Human Scale	3		1	

Figure 16: Sample of collected raw data

Further spots and variables were being investigated, and frequency tables have been created for these spots as well. The data collected from 40 respondents were organized by calculating the rank and frequency of each urban design quality (Table 4). For instance, eight participants ranked "imageability" as their second choice. This information was systematically arranged.

Table 4: Arranging collected data on the basis of frequency

Urban Design Qualities	Frequency of Rank			
	1	**2**	**3**	**4**
Imageability	9	8	8	15
Enclosure	8	13	9	10
Transparency	7	11	11	11
Human Scale	16	8	12	4

Table 5: Calculating percent position and corresponding Garrett's score

Ranking	Percent Position	Garrett Score (From Garret's ranking conversion table)
1	12.5	73
2	37.5	56
3	62.5	44
4	87.5	27

To determine the percent position of each rank, as outlined in the research methodology section, a formula was applied. Additionally, the Garrett ranking conversion table was utilized to derive the corresponding Garrett score. The frequency of each rank was then multiplied by the respective Garrett score to obtain the precise score for each urban design quality (imageability, enclosure, transparency, and human scale).

The total score was obtained by summing up all the individual scores assigned to each urban design quality (Table 6). For instance, the scores for the 1st, 2nd, 3rd, and 4th ranks of imageability were 657, 448, 352, and 405, respectively, resulting in a total value of 1862. The same technique was applied to calculate the total scores for the other urban design qualities. Subsequently, the average score was calculated by dividing the total score by the total number of respondents, which in this case is 40. Finally, the percentage was computed, representing the weightage factor (Table 7).

Table 6: Multiplication of frequency and Garret's score

Urban Design Qualities	Frequency of Rank X Garrett Score				Total
	1	2	3	4	
Imageability	657	448	352	405	1862
Enclosure	584	728	396	270	1978
Transparency	511	616	484	297	1908
Human Scale	1168	448	528	108	2252

Table 7: Calculating weightage factor

Urban Design Qualities	Total	Average	Percentage
Imageability	1862	46.6	23.3
Enclosure	1978	49.5	24.7
Transparency	1908	47.7	23.9
Human Scale	2252	56.3	28.2

Applying weightage factor in urban design coverage obtained by serial vision method

In order to determine the exact coverage using the serial vision method, incorporating the weightage factor, it was necessary to normalize the data to ensure a consistent scale, as observed in the color mapping process. Notably, all four urban design qualities were evaluated using different scales. Imageability received a high coverage rating due to its consideration of large buildings, while human scale received a low coverage rating due to its focus on smaller elements such as seating and flower beds.

Linear normalization was employed to normalize the data, ensuring values greater than 0 and less than or equal to 1. To find normalize value respective value was divided by maximum value of corresponding urban design qualities (Table 8). After normalization, the precise coverage was determined by multiplying the previously calculated weightage value with the corresponding normalized value for each of the four urban design qualities (imageability, enclosure, transparency, and human scale) at each of the four observation spots (Spot 1, Spot 2, Spot 3, and Spot 4) (Table 9).

Table 8: Normalizing coverage from serial vision method

Urban Design Qualities	Spot 1	Spot 2	Spot 3	Spot 4
Imageability	1.00	0.7	0.9	0.2
Enclosure	0.5	0.9	0.7	1.00
Transparency	0.3	0.6	0.2	1.00
Human Scale	0.5	0.8	0.8	1.00

Table 9: Calculating exact coverage with weightage factor

Urban Design Qualities	Weightage Factor	Spot 1	Spot 2	Spot 3	Spot 4
Imageability	23.3	23.3	15.2	22.8	4.3
Enclosure	24.7	11.6	24.2	16	24.7
Transparency	23.8	6.6	13.3	5.3	23.9
Human Scale	28.2	14.1	21.1	21.1	28.2

Result and Discussion

Serial vision method

The findings in this section were analyzed using the serial vision technique described by Gordon Cullen in his 1961 masterpiece Townscape. This was the outcome based on the color mapping method that was demonstrated in the observation and analysis section above. The results were covered below (Figure 17 & Figure 18).

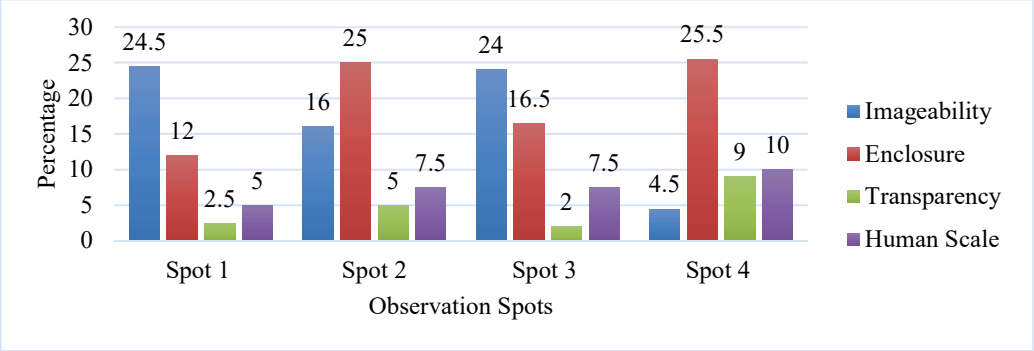

Figure 17: Different urban design qualities and their respective coverage

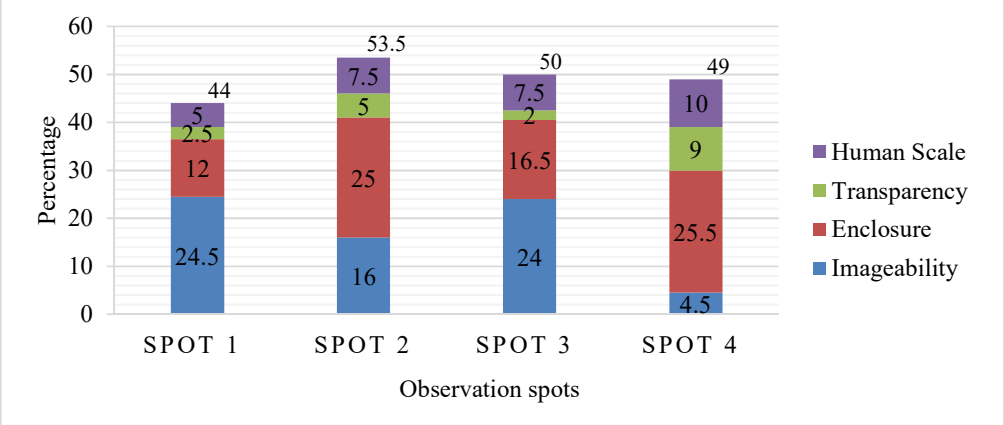

Figure 18: Different urban design qualities and their respective coverage in stack column

Transparency and Human Scale were the urban design qualities which have significantly lower value than others. Not greater than 10%. Imageability and Enclosure have comparatively higher value compare to other two urban design qualities. Spot 4 have lower value of Imageability which was quite different than other spots.

Overall analysis shows that observation spot 2 provides the best result. Although having the finest outcome, we cannot argue that it possesses the best urban design characteristics as a whole. Spot 4, which excels in enclosure, transparency, and human scale similarly, spot 1 has a greater imageability value.

Ranking method

The data obtained was interpreted using the ranking method to analyze the respondents' priorities and importance regarding urban design qualities. The ranking method, which provides Garrett's scores, assesses the respondents' significance or priorities related to a specific subject. For this study, the ranking method was applied to four urban design qualities, with ranks ranging from 1st to 4th. The 1st rank indicates a very important quality, while the 4th rank denotes the least important, based on the respondents' perceptions.

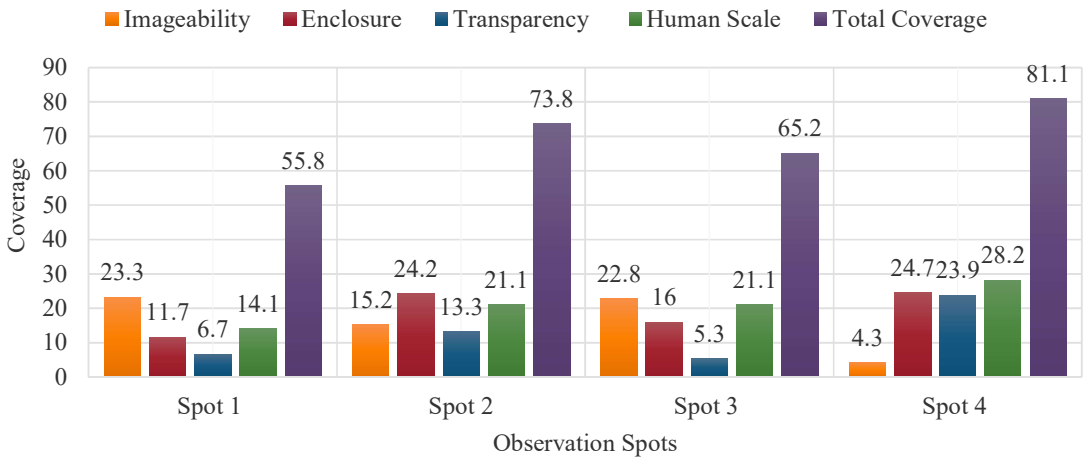

Figure 19: Exact coverage by applying weightage factor

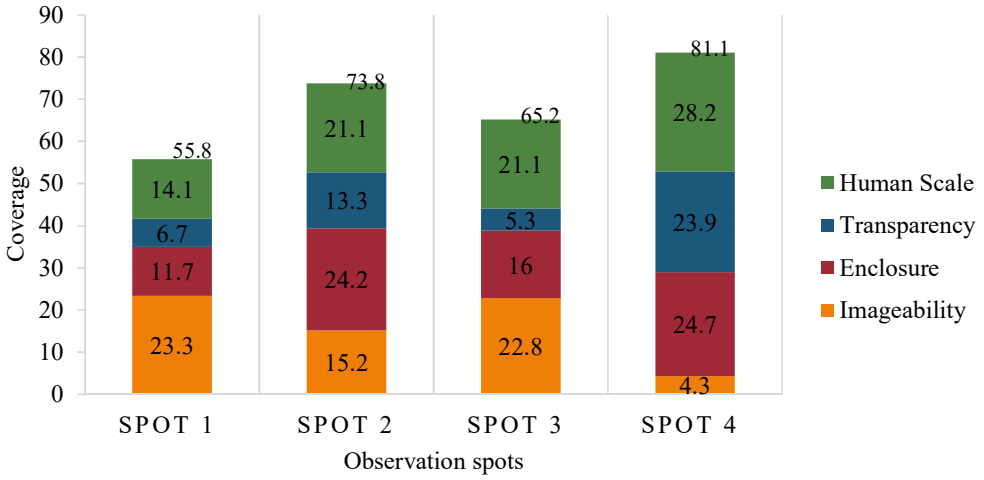

Figure 20: Urban design qualities calculated by ranking method in stacks column

By employing this technique, information regarding the importance factor was gathered. The use of Garrett's score allowed for the determination of weightage for each urban design quality, as showcased in the observation and analysis section mentioned earlier. These weightages were computed using the collected data. The ranking method results provided valuable insights into how individuals perceive the importance of specific urban design qualities (Figure 19 & Figure 20).

The analysis has found that “Spot 4” has a high coverage of all urban qualities with coverage 81.01, which means that this location has a wide range of features and amenities that make walking more pleasant and enjoyable for pedestrians. Because “Spot 4” has such a high coverage of all these urban qualities, pedestrians are more likely to find walking in this area acceptable and enjoyable. On the other hand, “Spot 1” has lower coverage of these urban qualities with coverage 55.63, which means that this location may be lacking in some of the features and amenities that make walking more pleasant and enjoyable for pedestrians. Because these urban qualities are less prevalent in “Spot 1”, pedestrians may find walking in this area less desirable or less acceptable.

According to the research carried out utilizing the Garrett’s ranking technique, “Spot 4” produced the best result out of all the observed spots. This finding is significant since it indicates that, in comparison to other areas, “Spot 4” has shown a better degree of urban design qualities. Furthermore, this finding has also strengthened the individual qualities of urban design except only imageability. This means that

the qualities of urban design observed at “Spot 4” were more prominent and effective than those observed at other spots. This outcome is valuable because similar result as previous method. The Garrett's ranking technique was used to conclude that all urban design qualities have the highest value at “Spot 4” except imageability which excels at spot 1. The findings suggest that “Spot 4” is an ideal location for urban design interventions, and that the qualities observed at this spot can serve as a model for effective urban design in other locations.

Compare and contrast

The research findings indicate that the two methods used to determine the more walkable spot have resulted in different outcomes. The visual analysis technique, which involves the subjective interpretation of images, indicates that "Spot 2" was the most walkable area. On the other hand, the Garrett’s ranking technique, which is a quantitative measure of participant's importance, gives the highest rating to "Spot 4." These discrepancies may be attributed to the different approaches and methodologies used in each method, highlighting the importance of using multiple methods in urban design research. These results suggest that different methods may yield different results, and both subjective and objective measures should be considered when evaluating urban design.

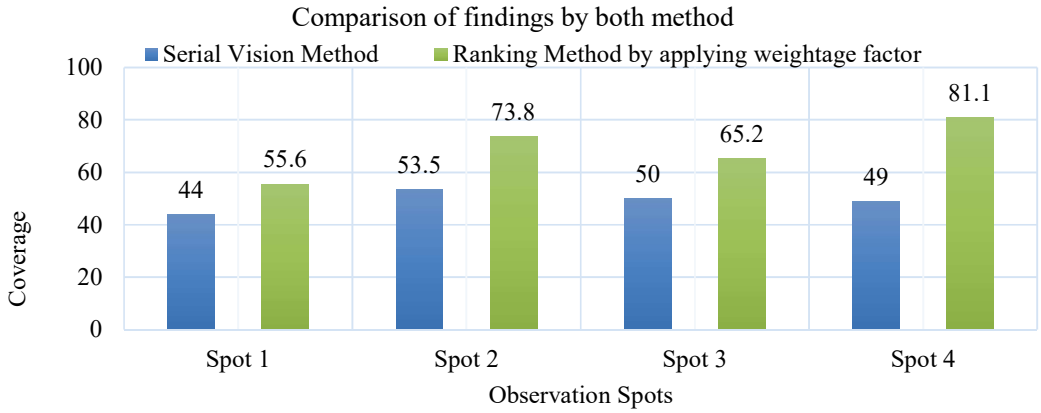

Figure 21: Comparisons of findings

Furthermore, the both methods identified "Spot 1" as having a high imageability rating, suggesting that it is visually appealing and memorable. Furthermore, the results of both methods indicate that "Spot 4" excels in other urban design qualities (enclosure, transparency and human scale). These results suggest that "Spot 4" is a more attractive and walkable area, considering multiple aspects of urban design.

Table 10: Comparison of urban design qualities

Description	Spot with maximum values	
	Serial Vision Method	Ranking Method
Walkable Spot	Spot 2`	Spot 4
Imageability	Spot 1	Spot 1
Enclosure	Spot 4	Spot 4
Transparency	Spot 4	Spot 4
Human Scale	Spot 4	Spot 4

Only coverage and the most crucial characteristics and spots were identified using the serial vision method; however, the underlying cause is unknown. This explanation was derived from the ranking methodology. The analysis of respondents' preferences further revealed the reasons behind their choices. As for "Imageability," the respondents who placed it as their primary preference described its attractiveness, strong visual impact, and ability to evoke positive memories. They appreciated the lasting impression it left and its potential to foster interest in exploring the surroundings. Respondents who ranked "Enclosure" as their top priority highlighted its advantages in terms of providing shelter, ensuring comfort, and offering protection from adverse weather conditions. The ability to locate shops

easily and the sense of safety it imparts were cited as essential elements contributing to its appeal. Those who prioritized "Human Scale" expressed that the spot's pleasant ambiance, visual appeal, and provision of resting areas were decisive factors. Additionally, attributes such as shade, accessibility, and seating facilities played significant roles in influencing their preferences. Regarding "Transparency," participants emphasized the importance of clear visibility, which allows for effortless browsing, effective navigation within the commercial hub, and quick identification of desired products or services. They also emphasized the enjoyable experience of window shopping and the overall aesthetic appeal of transparent spaces.

Finally, the findings from both literature analysis and people's perceptions provided valuable insights into creating a more walkable urban streetscape. Combining the results from the Serial Vision method and the ranking methodology enabled the determination of the most walkable spot and the identification of essential urban design qualities for achieving higher walkability. The prioritization of "Human Scale," "Enclosure," "Transparency," and "Imageability" offers valuable guidance for urban planners and designers seeking to enhance the walkability of urban spaces. By incorporating these design qualities effectively, cities can foster a more pedestrian-friendly environment that promotes physical activity, community engagement, and overall well-being.

Discussion

The objective of this research was to determine the most walkable spot among the selected locations through a combination of literature analysis and the assessment of people's perceptions. To achieve this, a two-fold approach was adopted, comprising the Serial Vision method from literature analysis and a ranking methodology based on respondents' perception of urban design qualities.

Firstly, the Serial Vision method was employed, drawing upon existing literature and "Spot 2" was identified as the most walkable spot. This method offers valuable insights into urban design features that contribute to enhanced walkability.

Secondly, the ranking method was utilized to assess people's perceptions regarding key urban design qualities. Participants were asked to rank four urban design qualities based on their preferences, and the Henry Garrett's ranking technique was employed to determine the most important urban design quality. According to the respondents, "Human Scale" emerged as the top priority, followed by "Enclosure," "Transparency," and "Imageability," in that order. The paramount importance of "Human Scale" in the participants' rankings can be attributed to its direct relevance to the comfort and experience of pedestrians within the urban environment. As a critical factor in creating vibrant and livable urban spaces, "Human Scale" emphasizes designing streetscapes that cater to pedestrians' needs. It focuses on creating a sense of intimacy and human interaction, offering walkable distances, pedestrian-friendly amenities, and an inviting environment that encourages people to walk, socialize, and explore the area on foot. Following closely behind, "Enclosure" secured the second position, underscoring the participants' recognition of the significance of a sense of enclosure and protection for pedestrians. Well-designed streetscapes with appropriate enclosure characteristics provide a safe and secure atmosphere. Strategically placed buildings, trees, and other elements create a cozy and comfortable environment, shielding pedestrians from traffic and noise, thus enhancing the overall walkability experience. "Transparency" attained the third rank, indicating that respondents also valued visual openness and clear connections within the urban environment. Streetscapes with transparency offer unobstructed views of adjacent spaces, businesses, and points of interest. This quality fosters a sense of connection with the surroundings, evoking curiosity and encouraging pedestrians to explore their environment more actively. Lastly, "Imageability" obtained the fourth position, suggesting that while it remains essential, participants ranked it lower compared to the other qualities. Streetscapes with high imageability are visually appealing and leave a lasting impression on pedestrians. However, respondents may have prioritized qualities that directly impact the practicality and comfort of walkability over purely aesthetic aspects.

The concept of a "walkable spot," as explored in this study, is dependent upon the specific methodology used to ascertain it within a particular setting. However, this method can be adapted for determining walkable areas in diverse contexts. Conversely, the results derived from the ranking method, which

prioritizes urban design attributes i.e., “Human Scale”, possess a more universal applicability, as they can be emphasize and employed across various urban settings for achieving higher walkable spots.

Conclusion

The study mentioned in the prompt was conducted to understand the perception of individuals regarding the walkability of urban environments. Walkability is an important attribute of urban design as it is closely related to the physical activity levels of individuals, which can have a significant impact on their health and well-being. Therefore, urban designers and planners are increasingly focused on creating walkable environments that are safe, attractive, and accessible for pedestrians.

In this study, Reid Ewing and Susan Handy's examination of urban design attributes identified “Spot 2” as the finest walkable component of the intersection. However, to validate this finding by investigating how individuals perceive the walkability of four observation spots in the area, a questionnaire survey was conducted to collect data on people's perceptions of these four spots and compared the results with those obtained through visual analysis. The Garrett’s ranking technique was used to analyse the data collected from the survey. This method is based on people's perceptions and measures the importance of different attributes of urban design for walkability. The results of this analysis showed that people's perceptions of walkability were different from the theoretical method used in the earlier analysis. In contrast to the previous finding, the results showed that “Spot 4” had the best urban design qualities for walkability according to people's priorities. The study highlights the importance of incorporating public perceptions into urban design and planning processes. While theoretical methods can provide valuable insights, it is essential to consider people's perceptions and preferences to create urban environments that are attractive, accessible, and safe for pedestrians. The findings of this study can inform urban design and planning decisions and help create more walkable environments that are conducive to physical activity and promote public health.

In the analysis conducted using the serial vision method, it was observed that transparency and human scale, two of the urban design qualities under consideration, initially received relatively lower coverage. This suggests that these qualities were not prominently perceived or emphasized by the respondents during their visual experience of the area. However, upon applying the weightage factor derived from the ranking method, a significant growth in the coverage of transparency and human scale was observed. This indicates that, despite their initial lower coverage, these urban design qualities gained enhanced importance and attention when the respondents' priorities and perceptions were taken into account.

The weightage factor, which was calculated based on the respondents' rankings and the utilization of Garrett's scores, played a crucial role in assigning greater significance to transparency and human scale. This adjustment in perception highlights the impact of individual preferences and priorities in shaping the perceived importance of urban design qualities. The findings suggest that the weightage factor, derived from the ranking method, serves as a valuable tool in understanding the subjective significance attributed to different urban design qualities. By incorporating the weightage factor into the evaluation of coverage through the serial vision method, it was possible to reveal the underlying importance and elevate the perceived significance of transparency and human scale in the urban environment.

The study's conclusions provide insightful guidance for urban planning initiatives that aim to improve walkability and user-friendliness in urban settings. Prioritizing pedestrian infrastructure must start with making sure that there are safe crosswalks, well-maintained sidewalks, and accessible facilities. Additionally, streets can be made more visually appealing and imageable by including unique architectural elements, public art, and distinctive landmarks. For pedestrians, enclosed areas created by well-planned building placement and landscaping promote a cozy and secure environment. Furthermore, safety and transparency can be improved by optimizing sightlines and visibility. Urban planning should prioritize human-scale design concepts, which take into account street widths, building heights, and street furniture placements. Essential elements of user-centric design are continuous maintenance and community engagement for feedback. Vibrant and pedestrian-friendly urban places are also facilitated by safety precautions, constant monitoring, design flexibility to meet the needs of varied neighborhoods, and promotion of walking's advantages. Last but not least, walking is promoted as a healthy and sustainable mode of transportation by seamless intermodal connectivity and integration

with public transportation. Urban design projects can successfully improve walkability by implementing these ideas, which will improve the general quality of life in urban areas and encourage sustainable urban living.

Further Research

This study aimed to identify the most pedestrian-friendly location using both theoretical analysis and public perception. The primary emphasis was on the research and theoretical findings. However, these research outcomes can also be applied to improve the streetscape at Itahari Chowk. By implementing design adjustments, subsequent employment of the serial vision approach could gauge whether walkability coverage indeed improves or not. This suggests that design intervention of streetscape for higher walkability presents a potential avenue for further research. Moreover, this research delves into only four specific urban design qualities, recognizing that there could be additional qualities that directly impact an area's walkability. Identifying these attributes may require more extensive methods such as in-depth interviews and qualitative research, which could serve as interesting topic for future investigation. It's also worth noting that perceptions of these urban design qualities may differ among individuals based on factors like gender and age, providing another potential area for future research exploration.

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Conflicts of Interest

The authors declare no conflict of interest.

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