

# ASSESSING VISUAL QUALITY PARAMETERS IN URBAN STREETScape ALONG TRANSIT CORRIDORS

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**Abstract.** With the world's rapid urban development, it has been observed that space for sociability has decreased. To overcome the impact of the same, streets should develop as an urban space along transit corridors. These spaces encourage meaning and identity creation by offering visual quality to everyone. This paper focuses on assessing parameters through which an urban streetscape along transit corridor can be analyzed to enhance visual quality. The authors suggest nine essential parameters based on literature review and expert interviews.

**Key words:** visual quality, human perception, spatial perception, greenery, transit corridor

## 1. Introduction

Urban spaces offer opportunities for human activities, to experience nature and promote walkability which reduces stress and health problems. These expected responses are witnessed in spaces with visual quality which create an urban image while developing a perception and association with that space (Ma *et al.*, 2021). According to Santosa in 2018, human preferences are influenced by city values which are dependent on how the city spaces are developed and maintained. Hence, streets with high visual quality create a positive emotion for the city (Santosa *et al.*, 2018).

In 2022, Global Designing Cities Initiative (GDCI) has defined the word "streets" as

an urban space which creates experiences for people. Roads are generally considered as a two-dimensional surface, mainly focused on vehicles to move people and goods from one place to another. Whereas streets are multidimensional spaces, where variety of uses and activities happen while facilitating movement and access.

Spatial arrangement and visual appearance of street elements like building and landscape features, form a "streetscape". It includes sidewalks, vehicle lanes, streetlights, street furniture, and other elements through which people identify a place and remember it. It is even considered as an outdoor room whose bottom plane is the ground,

buildings are the side planes, and tree canopy along the street edges acting as the top plane. Thus, the unification of natural and built fabric of the street creates a visual experience which defines the quality of the street.

“Street visual quality” is related to physical activity and movement especially when it has pedestrian circulation. A positive correlation has been noticed between activity (both social and commercial) and the presence of comfort, sense of place and greenery in the pedestrian space of the street. Jane Jacobs in 1961 elaborates that visual quality of a street was related to its elements which provide the opportunity of socializing. Kevin Lynch in 1984 describes it in terms of richness of activities. Allen Jacobs and Appleyard in 1987 discuss how visual diversity on a street with pedestrian movement and social activities, forms meaning and identity of the space. Researchers have elaborated the visual quality of streets in terms of the physical characteristics of the transit corridors through greenery, permeability, imageability, building form, greenery, physical activity, sense of place, and many other aspects.

It is estimated that 70% of the world population will reside in cities by 2050 (Lu *et al.*, 2018). Mounting cost pressures have resulted in a reduction of greenery ratio in cities, especially with the increasing construction of transit corridors. According to North America’s National Association of City Transportation, “transit corridors” are those streets which run parallel to the commercial corridors where focus is given to pedestrian activity and transit. The transit modes can be either bus rapid transit (BRT), light rail transit (LRT) or streetcar. These corridors

promote economic development of the city by building a mixed use space. To maintain the experience as well as welcome visitors, it is important to have visual quality in such corridors (Stojanovski, 2019; Adeel *et al.*, 2021). It has been suggested by the researchers that visual aspect of transit corridors influences human behavior, but this relationship has not been given its due importance (Adeel *et al.*, 2021). To understand the relationship between them, it is essential to understand the parameters which influence and constitute this relationship. To improve the focus on this research gap, the author aims to address it by assessing the parameters related to visual quality in urban streetscapes along the transit corridors.

Visual quality aspects related to streetscape have both spatial factors (like building form, pedestrian space, street greenery, etc.) and human perception factors (like imageability, permeability, sense of place, etc.). Designing any urban space needs to establish a relationship between people and the space. Hence, it is important to list down the significant parameters for assessing visual quality of a streetscape to help analyze the same across all scenarios and geographies. This paper aims to identify the visual quality parameters for an urban streetscape along transit corridor with the following objectives:

- 1.1. To conduct a comprehensive analysis of literature related to visual quality, streetscapes, and transit corridors.
- 1.2. To identify essential parameters through a synthesis of expert interviews and an extensive literature review.
- 1.3. To validate the feasibility of assessing visual parameters in the urban streetscape of a transit corridor.

## 2. Methodology

The paper is based on two steps, first gathering parameters through urban theorists' books and literature review via research papers and theses. Second was gathering parameters through expert interviews based on the Delphi method.

Online search engines like Web of Science, Science Direct, and Google Scholar were used to review the research papers. The keywords used to seek the research papers relevant to this paper were "streetscape", "visual quality", "transit corridor", "sense of place", and "greenery". Approximately, 450 research papers were studied for literature review. The literature review as well as expert interviews both gave a list of a thousand words each. These 2 lists had keywords, adjectives, prepositions, verbs, and nouns. Both lists were created with the help of "NVIVO 11" software. Both thousand-word lists were narrowed down to around a hundred and fifty keywords each (146 and 152 respectively) manually by the author using Microsoft Excel. Words like numbers (100, 2022, 500) and those with no relation to architecture or urban design were removed (like act, add, allow, another, care, done, mentioned, priority, understand and many more). Then each hundred- and fifty-word list was arranged under nine parameters as elaborated in section 3. These parameters were shortlisted based on their intent and definition as elaborated in literature review and expert interviews. The parameters in these two lists were common to each other. These parameters were categorized into two categories, spatial perception and human perception.

Urban Design books like Public Places-Urban Spaces (Carmona *et al.*, 2010), The Boulevard Book (Jacobs *et al.*, 2001), Great

Streets (Jacobs, 1993), Life Between Building: Using Public Space (Gehl, 1989), Death and Life of Great American Cities (Jacobs, 1982), Livable Streets (Appleyard, 1981), The Concise Townscape (Cullen, 1961), and The Image of the City (Lynch, 1960) were also referred to for this paper. These theorists elaborate on the desired qualities of streetscape and visual dimension which facilitate in developing a better space for people.

An unstructured interview technique named the Delphi method was selected for this study as it offers experts flexibility and comfort while reducing the chances for researcher's bias. The Delphi Method is a technique to take valuable inputs from experts in the form of rankings, ratings, or open questions (Beiderbeck *et al.*, 2021). The intention of the interview was to understand the experts' perception related to streetscape and its elements which enhance visual quality. Based on their opinion, the list of nine parameters was created. Interviews with fifteen experts were conducted, recorded, and converted to transcripts through online tools like "Podscastle", "Veed" and "Happy Scribe". These transcripts were then imported into the NVIVO 11 software was used to qualitative data analysis and to calculate the word count and weighted percentage (Phillips *et al.*, 2023; Daniel *et al.*, 2021). All further steps were taken as per the obtained word count and weighted percentage.

NVIVO 11 software generates the word count and its frequency list by analyzing the most frequently used word in a particular demographic. While running the word frequency query in the software it gives an option to select and shortlist words as per the words length as well as

number of words to be displayed in result. It also offers grouping options like exact match and stem together. The limitation of the software is its inability to identify keywords and analyze them. It provides an analysis of all words including less significant ones like conjunctions or prepositions.

The author while running the analysis in NVIVO 11 used a filter that the minimum letter count limit in a word should be 3 and above to remove conjunctions or prepositions. The purpose of word limit of 3 was to ensure keywords like air, eat or bus do not get eliminated in the filtration process. The initial result was a list of thousand plus words (1045 and 1096 respectively) each with their weighted percentages. These lists were sorted by weighted percentage in a descending order. However, the words after the 1000 mark had a weighted percentage equal to or approximately zero. Along with that, words were stemmed together, i.e., words with similar meanings were grouped together. For example, words like aesthetic, aesthetical, aesthetically, aesthetics were grouped together as aesthetic.

Three rounds of interviews were performed with fifteen experts including urban designers, urban planners, landscape architects, architects and planners from the industry, academia and government organizations like Lucknow Development Authority (LDA), Lucknow Nagar Nigam, and Lucknow Metro Authority to validate the parameters.

Starting with the parameters extracted from literature review, unstructured interviews with the experts were held in the first round to get their opinion on the extracted parameters. These inputs

were refined to form the next iteration of the parameters which again went through the above-mentioned process in the second round. Outputs from the second round were used to formulate the final consensus of the parameters related to visual quality of a streetscape. The paper discusses the final parameters obtained from the third iteration. These identified nine parameters are further categorized under two categories elaborated in 3.2 section. The multiple rounds helped cross-pollination of ideas between experts and reduced the personal bias effect of the interviewees and the author.

Shortlisting and grouping are an essential method to identify parameters and convert qualitative data to quantitative. However, there are limitations as well. It is a time intensive method as shortlisting was executed manually. Along with that, the 45 interviews (3 rounds each for fifteen experts) were extremely difficult to complete due to scheduling issues along with the time they took.

### [3. Results and discussion](#)

This section is divided into 5 parts. The first part is based on the varied perceptions of urban theorists and highlights keywords which are essential to visual quality of the urban streetscape. The second part elaborated on the use of the Delphi method and emphasizes identifying necessary keywords apart from the common keywords listed down in the literature review. The third part discusses in detail how the common keywords mentioned by theorists, researchers and experts were assembled into nine parameters. The fourth part discusses the two categories under which the nine parameters were grouped. The last part discusses the outcome of the above elaborated steps.

### *3.1.1. Literature review*

Lynch in 1960 elaborated that every individual has his/her own perception about the city and its space, and each perception is important. These perceptions evolve around five elements which make a city. These elements are “nodes, paths, edges, landmarks, and district”. He defines that a city’s visual quality develops through these elements. Understanding of human perception was established by surveying individuals on landmarks and locations. This process also included asking them to draw a sketch of a place (mental maps). Along with that, they were also asked to list down all the places they could recall in a short span of time. Through these mental maps, desirable parameters were identified for any urban space. They are “identity”, which is recognition of urban elements (streetscape elements), and “meaning” which is practical and emotional perception i.e., how people use the space for physical activity and what they remember about the space in the form of memory (Lynch, 1960).

Cullen in 1961 describes visual quality as a concept of “serial vision”, which is elaborated as experiencing a space while moving with pauses. He defines pauses as static possession, which is people interacting in groups, window shopping and local vendors selling. He also discusses the visual quality of a streetscape in terms of sense of place and content. He elaborates on the sense of place as how people perceive or record the place or remember the place through some activities. He describes content as quality of the space, which is achieved by defining the space well, segregating space for activities, and incorporating buildings as well as landscape, forming a relationship with the vicinity (Cullen, 1961).

Appleyard in 1981 mentions street visual quality depends on street greenery, safety, sidewalks, vehicle lane, and building form. As per him, comfort and human interaction enhances a street’s visual and aesthetic qualities. This argument was supported with the help of a survey, that with the increase in traffic volume, the threshold of spaces for physical activity diminished. Also, he describes that various stakeholders are involved in transforming a space into a place, and then later to a neighborhood or city. As everyone plays a role in defining a space, that’s why different stakeholders were surveyed. They were asked to develop image maps (like mental maps suggested by Lynch in 1960) about their notion of a space on a tracing paper laid over building footprint section (Appleyard, 1981).

Jacob in 1982 discusses that visual impression of streets is through functional order with intense and diverse activities forming an enclosure and entity. According to her, trees should be provided along the sidewalks for visual emphasis as they provide a sense of security. Safety, interaction, imageability, walkability, scale, and frontage are essential parameters which enhance streetscape and economic development (Jacobs, 1982).

As per Gehl in 1989, visual expression of cities is based on safety and social activities. The parameters which influence the visual expression are permeability and legibility of a space for event and function. Along with that, the space should offer a sense of place and safety to enhance visual quality. Space offers meaningful opportunity when people are at ease and able to experience or socially interact. This is possible when the physical structure supports social



quality and is broken down in a hierarchical manner of public, semi-private and private domain. This is how an individual processes the visual impression of a space (Gehl, 1989).

Jacob in 1993 considered that streets are the most basic element which facilitates social interaction. It also allows for commercial encounters and exchange. He focuses on their visual aspects by making them a meaningful space for humans through building forms and activities. He defines the visual quality of a streetscape using parameters like scale, enclosure, physical activity, sidewalks, and trees. He highlights that a tree alone was able to attract people to walk on the sidewalks in any season. He also describes three essential attributes for each street. First, a pedestrian realm which includes a well-defined space for people to walk around. Second was physical comfort in terms of walkability and last was a defined space in terms of sense of place (Jacobs, 1993).

Jacob in 2001 brought attention to boulevards with poorly designed pedestrian movement and a deliberate emphasis on vehicular traffic. He suggested that there should be tree lines and dedicated lanes for different movements. The essential parameters which enhance the visual quality were livability, safety, and open spaces for any streetscape (Jacobs *et al.*, 2001).

Carmona in 2010 considered the visual quality of an urban space, a mixture of perception and cognition. It depends on how people perceive, interpret, and use it. He defined visual quality of a streetscape through imageability, legibility, building form and its characteristics, comfort, human-scale, safety, human perception, naturalness, open spaces, sense of place, enclosure,

and walkability. He concluded by emphasizing buildings along the streets with interactive spaces having streets elements and soft landscape together enhance or reinforce visual interest. The key attributes which support the enhancement and reinforcement of streetscape visual quality were comfort, imageability, access, usage, activity, sociability, and safety (Carmona *et al.*, 2010).

Multiple theorists and researchers have postulated that the visual quality of a streetscape was significantly dependent on following parameters – comfort, vehicle lane, building form, greenery system, imageability, sense of place, pedestrian path, physical activity, and permeability. These parameters were commonly used as illustrated by their occurrence counts in Table 1. Reasons on why these parameters were arrived upon will be discussed in detail in section 3.3.

### 3.1.2. Expert interviews (Delphi method)

The author reached out to Indian experts, all of whom are academicians, urban planners, landscape architects, architects, and professional urban designers and planners in renowned private firms, Lucknow Development Authority (LDA), Lucknow Nagar Nigam, and Lucknow Metro Authority. Each expert has experience of more than two decades in their respective fields. The Delphi method helped identify the nine parameters, physical activity, comfort, transit corridor, building form, greenery system, imageability, sense of place, pedestrian lane, and permeability. These parameters were repetitively used, have occurred most frequently and have the highest weighted percentage in the interviews. These nine parameters were categorized into two categories, as discussed in the next section.

Table 1. List of parameters identified from various urban theorist books (Source: Author).

| S.No. | Book   | Words stated in book | Author Suggested parameters | Count |
|-------|--|----------------------|-----------------------------|-------|
| 1     | The Image of the City (Lynch, 1960)                    | Nodes                | Physical Activity           | 12    |
| 2     |  | Paths                | Pedestrian Path             | 7     |
| 3     |  | Edges                | Pedestrian Path             | 7     |
| 4     |  | Landmarks            | Imageability                | 7     |
| 5     |  | District             | Building Form               | 10    |
| 6     |  | Legibility           | Imageability                | 7     |
| 7     |  | Trees                | Greenery System             | 10    |
| 8     |  | Meaning              | Imageability                | 7     |
| 9     | The Concise Townscape (Cullen, 1961)                   | Serial vision        | Sense of Place              | 7     |
| 10    |  | Activity             | Physical Activity           | 12    |
| 11    |  | Landscape            | Greenery System             | 10    |
| 12    | Livable Streets (Appleyard, 1981)                      | Streets Greenery     | Greenery System             | 10    |
| 13    |  | Physical Activity    | Physical Activity           | 12    |
| 14    |  | Safety               | Comfort                     | 12    |
| 15    |  | Sidewalks            | Pedestrian Path             | 7     |
| 16    |  | Light Rail Transit   | Vehicle lane                | 2     |
| 17    |  | Building form        | Building Form               | 10    |
| 18    |  | Comfort              | Comfort                     | 12    |
| 19    |  | Human Interaction    | Physical Activity           | 12    |
| 20    | Death and Life of Great American Cities (Jacobs, 1982) | Activity             | Physical Activity           | 12    |
| 21    |  | Trees                | Greenery System             | 10    |
| 22    |  | Sidewalks            | Pedestrian Path             | 7     |
| 23    |  | Sense of security    | Comfort                     | 12    |
| 24    |  | Walkability          | Comfort                     | 12    |
| 25    |  | Scale                | Building Form               | 10    |
| 26    |  | Interaction          | Physical Activity           | 12    |
| 27    |  | Imageability         | Imageability                | 7     |
| 28    |  | Safety               | Comfort                     | 12    |
| 29    | Life Between Building: Using Public Space (Gehl, 1989) | Safety               | Comfort                     | 12    |
| 30    |  | Bus                  | Vehicle lane                | 2     |
| 31    |  | Social activities    | Physical Activity           | 12    |
| 32    |  | Accessibility        | Permeability                | 5     |
| 33    |  | Legibility           | Imageability                | 7     |
| 34    |  | Sense of place       | Sense of Place              | 7     |
| 35    |  | Interaction          | Physical Activity           | 12    |
| 36    | Great Streets (Jacobs, 1993)                           | Interaction          | Physical Activity           | 12    |
| 37    |  | Building forms       | Building Form               | 10    |
| 38    |  | Scale                | Building Form               | 10    |
| 39    |  | Walkability          | Comfort                     | 12    |
| 40    |  | Comfort              | Comfort                     | 12    |
| 41    |  | Sense of Place       | Sense of Place              | 7     |
| 42    |  | Meeting              | Physical Activity           | 12    |
| 43    |  | Enclosure            | Building Form               | 10    |
| 44    |  | Plantation           | Greenery System             | 10    |
| 45    |  | Physical Activity    | Physical Activity           | 12    |
| 46    |  | Sidewalks            | Pedestrian Path             | 7     |
| 47    |  | Trees                | Greenery System             | 10    |
| 48    | The Boulevard Book (Jacobs et al., 2001)               | Livability           | Accessibility               | 5     |
| 49    |  | Trees                | Greenery System             | 10    |
| 50    |  | Safety               | Comfort                     | 12    |
| 51    |  | Open spaces          | Greenery System             | 10    |

| S.No. | Book   | Words stated in book               | Author Suggested parameters | Count |
|-------|--|------------------------------------|-----------------------------|-------|
| 52    | Public Places<br>Urban Spaces<br>(Carmona <i>et al.</i> , 2010), | Access                             | Permeability                | 5     |
| 53    |  | Sidewalks                          | Pedestrian Path             | 7     |
| 54    |  | Perception                         | Sense of Place              | 7     |
| 55    |  | Naturalness                        | Greenery System             | 10    |
| 56    |  | Open spaces                        | Greenery System             | 10    |
| 57    |  | Pedestrian                         | Pedestrian Path             | 7     |
| 58    |  | Sense of place                     | Sense of Place              | 7     |
| 59    |  | Legibility                         | Imageability                | 7     |
| 60    |  | Access                             | Permeability                | 5     |
| 61    |  | Building Facade                    | Building Form               | 10    |
| 62    |  | Enclosure                          | Building Form               | 10    |
| 63    |  | Robust                             | Permeability                | 5     |
| 64    |  | Walkability                        | Comfort                     | 12    |
| 65    |  | Activity                           | Physical Activity           | 12    |
| 66    |  | Imageability                       | Imageability                | 7     |
| 67    |  | Built form and its characteristics | Building Form               | 10    |
| 68    |  | Comfort                            | Comfort                     | 12    |
| 69    |  | Safety                             | Comfort                     | 12    |
| 70    |  | Sociability                        | Sense of Place              | 7     |
| 71    |  | Scale                              | Building Form               | 10    |
| 72    |  | Human perception                   | Sense of Place              | 7     |

(pedestrian path and physical activity) and vehicular lane.

### 3.2. Categorization

Words extracted from NVIVO 11, and Microsoft Excel were grouped into the above elaborated nine parameters according to their definitions and explanation as per various theorists, researchers, and experts. The nine parameters were then grouped into two categories as per domain coverage (Illustrated in Table 2). The First category is “spatial perception” which consists of four parameters, street greenery, building form, vehicle lane and pedestrian space. The second category is “Human Perception”, elaborated through comfort, imageability, permeability and sense of place.

#### 3.2.1. Spatial Perception

Perception of any space is dependent on physical and tactile qualities which form a sense and picture of a place influencing its visual quality. Hence, spatial perception includes all physical aspects of a streetscape which are street greenery, building form, pedestrian spaces

Table 2. Parameters assembled under two categories (Source: Author).

| S.No. | Parameter         | Category           |
|-------|-------------------|--------------------|
| 1     | Street greenery   | Spatial Perception |
| 2     | Pedestrian path   |                    |
| 3     | Physical activity |                    |
| 4     | Building form     |                    |
| 5     | Vehicle lane      | Human Perception   |
| 6     | Comfort           |                    |
| 7     | Imageability      |                    |
| 8     | Permeability      |                    |
| 9     | Sense of place    |                    |

#### 3.2.1.1. Street Greenery

The parameter street greenery includes two sub parameters vegetation and greenery systems. “Greenery system” is a system which includes trees against wall and modular greenery in the form of living wall, green wall, green façade and many more (Al-Kayiem *et al.*, 2020; Goel *et al.*, 2022). Whenever greenery systems have been discussed in reference literature, it is in the above forms only. Therefore, all greenery forms will be



discussed under the category “street greenery”. “Vegetation” refers to the plant community that has developed naturally, without any human intervention. This includes keywords like greenery, plantation, park, landscape, open spaces, vegetation, species and shrub from the literature review and expert interview round (Box and Fujiwara, 2013).

As per the literature review, words with similar meaning as “vegetation” and “greenery system”, have been listed in Table 3. Similarly, words extracted from expert interviews have been listed in Table 4. Words mentioned in Table 3 and 4 respectively are all related to greenery, and its types in different forms.

### 3.2.1.2. Pedestrian Space

Pedestrian space parameter includes two sub parameters pedestrian path and physical activity.

The pedestrian path focuses on street elements and open spaces. These spaces include sidewalks and street furniture like benches, light, signages, facilities, etc. In short, all the elements available within the right of way.

The parameter “physical activity” includes social and commercial activities such as socializing, interacting, playing, shopping, sitting, selling, and eating (Koohsari *et al.*, 2015). “Interaction” is communication between individuals or a group of individuals in an urban space. It focuses on how the design of an urban space in the built environment influences people and their activities (Ghahtarani *et al.*, 2020). Hence it is tagged under “physical activity”.

Table 3. Similar words for street greenery as per the literature review (Source: Author).

| S. No.           | Word              | Count  | Weighted Percentage |
|------------------|-------------------|--------|---------------------|
| 1.1              | Vegetation        | 81547  | 2.10                |
| 1.1.1            | Greenery          | 40819  | 1.22                |
| 1.1.2            | Plantation        | 9975   | 0.21                |
| 1.1.3            | Park              | 8759   | 0.19                |
| 1.1.4            | Landscape         | 6974   | 0.15                |
| 1.1.5            | Open spaces       | 4530   | 0.10                |
| 1.1.6            | Vegetation        | 4471   | 0.10                |
| 1.1.7            | Species           | 4714   | 0.10                |
| 1.1.8            | Shrub             | 1305   | 0.03                |
| 1.2              | Greenery system   | 36537  | 0.79                |
| 1.2.1            | Green wall        | 4966   | 0.11                |
| 1.2.2            | Living wall       | 2605   | 0.06                |
| 1.2.3            | Green facade      | 2329   | 0.05                |
| 1.2.4            | Trees             | 6304   | 0.13                |
| 1.2.5            | Greenery system   | 16201  | 0.35                |
| 1.2.6            | Vertical greenery | 4132   | 0.09                |
| Total (1.1 +1.2) | Street greenery   | 118084 | 2.89                |

Table 4. Similar words for street greenery as per expert interviews (Source: Author).

| S. No.           | Word              | Count | Weighted Percentage |
|------------------|-------------------|-------|---------------------|
| 1.1              | Vegetation        | 254   | 2.7                 |
| 1.1.1            | Greenery          | 140   | 1.49                |
| 1.1.2            | Plantation        | 11    | 0.12                |
| 1.1.3            | Park              | 12    | 0.12                |
| 1.1.4            | Landscape         | 47    | 0.50                |
| 1.1.5            | Open spaces       | 8     | 0.09                |
| 1.1.6            | Vegetation        | 19    | 0.20                |
| 1.1.7            | Species           | 10    | 0.11                |
| 1.1.8            | Shrub             | 7     | 0.07                |
| 1.2              | Greenery system   | 186   | 1.98                |
| 1.2.1            | Green wall        | 40    | 0.43                |
| 1.2.2            | Living wall       | 10    | 0.11                |
| 1.2.3            | Green facade      | 5     | 0.05                |
| 1.2.4            | Trees             | 38    | 0.40                |
| 1.2.5            | Greenery system   | 90    | 0.96                |
| 1.2.6            | Vertical greenery | 3     | 0.03                |
| Total (1.1 +1.2) | Street greenery   | 347   | 3.69                |

As per the literature review, words with similar meaning as “pedestrian path” and “physical activity”, have been listed in Table 5 and 6 respectively. Similarly, words extracted from expert interviews have been listed in Table 7 and 8 respectively.

**Table 5.** Similar words for pedestrian path as per the literature review (Source: Author).

| S. No. | Word            | Count | Weighted Percentage |
|--------|-----------------|-------|---------------------|
| 3.1    | Facilities      | 10209 | 0.22                |
| 3.2    | Pedestrian      | 7082  | 0.15                |
| 3.3    | Sidewalks       | 7007  | 0.15                |
| 3.4    | Cycle           | 5832  | 0.12                |
| 3.5    | Open Spaces     | 4530  | 0.10                |
| 3.6    | Signage         | 858   | 0.02                |
| 3.7    | Furniture       | 565   | 0.01                |
| 3.8    | Light           | 3254  | 0.07                |
| Total  | Pedestrian path | 39337 | 0.84                |

**Table 6.** Similar words for pedestrian path as per expert interviews (Source: Author).

| S. No. | Word            | Count | Weighted Percentage |
|--------|-----------------|-------|---------------------|
| 3.1    | Facilities      | 18    | 0.19                |
| 3.2    | Pedestrian      | 29    | 0.31                |
| 3.3    | Sidewalks       | 13    | 0.14                |
| 3.4    | Cycle           | 15    | 0.16                |
| 3.5    | Open Spaces     | 8     | 0.09                |
| 3.6    | Signage         | 7     | 0.07                |
| 3.7    | Furniture       | 19    | 0.20                |
| 3.8    | Light           | 16    | 0.17                |
| Total  | Pedestrian path | 125   | 1.33                |

### 3.2.1.3. Building form

Building form refers to how a building responds to the street and open space in its vicinity. It also refers to building height, type, function, and appearance. While analyzing any built form, they are studied as per the building layers which include building typology, building use, building height, and building facade. The scale of a building also plays a vital role in understanding its relationship to its contextual surroundings (Boeing, 2018).

**Table 7.** Similar words for physical activity as per the literature review (Source: Author).

| S. No.               | Word                | Count | Weighted Percentage |
|----------------------|---------------------|-------|---------------------|
| 4.1                  | Social              | 29527 | 0.63                |
| 4.1.1                | Socializing         | 12157 | 0.26                |
| 4.1.2                | Activities          | 8478  | 0.18                |
| 4.1.3                | Interaction         | 3744  | 0.08                |
| 4.1.4                | Playing             | 3230  | 0.07                |
| 4.1.5                | Shopping            | 1610  | 0.03                |
| 4.1.6                | Sitting             | 308   | 0.01                |
| 4.2                  | Commerce            | 3370  | 0.08                |
| 4.2.1                | Market              | 2313  | 0.05                |
| 4.2.2                | Vendors             | 409   | 0.01                |
| 4.2.3                | Selling             | 318   | 0.01                |
| 4.2.4                | Kiosks              | 330   | 0.01                |
| Total<br>4.1+<br>4.2 | Physical activities | 32897 | 0.71                |

**Table 8.** Similar words for physical activity as per expert interviews (Source: Author).

| S. No.               | Word                | Count | Weighted Percentage |
|----------------------|---------------------|-------|---------------------|
| 4.1                  | Social              | 132   | 1.4                 |
| 4.1.1                | Socializing         | 23    | 0.25                |
| 4.1.2                | Activities          | 24    | 0.25                |
| 4.1.3                | Interaction         | 27    | 0.29                |
| 4.1.4                | Playing             | 20    | 0.21                |
| 4.1.5                | Shopping            | 25    | 0.26                |
| 4.1.6                | Sitting             | 13    | 0.14                |
| 4.2                  | Commerce            | 53    | 0.55                |
| 4.2.1                | Market              | 7     | 0.07                |
| 4.2.2                | Vendors             | 36    | 0.38                |
| 4.2.3                | Selling             | 5     | 0.05                |
| 4.2.4                | Kiosks              | 5     | 0.05                |
| Total<br>4.1+<br>4.2 | Physical activities | 185   | 1.95                |

“District” is recognized by a place having its own character through its physical characteristics of the building form like texture, color, frontage, building use and many others (Lynch, 1960). “Frontage” is defined as front or facade of any building and as such is represented under “building form” (Sung, 2016; Balasubramanian *et al.*, 2022).

“Edge” refers to the interface between the elements which impact the overall character, functionality, and visual quality of a space. In case of streetscape, the transition zone is between a street and the adjacent building or sidewalks, is considered the edge (Simpson *et al.*, 2019).

“Enclosure” in the urban context means when a public space is surrounded by vertical elements such as buildings and walls. As it is dependent on buildings, that’s why it has been considered under the building form category (Yin, 2016; Ewing and Handy, 2009).

“Scale” of a space is defined as the size, height, depth, width, and setback in comparison to the surrounding building forms and streets. Hence, it is categorized under the category “building form” (Ewing and Handy, 2009).

Table 9. Similar words for building form as per the literature review (Source: Author).

| S.No. | Word              | Count | Weighted Percentage |
|-------|-------------------|-------|---------------------|
| 1     | Building Use      | 21085 | 0.45                |
| 2     | Building form     | 9417  | 0.20                |
| 3     | Scale             | 4024  | 0.09                |
| 4     | Building Function | 3899  | 0.08                |
| 5     | Building Facade   | 2488  | 0.05                |
| 6     | Building Height   | 1764  | 0.04                |
| 7     | Edge              | 1496  | 0.03                |
| 8     | Building Typology | 623   | 0.01                |
| 9     | Enclosure         | 432   | 0.01                |
| Total | Building Form     | 45228 | 0.96                |

As per the literature review, the words with similar meaning related to “building form” have been listed in Table 9. Similarly, words extracted through expert interviews have been listed down in

Table 10. Words mentioned in Table 9 and 10 are related to buildings, and their different forms and urban layers.

Table 10. Similar words for building form as per expert interviews (Source: Author).

| S.No. | Word              | Count | Weighted Percentage |
|-------|-------------------|-------|---------------------|
| 1     | Building Use      | 84    | 0.89                |
| 2     | Building form     | 15    | 0.16                |
| 3     | Scale             | 2     | 0.02                |
| 4     | Building Function | 17    | 0.18                |
| 5     | Building Facade   | 6     | 0.06                |
| 6     | Building Height   | 5     | 0.05                |
| 7     | Edge              | 8     | 0.09                |
| 8     | Building Typology | 17    | 0.18                |
| 9     | Enclosure         | 1     | 0.01                |
| Total | Building Form     | 155   | 1.64                |

#### 3.2.1.4. Vehicle Lane

Urbanization and globalization have led to mixed used development along transit-oriented development (TOD) corridor. The increase in number of cars and other vehicles has exacerbated traffic pressure on existing mobility systems, which in turn has reduced the streetscape green cover. To alleviate these issues, flyovers and other transit systems like metro, bus, etc. are being constructed on the vehicle lanes which impact the sense of enclosure and belongingness for pedestrians.

As per the literature review, the words with similar meaning related to “vehicle lane” have been listed in Table 11. Similarly, words extracted through expert interviews have been listed down in Table 12.

#### 3.2.2. Human Perception

“Human perception” recognizes and analyzes responses to objects in space, based on human memory. It is a visual

survey based on the form, appearances and composition of the objects forming a personal connection with the objects (Jia *et al.*, 2022). Hence the parameters based on human perceptions are listed down in this category which are comfort, imageability, permeability and sense of place.

**Table 11.** Similar words for vehicle lane as per the literature review (Source: Author).

| S.No. | Word                | Count | Weighted Percentage |
|-------|---------------------|-------|---------------------|
| 1     | Road                | 10644 | 0.23                |
| 2     | Vehicle             | 6875  | 0.15                |
| 3     | Bus                 | 6881  | 0.14                |
| 4     | Metros              | 5483  | 0.12                |
| 5     | Car                 | 3610  | 0.07                |
| 6     | Flyover Under Space | 1383  | 0.03                |
| Total | Vehicle lane        | 34876 | 0.74                |

**Table 12.** Similar words for vehicle lane as per expert interviews (Source: Author).

| S.No. | Word                | Count | Weighted Percentage |
|-------|---------------------|-------|---------------------|
| 1     | Road                | 1     | 0.01                |
| 2     | Vehicle             | 33    | 0.34                |
| 3     | Bus                 | 7     | 0.07                |
| 4     | Metros              | 9     | 0.10                |
| 5     | Car                 | 8     | 0.09                |
| 6     | Flyover Under Space | 34    | 0.36                |
| Total | Vehicle lane        | 92    | 0.97                |

### 3.2.2.1. Comfort

“Comfort” is an experience of easement, relaxation and freedom from distress and exposure to unpleasant atmosphere caused by wind, heat, rain, traffic, and pollution, both noise and environmental. This feeling enhances walking, cycling, sitting, playing, standing, talking, reading, or relaxing in any space by an individual or a group and transforms a space into an active place. It also enforces a sense of safety among individuals. Comfort is dependent on “safety” and “walkability” in any space (Shao, 2023; Ewing and Handy, 2009).

“Walkability” is a concept which measures whether an area promotes walking or not. It is about designing a space which maximizes the movement on foot rather than vehicle movement. People walk around only if they feel comfortable and safe exploring an interesting area (Ewing and Handy, 2009).

“Safety” is not just a personal experience but also a architectural, social, environmental, and infrastructural quality. In the architectural context, safety is experienced through the concept of “eyes on the street”. People feel secure when there is movement and activities visible around, forming a sense of social cohesion (Jacobs, 1982). In the social context, the activeness and liveliness of a space brings out human interaction in the form of both formal and informal activities. In the environmental context, greenery creates a comfortable atmosphere for people to experience. In the infrastructural context, walkability to one’s destination provides a feeling of safety. These above contexts together create a safe and secure place and develops easement and comfortable environment (Rastyapina, 2006).

As per the literature review, the words with similar meaning related to “comfort” have been listed in Table 13. Similarly, words extracted through expert interviews have been listed down in Table 14.

### 3.2.2.2. Imageability

“Imageability” refers to identity, meaning, legibility, visual, landmark, and aesthetics. “Identity and meaning” signifies how people remember and feel about a place (Dai *et al.*, 2021; Ewing and Handy, 2009). “Legibility” in urban design means the tendency of a place to

be memorable and recognizable through its unique combination of elements. This helps in enhancing the street image (Lynch, 1960; Taylor, 2009; Koseoglu, 2011).

**Table 13.** Similar words for comfort as per the literature review (Source: Author).

| S.No. | Word        | Count | Weighted Percentage |
|-------|-------------|-------|---------------------|
| 1     | Safety      | 9084  | 0.19                |
| 2     | Walkability | 6531  | 0.14                |
| 3     | Comfort     | 1975  | 0.04                |
| Total | Comfort     | 17590 | 0.37                |

**Table 14.** Similar words for comfort as per expert interviews (Source: Author).

| S.No. | Word        | Count | Weighted Percentage |
|-------|-------------|-------|---------------------|
| 1     | Safety      | 13    | 0.13                |
| 2     | Walkability | 48    | 0.51                |
| 3     | Comfort     | 29    | 0.31                |
| Total | Comfort     | 90    | 0.95                |

“Visual” is a crucial element in forming an imageability of a space. With the help of visual characteristics, a place is made memorable and recognizable. “Landmarks” is one of the ways to achieve the same. They help the individual to orient and create a mental map of a place. They can be any architectural feature, natural elements, or iconic structure. This helps create a strong visual image of the place (Lynch, 1960; Ewing and Handy, 2009).

“Aesthetic” is about the visual attractiveness enhancing the overall quality and appeal of a place. The elements which focus on aesthetics of streetscapes are its elements, buildings, and vegetation which tend to capture people’s attention and leave a lasting impression contributing to imageability (Balasubramanian, 2022).

As per the literature review, the words with similar meaning related to

“imageability” have been listed in Table 15. Similarly, words extracted through expert interviews have been listed down in Table 16.

**Table 15.** Similar words for imageability as per the literature review (Source: Author).

| S.No. | Word         | Count | Weighted Percentage |
|-------|--------------|-------|---------------------|
| 1     | Visual       | 10746 | 0.22                |
| 2     | Identity     | 4964  | 0.1                 |
| 3     | Imageability | 3464  | 0.07                |
| 4     | Aesthetic    | 2881  | 0.06                |
| 5     | Legibility   | 296   | 0.01                |
| 6     | Landmark     | 261   | 0.01                |
| Total | Imageability | 22612 | 0.47                |

**Table 16.** Similar words for imageability as per expert interviews (Source: Author).

| S.No. | Word         | Count | Weighted Percentage |
|-------|--------------|-------|---------------------|
| 1     | Visual       | 85    | 0.91                |
| 2     | Identity     | 2     | 0.02                |
| 3     | Imageability | 6     | 0.06                |
| 4     | Aesthetic    | 17    | 0.18                |
| 5     | Legibility   | 5     | 0.05                |
| 6     | Landmark     | 2     | 0.02                |
| Total | Imageability | 117   | 1.24                |

### 3.2.2.3. Permeability

“Permeability” is the quality of being able to cut through vehicular and pedestrian movement, visually or physically (Carmona *et al.*, 2010).

“Livability” is measured in terms of ease of access to amenities like food, water, transport, education, open green space, and many others. To achieve that, there should be a proper connection and linkage to space (Higgs *et al.*, 2019). “Linkage” is about connecting different elements on the streets. Through this, important nodes are connected, and people reach different desired destinations (Cheng *et al.*, 2013). “Nodes” are points that link different neighborhood places which have diverse uses such as shopping, community, libraries, residences, and institutions



(Lynch, 1960; Cheng *et al.*, 2013). Hence, they are grouped under the parameter “permeability”.

“Accessibility” is the about how easy it is to get to any place without any obstacles. It makes a place for all, removing barriers and promoting inclusivity. “Inclusive” refers to making the place accessible for all and not being discriminated against based on socio-economic status, gender, age, sexual identity, religion, or nationality. They are allowed to participate equally in each activity and opportunity (Mora *et al.*, 2017; Gaglione *et al.*, 2022). Hence, they are grouped under the parameter “permeability”.

“Entry” and “Exit” to the destination should be permeable so that any commuter or visitor can identify the place from afar. It is dependent on the pedestrian network’s ability to promote walkability while offering transparency and robustness (Andrade *et al.*, 2018; Subramanian and Jana, 2018). “Transparency” creates a visual connection between different spaces, develops a sense of openness and promotes a desire to keep your “eyes on the street”. A transparent visual helps people understand the place, its functions and activities. A place with a clear entry and exit, and transparency, promotes visual connection and improves orientation (Ewing and Handy, 2009). Hence, they are grouped under the parameter “permeability”.

As per the literature review, the words with similar meaning related to “permeability” have been listed in Table 17. Similarly, words extracted through expert interviews have been listed down in Table 18.

**Table 17.** Similar words for permeability as per the literature review (Source: Author).

| S.No. | Word          | Count | Weighted Percentage |
|-------|---------------|-------|---------------------|
| 1     | Accessibility | 9954  | 0.21                |
| 2     | Inclusive     | 2524  | 0.06                |
| 3     | Linkage       | 1657  | 0.04                |
| 4     | Entry         | 998   | 0.02                |
| 5     | Permeability  | 868   | 0.02                |
| 6     | Livability    | 751   | 0.02                |
| 7     | Nodes         | 559   | 0.01                |
| 8     | Transparency  | 475   | 0.01                |
| 9     | Exit          | 288   | 0.01                |
| Total | Permeability  | 34876 | 0.74                |

**Table 18.** Similar words for permeability as per expert interviews (Source: Author).

| S.No. | Word          | Count | Weighted Percentage |
|-------|---------------|-------|---------------------|
| 1     | Accessibility | 32    | 0.33                |
| 2     | Permeability  | 31    | 0.32                |
| 3     | Inclusive     | 3     | 0.03                |
| 4     | Linkage       | 1     | 0.01                |
| 5     | Entry         | 7     | 0.07                |
| 6     | Livability    | 3     | 0.03                |
| 7     | Nodes         | 11    | 0.11                |
| 8     | Transparency  | 12    | 0.12                |
| 9     | Exit          | 5     | 0.05                |
| Total | Permeability  | 92    | 0.97                |

#### 3.2.2.4. Sense of Place

“Sense of place” is the emotional connection felt by people for a place for its tangible and intangible qualities. It is based on individual meaning, perception, and attachment to a space (Rajala *et al.*, 2020).

“Sociability” is a perception of an individual or a group where they feel attracted to a space which leads to social and leisure activities. What one finds attractive varies significantly (Mehta, 2009; Oppong *et al.*, 2017). “Serial vision” is how each individual or group experiences a space differently (Cullen, 1961). All these have been tagged under the parameter “sense of place”.

“Attachment” is the about the bond a person forms with a place and its characteristics. This attachment is based on any symbol which creates meaning for that place (Mehta, 2009; Carmona *et al.*, 2010; Oppong *et al.*, 2017). “Symbolism” gives an identity to a place and develops meaning for a group of individuals. Any architectural feature, public space or urban intervention can be signified as a symbol forming the sense of the place for an individual (Carmona *et al.*, 2010). “Meaning” encompasses distinctive characteristics that reflect and reinforce the sense of a place, belongingness and attachment among residents and visitors (Carmona *et al.*, 2010; Rajala *et al.*, 2020). “Belongingness” is about creating an environment with sense of attachment with the place. This allows for personalization and taking pride in taking care of the surroundings. Developing community space for attachment, symbols, meaning and belongingness forms a sense of place (Mehta, 2009; Carmona *et al.*, 2010).

“Behaviour” is a user centric approach, focusing on the needs and preferences of how people use a space (Mehta, 2009; Carmona *et al.*, 2010). “Observation” is when people discern and analyze how an individual uses, moves and interacts in any space. Understanding human behaviours and designing a space accordingly creates a desirable environment, supports interaction, and enhances the sense of place among individuals (Mehta, 2009; Carmona *et al.*, 2010).

A “friendly” environment in a space is essential for encouraging social interaction. These spaces encourage a sense of belongingness and connection amongst the community. These spaces should be attractive and inviting with the provision of amenities like greenery, sidewalks and

diverse uses (Mehta, 2009; Carmona *et al.*, 2010; Rajala *et al.*, 2020). “Attraction” is creating a visually appealing environment to attract people through greenery, architecture, and other elements (Mehta, 2009; Carmona *et al.*, 2010; Rajala *et al.*, 2020). By considering these aspects, a friendly and attractive streetscape can be created which encourages social interaction, supports activity and enhances the sense of the place.

As per the literature review, words with similar meaning to “sense of place” have been listed in Table 19. Similarly, words extracted through expert interviews have been listed down in Table 20.

Table 19. Similar words for transit corridor as per the literature review (Source: Author).

| S.No. | Word           | Count | Weighted Percentage |
|-------|----------------|-------|---------------------|
| 1     | Place          | 26024 | 0.55                |
| 2     | Perception     | 7365  | 0.16                |
| 3     | Attachment     | 4963  | 0.1                 |
| 4     | Meaning        | 3659  | 0.08                |
| 5     | Behaviour      | 3038  | 0.07                |
| 6     | Observing      | 3014  | 0.06                |
| 7     | Sense          | 2252  | 0.05                |
| 8     | Attraction     | 1909  | 0.04                |
| 9     | Friendly       | 954   | 0.02                |
| 10    | Symbolism      | 711   | 0.02                |
| 11    | Belongingness  | 349   | 0.01                |
| Total | Sense of place | 54238 | 1.16                |

### 3.3. Common parameter

“Open space” denotes a public space with no built structures such as plazas, streets, parks and many others. Parks are considered as open spaces as well as green spaces under greenery systems. Streets have been previously explained as part of transit corridor as well (Carmona *et al.*, 2010; Koohsari *et al.*, 2015; Pattacini, 2021). This suggests that open spaces are common in greenery system and transit corridor categories.

**Table 20.** Similar words for transit corridor as per expert interviews (Source: Author).

| S.No. | Word           | Count | Weighted Percentage |
|-------|----------------|-------|---------------------|
| 1     | Place          | 134   | 1.43                |
| 2     | Perception     | 23    | 0.24                |
| 3     | Attachment     | 7     | 0.07                |
| 4     | Meaning        | 9     | 0.1                 |
| 5     | Behaviour      | 4     | 0.04                |
| 6     | Observing      | 4     | 0.04                |
| 7     | Sense          | 12    | 0.13                |
| 8     | Attraction     | 4     | 0.04                |
| 9     | Friendly       | 2     | 0.02                |
| 10    | Symbolism      | 4     | 0.04                |
| 11    | Belongingness  | 3     | 0.03                |
| Total | Sense of place | 206   | 2.18                |

Though this parameter is listed down under two categories as of now, at the stage of primary data collection, it will be classified under one category based on the statistical relation between the parameter and the category.

### *3.4. Outcome*

#### *3.4.1. Literature review*

Table 21 lists down the weighted percentage and word count for all terms which were clubbed together to form the nine parameters.

#### *3.4.2. Expert interview*

Table 22 lists down the weighted percentage and word count for all terms which were clubbed together to form the nine parameters based on expert interviews.

#### *3.4.3. Final parameters*

Nine parameters namely, street greenery, sense of place, comfort, building form, physical activities, pedestrian path, imageability, permeability and vehicle lane are listed down as per the weighted percentage. These parameters have been

found to be significant in assessment of visual quality of urban streetscape along transit corridors.

The above results indicate the keywords which were gathered through comprehensive literature review related to visual quality, streetscapes, and transit corridors as clearly explained in section 3.1 to 3.3 from varied sources. These keywords were narrowed down to identify essential parameters through a synthesis of extensive literature review which was discussed repeatedly with fifteen experts as explained in 3.4.1 and 3.4.2. Lastly, parameters for assessing visual parameters in the urban streetscape of a transit corridor were validated based on the NVIVO generated weighted percentage.

Taking the weighted percentage of the parameters based on all papers, street greenery has the highest weighted percentage and permeability has the least. Whereas based on experts' opinion, street greenery has the highest weighted percentage and vehicle lanes have the least (refer Table 23).

This signifies that there is a high focus on street greenery as a streetscape element. However, human perception in the form of imageability and permeability has not been discussed enough. The literature on the subject focuses on vehicle lanes while leaving out imageability and permeability. However, in experts' opinion, vehicle lanes are not considered as important as imageability and permeability. This conflict between literature review and experts needs to be addressed.

Table 21. Total word count and weighted percentage of nine parameters as per literature review (Source: Author).

| S. No. | Parameter / Sub Parameter |                   | Count  | Weighted Percentage |
|--------|---------------------------|-------------------|--------|---------------------|
|        |                           | Word              |        |                     |
| 1      | Street Greenery           |                   | 118084 | 2.89                |
| 1.1    | Vegetation                |                   | 81547  | 2.1                 |
| 1.1.1  |                           | Greenery          | 40819  | 1.22                |
| 1.1.2  |                           | Plantation        | 9975   | 0.21                |
| 1.1.3  |                           | Park              | 8759   | 0.19                |
| 1.1.4  |                           | Landscape         | 6974   | 0.15                |
| 1.1.5  |                           | Open Spaces       | 4530   | 0.10                |
| 1.1.6  |                           | Vegetation        | 4471   | 0.10                |
| 1.1.7  |                           | Species           | 4714   | 0.10                |
| 1.1.8  |                           | Shrub             | 1305   | 0.03                |
| 1.2    | Greenery System           |                   | 36537  | 0.79                |
| 1.2.1  |                           | Green Wall        | 4966   | 0.11                |
| 1.2.2  |                           | Living Wall       | 2605   | 0.06                |
| 1.2.3  |                           | Green Facade      | 2329   | 0.05                |
| 1.2.4  |                           | Trees             | 6304   | 0.13                |
| 1.2.5  |                           | Greenery System   | 16201  | 0.35                |
| 1.2.6  |                           | Vertical Greenery | 4132   | 0.09                |
| 2      | Pedestrian Path           |                   | 39337  | 0.84                |
| 2.1    |                           | Facilities        | 10209  | 0.22                |
| 2.2    |                           | Pedestrian        | 7082   | 0.15                |
| 2.3    |                           | Sidewalks         | 7007   | 0.15                |
| 2.4    |                           | Cycle             | 5832   | 0.12                |
| 2.5    |                           | Open Spaces       | 4530   | 0.10                |
| 2.6    |                           | Signage           | 858    | 0.02                |
| 2.7    |                           | Furniture         | 565    | 0.01                |
| 2.8    |                           | Light             | 3254   | 0.07                |
| 3      | Physical Activities       |                   | 32897  | 0.71                |
| 3.1    | Social                    |                   | 29527  | 0.63                |
| 3.1.1  |                           | Socializing       | 12157  | 0.26                |
| 3.1.2  |                           | Activities        | 8478   | 0.18                |
| 3.1.3  |                           | Interaction       | 3744   | 0.08                |
| 3.1.4  |                           | Playing           | 3230   | 0.07                |
| 3.1.5  |                           | Shopping          | 1610   | 0.03                |
| 3.1.6  |                           | Sitting           | 308    | 0.01                |
| 3.2    | Commerce                  |                   | 3370   | 0.08                |
| 3.2.1  |                           | Market            | 2313   | 0.05                |
| 3.2.2  |                           | Vendors           | 409    | 0.01                |
| 3.2.3  |                           | Selling           | 318    | 0.01                |
| 3.2.4  |                           | Kiosks            | 330    | 0.01                |
| 4      | Building Form             |                   | 45228  | 0.96                |
| 4.1    |                           | Building Use      | 21085  | 0.45                |
| 4.2    |                           | Building form     | 9417   | 0.20                |
| 4.3    |                           | Scale             | 4024   | 0.09                |
| 4.4    |                           | Building Function | 3899   | 0.08                |
| 4.5    |                           | Building Facade   | 2488   | 0.05                |
| 4.6    |                           | Building Height   | 1764   | 0.04                |
| 4.7    |                           | Edge              | 1496   | 0.03                |
| 4.8    |                           | Building Typology | 623    | 0.01                |
| 4.9    |                           | Enclosure         | 432    | 0.01                |
| 5      | Vehicle Lane              |                   | 34876  | 0.74                |
| 5.1    |                           | Road              | 10644  | 0.23                |

| S. No. | Parameter / Sub Parameter |                     | Count | Weighted Percentage |
|--------|---------------------------|---------------------|-------|---------------------|
|        |                           | Word                |       |                     |
| 5.2    |                           | Vehicle             | 6875  | 0.15                |
| 5.3    |                           | Bus                 | 6881  | 0.14                |
| 5.4    |                           | Metros              | 5483  | 0.12                |
| 5.5    |                           | Car                 | 3610  | 0.07                |
| 5.6    |                           | Flyover Under Space | 1383  | 0.03                |
| 6      |                           | Comfort             | 17590 | 0.37                |
| 6.1    |                           | Safety              | 9084  | 0.19                |
| 6.2    |                           | Walkability         | 6531  | 0.14                |
| 6.3    |                           | Comfort             | 1975  | 0.04                |
| 7      |                           | Imageability        | 22612 | 0.47                |
| 7.1    |                           | Visual              | 10746 | 0.22                |
| 7.2    |                           | Identity            | 4964  | 0.1                 |
| 7.3    |                           | Imageability        | 3464  | 0.07                |
| 7.4    |                           | Aesthetic           | 2881  | 0.06                |
| 7.5    |                           | Legibility          | 296   | 0.01                |
| 7.6    |                           | Landmark            | 261   | 0.01                |
| 8      |                           | Permeability        | 18074 | 0.40                |
| 8.1    |                           | Accessibility       | 9954  | 0.21                |
| 8.2    |                           | Inclusive           | 2524  | 0.06                |
| 8.3    |                           | Linkage             | 1657  | 0.04                |
| 8.4    |                           | Entry               | 998   | 0.02                |
| 8.5    |                           | Permeability        | 868   | 0.02                |
| 8.6    |                           | Livability          | 751   | 0.02                |
| 8.7    |                           | Nodes               | 559   | 0.01                |
| 8.8    |                           | Transparency        | 475   | 0.01                |
| 8.9    |                           | Exit                | 288   | 0.01                |
| 9      |                           | Sense of place      | 54238 | 1.16                |
| 9.1    |                           | Place               | 26024 | 0.55                |
| 9.2    |                           | Perception          | 7365  | 0.16                |
| 9.3    |                           | Attachment          | 4963  | 0.1                 |
| 9.4    |                           | Meaning             | 3659  | 0.08                |
| 9.5    |                           | Behaviour           | 3038  | 0.07                |
| 9.6    |                           | Observing           | 3014  | 0.06                |
| 9.7    |                           | Sense               | 2252  | 0.05                |
| 9.8    |                           | Attraction          | 1909  | 0.04                |
| 9.9    |                           | Friendly            | 954   | 0.02                |
| 9.10   |                           | Symbolism           | 711   | 0.02                |
| 9.11   |                           | Belongingness       | 349   | 0.01                |

Table 22. Total word count and weighted percentage of nine parameters as per expert interviews (Source: Author).

| S. No. | Parameter / Sub Parameter |                 | Count | Weighted Percentage |
|--------|---------------------------|-----------------|-------|---------------------|
|        |                           | Word            |       |                     |
| 1      |                           | Street Greenery | 347   | 3.69                |
| 1.1    |                           | Vegetation      | 254   | 2.7                 |
| 1.1.1  |                           | Greenery        | 140   | 1.49                |
| 1.1.2  |                           | Plantation      | 11    | 0.12                |
| 1.1.3  |                           | Park            | 12    | 0.12                |
| 1.1.4  |                           | Landscape       | 47    | 0.50                |
| 1.1.5  |                           | Open Spaces     | 8     | 0.09                |
| 1.1.6  |                           | Vegetation      | 19    | 0.20                |
| 1.1.7  |                           | Species         | 10    | 0.11                |



| S. No. | Parameter / Sub Parameter |                     | Count | Weighted Percentage |
|--------|---------------------------|---------------------|-------|---------------------|
|        |                           | Word                |       |                     |
| 1.1.8  |                           | Shrub               | 7     | 0.07                |
| 1.2    |                           | Greenery System     | 186   | 1.98                |
| 1.2.1  |                           | Green Wall          | 40    | 0.43                |
| 1.2.2  |                           | Living Wall         | 10    | 0.11                |
| 1.2.3  |                           | Green Facade        | 5     | 0.05                |
| 1.2.4  |                           | Trees               | 38    | 0.40                |
| 1.2.5  |                           | Greenery System     | 90    | 0.96                |
| 1.2.6  |                           | Vertical Greenery   | 3     | 0.03                |
| 2      |                           | Pedestrian Path     | 125   | 1.33                |
| 2.1    |                           | Facilities          | 18    | 0.19                |
| 2.2    |                           | Pedestrian          | 29    | 0.31                |
| 2.3    |                           | Sidewalks           | 13    | 0.14                |
| 2.4    |                           | Cycle               | 15    | 0.16                |
| 2.5    |                           | Open Spaces         | 8     | 0.09                |
| 2.6    |                           | Signage             | 7     | 0.07                |
| 2.7    |                           | Furniture           | 19    | 0.20                |
| 2.8    |                           | Light               | 16    | 0.17                |
| 3      |                           | Physical Activities | 185   | 1.95                |
| 3.1    |                           | Social              | 132   | 1.4                 |
| 3.1.1  |                           | Socializing         | 23    | 0.25                |
| 3.1.2  |                           | Activities          | 24    | 0.25                |
| 3.1.3  |                           | Interaction         | 27    | 0.29                |
| 3.1.4  |                           | Playing             | 20    | 0.21                |
| 3.1.5  |                           | Shopping            | 25    | 0.26                |
| 3.1.6  |                           | Sitting             | 13    | 0.14                |
| 3.2    |                           | Commerce            | 53    | 0.55                |
| 3.2.1  |                           | Market              | 7     | 0.07                |
| 3.2.2  |                           | Vendors             | 36    | 0.38                |
| 3.2.3  |                           | Selling             | 5     | 0.05                |
| 3.2.4  |                           | Kiosks              | 5     | 0.05                |
| 4      |                           | Building Form       | 155   | 1.64                |
| 4.1    |                           | Building Use        | 84    | 0.89                |
| 4.2    |                           | Building form       | 15    | 0.16                |
| 4.3    |                           | Scale               | 2     | 0.02                |
| 4.4    |                           | Building Function   | 17    | 0.18                |
| 4.5    |                           | Building Facade     | 6     | 0.06                |
| 4.6    |                           | Building Height     | 5     | 0.05                |
| 4.7    |                           | Edge                | 8     | 0.09                |
| 4.8    |                           | Building Typology   | 17    | 0.18                |
| 4.9    |                           | Enclosure           | 1     | 0.01                |
| 5      |                           | Vehicle Lane        | 92    | 0.97                |
| 5.1    |                           | Road                | 1     | 0.01                |
| 5.2    |                           | Vehicle             | 33    | 0.34                |
| 5.3    |                           | Bus                 | 7     | 0.07                |
| 5.4    |                           | Metros              | 9     | 0.10                |
| 5.5    |                           | Car                 | 8     | 0.09                |
| 5.6    |                           | Flyover Under Space | 34    | 0.36                |
| 6      |                           | Comfort             | 90    | 0.95                |
| 6.1    |                           | Safety              | 13    | 0.13                |
| 6.2    |                           | Walkability         | 48    | 0.51                |
| 6.3    |                           | Comfort             | 29    | 0.31                |
| 7      |                           | Imageability        | 117   | 1.24                |

| S. No. | Parameter / Sub Parameter |                | Count | Weighted Percentage |
|--------|---------------------------|----------------|-------|---------------------|
|        |                           | Word           |       |                     |
| 7.1    |                           | Visual         | 85    | 0.91                |
| 7.2    |                           | Identity       | 2     | 0.02                |
| 7.3    |                           | Imageability   | 6     | 0.06                |
| 7.4    |                           | Aesthetic      | 17    | 0.18                |
| 7.5    |                           | Legibility     | 5     | 0.05                |
| 7.6    |                           | Landmark       | 2     | 0.02                |
| 8      |                           | Permeability   | 105   | 1.07                |
| 8.1    |                           | Accessibility  | 32    | 0.33                |
| 8.2    |                           | Permeability   | 31    | 0.32                |
| 8.3    |                           | Inclusive      | 3     | 0.03                |
| 8.4    |                           | Linkage        | 1     | 0.01                |
| 8.5    |                           | Entry          | 7     | 0.07                |
| 8.6    |                           | Livability     | 3     | 0.03                |
| 8.7    |                           | Nodes          | 11    | 0.11                |
| 8.8    |                           | Transparency   | 12    | 0.12                |
| 8.9    |                           | Exit           | 5     | 0.05                |
| 9      |                           | Sense of place | 206   | 2.18                |
| 9.1    |                           | Place          | 134   | 1.43                |
| 9.2    |                           | Perception     | 23    | 0.24                |
| 9.3    |                           | Attachment     | 7     | 0.07                |
| 9.4    |                           | Meaning        | 9     | 0.1                 |
| 9.5    |                           | Behaviour      | 4     | 0.04                |
| 9.6    |                           | Observing      | 4     | 0.04                |
| 9.7    |                           | Sense          | 12    | 0.13                |
| 9.8    |                           | Attraction     | 4     | 0.04                |
| 9.9    |                           | Friendly       | 2     | 0.02                |
| 9.10   |                           | Symbolism      | 4     | 0.04                |
| 9.11   |                           | Belongingness  | 3     | 0.03                |

**Table 23.** Total word count and weighted percentage of nine parameters as per literature review for all documents and expert interview (Source: Author).

| S.No. | Parameter           | All papers |                     | Expert Interview |                     |
|-------|---------------------|------------|---------------------|------------------|---------------------|
|       |                     | Count      | Weighted Percentage | Count            | Weighted Percentage |
| 1     | Street Greenery     | 118084     | 2.89                | 347              | 3.69                |
| 2     | Sense of place      | 54238      | 1.16                | 206              | 2.18                |
| 3     | Comfort             | 35302      | 0.76                | 162              | 1.70                |
| 4     | Building Form       | 45228      | 0.96                | 155              | 1.64                |
| 5     | Physical Activities | 32897      | 0.71                | 185              | 1.95                |
| 6     | Pedestrian Path     | 39337      | 0.84                | 125              | 1.33                |
| 7     | Imageability        | 22612      | 0.47                | 117              | 1.24                |
| 8     | Permeability        | 18074      | 0.40                | 105              | 1.07                |
| 9     | Vehicle Lane        | 34876      | 0.74                | 92               | 0.97                |

#### 4. Conclusion

The above result and discussion based on literature review and expert interviews elaborated that there are nine essential parameters to analyze any streetscape's visual quality. This paper had the limitation of knowledge from

approximately four hundred fifty articles through research paper and theses, nine urban theory books and fifteen expert interviews. The authors recommend analyzing the urban streetscape of each city using the following nine parameters, street greenery, sense of place, comfort,

building form, physical activities, pedestrian path, imageability, permeability and vehicle lane. This will help create a standard analysis approach to compare streetscapes across neighborhoods, cities and nations. This will also help urban designers and planners create frameworks for their city's streetscape to enhance visual quality along transit corridors.

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