Exploring Attributes of Public Open Spaces through Users' Perceptions at Lakefront Spaces of Nagpur City

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Abstract:

What qualifies as urban public space? What are the attributes that essentially outline an urban public space? Answers to these questions are multifarious as the urban setting is a complex and critical phenomenon especially in developing countries since it constitutes diverse factors of influences that have arisen due to lack of appropriate urban design and planning strategies which results in degradation of the urban environment and subsequently the quality of urban life. The problem needs to be addressed with sensitivity to space as well as the people, its main users. Hence it becomes imperative to study such urban public spaces in developing countries with anaim of seeking insight into peoples' perceptions of the present development of such public spaces in order to enhance the quality of urban public spaces.

Accordingly, this paper attempts to explore some of the attributes of urban public spaces in the form of lakefront spaces in the specific territorial context of Nagpur, a Tier II city of India, as perceived by the users with an objective of understanding the varied viewpoints of the public regarding present development. The paper adopts a qualitative approach for understanding people's perception of such spaces supported by questionnaire survey, walking interviews and onsite observations regarding four key attributes of successful public spaces namely, uses and activities, access and linkages, comfort and image and sociability. The study outcome suggests meaningful directions towards the design and development of lakefront spaces which will assist in achieving better urban public spaces. The study also proposes a framework for perception studies of lakefront spaces.

I. Public Open Spaces

Public spaces have a significant role to play in sustaining the public realm. There is an increasing belief that modern societies no longer depend upon squares or piazzas for basic needs but they need good public spaces where the elements provided and activities carried out will cater to their social and psychological health thereby contributing significantly to the quality of life. Hence there is a renewed interest in public spaces nowadays.They represent our societies and serve as face of our cities. As new public spaces are evolving around the world at the same time old public space typologies are also getting retrofitted to contemporary needs[1]. The reason being, everyday use of public space is being changed from necessary uses to optional and recreational uses. This changing role increases the need for appropriate, well-designed public spaces

that are responsive, democratic and meaningful and in which people choose to spend time and provide a place for people to relax, socialize and be part of urban life [2].

Moreover, urban life is becoming much more desirable day by day as more of the world population than ever before resides in cities. The transformation process can be witnessed by cities across the world which has become a particularly common and widespread phenomenon in cities of developing countries [3]. Nevertheless, because of this rapid population growth and a lack of appropriate urban design and planning strategies, cities in developing countries incline to have greater population densities and lesser environmental quality as compared to cities in developed countries [4,5,6].

With reference to this, enhancing the quality of urban open space can be a strategy for improving environmental quality, looking at the positive effects of such spaces on social and environmental dimensions connected to the quality of life[7]. Substantial research work on the quality of public open space has been conducted in developed countries where the public open spaces are well designed. But there is a lack of similar studies, ipso facto, in developing countries owing to which they are facing degradation of the urban environment and decrease of public open spaces quantity as well as quality-wise [8].

Furthermore, it is also realized that as compared to the post-occupancy evaluation of buildings, post-occupancy evaluation of public open spaces is rarely carried out so as to find out deficiencies in its process of design or construction [9,10]. As a result, users' experiences of urban public spaces have not been adequately taken into account at the time of design especially in developing countries [11].

II. Why Lakefront Open Spaces?

People are attracted to the water edge as part of their inherent attraction towards [12,13]. Waterfronts offer abundant opportunities and hence can contribute to a variety of leisure activities and experiences. Numerous projects across the world are targeting to bring people back to their city's waterfront, regardless of whether the waterfront is a sea, river or lake [14].

Lakes and surrounding landscapes are significant for urban civilization and human living environments. They demonstrate excellent aesthetic value resulting from beautiful sceneries and historic sites and can function as resources for public health and recreation [15]. Cities with lakes must strive to balance the relationship between development and preservation of the natural landscape [16]. On the contrary, in recent decades, increasing human activities have resulted in severe damage to lakes and surrounding landscapes as well as to the functional and visual amenities perceived by the public especially in developing countries. Even if the development process is carried out, people's perceptions are rarely taken into account. There may be different perspectives from both ends of the spectrum, the users as well as the designers, in terms of the design elements provided at lakefronts which establishes the need to identify and consider the user's perspective of the design elements provided at lakefronts, which should then guide the development of such spaces[17].

With this objective, efforts must be taken to establish an affinity association between humans and water and form a hydrophilic environmental structure. The creation of such territories should be based on human perception and experience of the water environment[18].

III. Public Perception

There are several pieces of evidence that indicate that contact with and activities in nature have beneficial effects on human health. Users' have certain expectations regarding urban landscape, which if in disharmony with actuality may lead to a state of dissonance among the public [19]. Though direct evidence of the effect of the natural environment as recreation settings is relatively scarce, indirect indications can be found in environmental perception and preference studies

[20].This establishes a need to understand the interaction between people and their physical environment which incidentally is the foremost goal of perception studies. If such goals are achieved, resultant design implications could be remarkable.

IV. Aim

The paper attempts to interpret and discuss the quality of public open space in the form of five lakefronts of Nagpur, a Tier-II city of India by empirically evaluating its usefulness, meaningfulness, inclusiveness, comfort, safety, sociability, and pleasurability from users' perspective and several directions for development of such spaces are suggested for public space planners, designers and managers. The paper also aims at deriving a framework for studying public perception about lakefront spaces.

V. Research Methodology

Since assessment of people's perception is an explicit goal of this paper, the adopted approach is based on attributes of public open spaces as formulated by Project for Public Spaces [21] in an attempt to assess users' perceptions and preferences in public spaces particularly lakefronts. It enquires about the types, appropriateness, and impact of natural and human-made factors with the intention to investigate how people perceive the developments occurring at the lakefronts.

Using a qualitative approach, backed up by questionnaire survey, walking interviews and onsite observations regarding four main attributes of urban open spaces, namely, uses and activities, access and linkages, comfort and image and sociability, aimed at understanding people's perception about such spaces and the development around which helped in formulating directions for the development of lakefront spaces. Each attribute is further categorized under related variables and indicators based on which the study is carried out (Table 1).

S.N.	ATTRIBUTES	VARIABLES	INDICATORS
1	**Users and Activities**	Diverse group of people	Children, youngsters, adults, elderly, men, women
		Diverse type of activity and use frequency	Jogging, strolling, sitting, playing, exercising, yoga, meditation, fishing, boating, eating, shopping, relaxing, watching peoples' activities, watching and photographing wildlife, bird watching
2	**Access and Linkages**	Easy to get to and connectivity to the surrounding community	Accessibility to the lake
			Connectivity with the neighbourhood
3	**Comfort and Image**	Comfort	Sitting provisions, sheltered spaces and shading devices, ease of walking, pavements, noise level, street furniture, food facility
		Safety	Boundary/safety walls, railings, lighting, policing, antisocial activities
		Cleanliness	Waste bins, restrooms, maintenance
		Attractiveness	Contact with nature, vegetation, landscape, quality of water, skyline, visibility from road
4	**Sociability**	Social contact a) Overt (getting together) b) Covert (privately)	Provisions to facilitate interactions with people and nature, sitting arrangements, Cultural/heritage elements, social events and celebrations, kids play zones

WHY NAGPUR?

Nagpur city, strategically located at the heart of India is the 13th largest urban conglomeration in India, with a population of about 3.60 million. Being rich in its biodiversity due to surrounding national parks and ecologically rich regions, the city serves as an important biodiversity link between these regions and various green zones and water bodies located within the city. Thus it acts as a biodiversity corridor and houses a variety of flora, fauna, and avifauna of the region. Owing to this, the city has got a lot of potentials to conserve the natural environment of the city. Realizing this, the local authority of the city, Nagpur Municipal Corporation has come up with the proposal of rejuvenation of major lakes of the city. (http://www.paryavaran.com/profiles/blogs/rejuvenation-of-lakes-and-river-project-a-brief-summary).

Since historic times, apart from serving as storage tanks these lakes also fulfilled the purpose of recreation. The religious significance of the lakes is evident from the fact that most of them are still having historic temples along their banks. The extreme climate of the city with hot summers and moderate rainfall furthermore enhances the significance of these lakes in balancing the temperature. Hence they enjoyed an indispensable position within the city fabric and always had a close association with the people and their settlements.

 Unfortunately, the approach towards these water bodies has changed today due to technological advancements and changing lifestyles as people are looking towards other sources of recreation. Moreover, presently these lakes serve as mere elements of the city since the water supply is augmented from other sources located outside the city limits. If the lakefronts are maintained and improved, they could act as centers of recreational and religious importance as they have done it since historic times and can cater to the ever-increasing demand for recreation and entertainment with increasing population. If the lakes are developed from users' point of view, the city residents would get better recreational opportunities and amenities thereby enhancing their quality of life. This would also help these lakes to be socially acceptable and taken care of by the citizens themselves.

Also, rapid urbanization has sprawled in Nagpur as well resulting in depletion and degradation of natural resources and disruption of biodiversity corridors resulting in ecological imbalance. Hence it becomes imperative to understand the ecological significance of these lakes and have an integrated approach towards planning and development of these water bodies. Rejuvenation of these lakes can aim at reconnecting the city residents with its water bodies though apt waterfront development and revitalization thereby giving the people an opportunity to interact with these water bodies and restore their faith in them through a holistic approach towards environment and planning.

Hence there is a need to study the lakefront attributes as perceived by the residents of the city. Insight into people's perceptions vis-à-vis types and characteristics of the natural and manmade elements in and around the lakes would guide designers, planners and developing authorities in dealing with future interventions to be carried out at these lakefronts.

VI.   ABOUT LAKEFRONTS

The study context incorporates five major lakes in Nagpur. Sonegaonlake is the oldest one and a 300-year-old heritage structure owned by Bhonslas. But it is the smallest of all the lakes under context and spread over 35 acres of land. Gandhisagar lake also known as Shukrawari lake, built by Chand Sultan, the then ruler of the city for supplying water to the city is existing for 275 years and stretched over 44 acres of land. It is situated almost at the center of the city. Futala Lake is also an ancient lake built about 200 years ago by Bhonslas. It extends over an area of 99 acres.   The largest is the Ambazarilake, situated in the northwest part of the city and is spread over 380 acres of land. It was built in 1870 under Bhonsla regime. Gorewadalake situated in the northwest corner is the latest one developed by the waterworks department in the year 1912 as the city's primary source of drinking water. It is situated on

the outskirts of the city and covers an area of about 343 acres (Table 2).

The reason for selecting these lakes lies in their varied locations and peculiarities in terms of surrounding development. Sonegaonlake is situated in one of the major residential zones of the city whereas Gandhisagar lake is positioned in the old city area amidst a busy commercial zone. It has also got a unique feature in the form of an island garden set at the center of the lake. Futala Lake is having an institutional zone on one side and no development zone on the rest of the sides. Ambazari Lake is well known for its garden placed at one of its sides and no development zone on other sides. Gorewadalake is most uniquely placed in a densely vegetated forest area with nature's trail on one of its sides.

Table 2: Physical characteristics of the Lakes (Source: Authors)

S.N.	Name of Lake	Size	Geometrical form	Image
1	Ambazari Lake	380 acres	Triangular with branching pattern	
2	Futala Lake	99 acres	Triangular	
3	Gandhisagar Lake	44 acres	Rectilinear	
4	Gorewada Lake	343 acres	Irregular	
5	Soengoan Lake	35 acres	Pentagonal	

VII.   ATTRIBUTES OF LAKEFRONT OPEN SPACES

A) Uses and Activities:

Various researches carried out in different cities have shown that human perceptions and preferences concerning public spaces strongly affect the actual use of such spaces [22]. Urban public spaces that encourage a wide array of activities to attract users with different age groups, abilities, and socio-economic backgrounds, improve the possibility of exchange of ideas and enhance the potential of social interactions [23,24,25]. A socially diverse public space is where children, women, older people, low-income groups and people with different educational backgrounds are able to attend and use. In support of this, Jacobs [26] also asserts that diversity is the most important characteristic of a healthy urban place. From Talen's[27] point of view, diversity encourages tolerance amongst people by aggregating the chances of impulsive exchanges amongst different user groups or communities.

Whether space is shared and actively used by different groups and individuals is described as 'animation' by George and Steve [28] according to whom such spaces comprise the degree to which the design of the place supports and meets human wants and needs in public space. Though the core element of animation comprises of particular physical configuration and design of that place, [29] various functional concerns with respect to how design features support use and activity are predominantly essential. According to Oc&Tiesdell[30], animation corresponds to features like the presence of people, activities, ambiance, accessibility, and inclusion, cultural animation and throughout the day and specifically evening economic strategy. This has been discussed by Ne'meth& Schmidt [31] in terms of 'design and image' which emphasizes factors like presence of restrooms, number, and diversity of seating type, type of micro-climate it creates, nighttime use, design which will encourage appropriate use, for an instance, presence of bollards to direct the pedestrian flow or restrict circulation, presence of food vendors, etc. So as pointed out by Carr et.al. animation encompasses dimensions like comfort, relaxation, passive engagement, active engagement and discovery along with visibility and

self-presentation in public space as added by Carmona et al. [32].

In affirmation to this, from the studies of lakefronts, it is strongly felt that the diversity of people's group is directly related or dependent upon the diversity of activities carried out which in turn is related to the provisions made for carrying out such activities. The 'more public' situation is where design supports and encourages use, predominantly active engagement, passive engagement, and discovery or in the words of Jan Gehl[33] it supports social and optional activities. This becomes evident at all the lakefronts where the provision of walking trails with proper lighting arrangements encourages active engagement where visitors jog and stroll along the lakeside. Hence the pathways are actively used by the younger and elderly people, particularly during morning and evening hours.

The diversification of facilities increases the attractiveness of this space. An example of this approach is the initiative to create an outdoor gymnasium at Ambazari lake garden and Gandhisagar island garden. This has defined and diversified activities thereby promoting public health concerns apart from active recreation and passive interaction and attracts a large number of adults and elderly people of both genders (Image 1). People also carry out activities like performing yoga, exercising, and meditation in the calm and quiet surroundings, particularly during early morning hours.

A well-developed children's play area serves as a major attraction for kids. The dearth of children's play equipment at Futala, Gorewada, and Sonegaon Lake results in a lesser number of families visiting the place. On the contrary, the Ambazari lakefront garden and Gandhisagar Island garden are visited majorly by the families due to the presence of children's play equipment. Since Futala lakefront does not have provision for either outdoor gymnasium or children's play area, it discourages active engagements but at the same time attracts passive engagement because of design elements like series of wider steps and wider stone safety walls

used for sitting at the edge of the lake which are cherished by the youngsters. Hence prime user group found here is the younger people reason being such wider walls give them the opportunity to be in close

vicinity with the lake and at the same time encourages interaction (Image 2).

Image 1: Actively used outdoor gymnasium at Gandhisagar Lake Island Garden (Source: Authors)

Image 2: Wider stone safety walls used for sitting encourage interaction (Source: Authors)

Image 3: Sheltered canopy and benches facing lake at Ambazari lakefront garden

The provision of benches along the lakeside also gives opportunities for passive engagements to the people to relax, observe other people's activities, and interact with each other as well as with the surrounding environment which is been done at all lakefronts. It is also observed that the benches which are located near the lake or which impart a direct view of the lake are more preferred as compared to benches located at other places. Sheltered canopies at regular intervals as provided at Ambazari lakeside garden also serve as relaxing and resting spaces (Image 3).

Lakes like Gorewada, Futala, and Ambazari being rich in bio-diversity, attract a lot of bird watchers from all over the city, particularly in early morning hours. Moreover, Gorewadalake surrounded by dense forest serves as a home for large bio-diversity in terms of varied flora and fauna and regarded as bird watcher's paradise where people enjoy watching and photographing birds and wildlife (Image 4).

Image 4: Gorewada lake serving as Bird watcher's paradise (Source: Authors)

Provisions for restrooms are done at all the lakefronts whereas food provisions in the form of snack corner, tea stalls, and street food vendors aregiven only at Ambazari and Futalalakefronts which is not perceived as a desirable situation at other lakefronts as people want such spaces.

Looking at the finishing materials, Gorewadalake does not have a paved pathway which makes the walking trail more natural and ecologically more supportive whereas the rest of the lakes have properly paved pathways used as jogging tracks (Images 5& 6). Interestingly, though nature's trail appears a bit uncomfortable particularly for use during harsh climatic situations, it is still preferred by the people compared to paved pathways because of its naturalness. Hence it is not only the design element that affects the use of the space, but the treatment given to such elements also has a major role to play in attracting people. Moreover, people seek natural elements over manmade, particularly at lakefronts.

Image 5: Nature's Trail at Gorewada lakefront Source: Authors)

Image 6: Paved pathway at Ambazari lakefront garden (Source: Authors)

Interestingly, no lakefront is having the provision of boating though, given a chance, people showed a

preference for such recreational activities and would like to enjoy such facilities. But looking at it from an environmental point of view, the provision of boating was not perceived as a much desirable situation by few particular due to its adverse effect on the Lake ecosystem.

According to Conedera, M. et.al.[34], perception differs with respect to gender as well. For instance, men use public places for meeting friends and recovering from everyday stress whereas women are more sensitive towards the safety concerns and facilities related to children. Hence the presence of women at Ambazari lakefront and Gandhisagar island garden is more as compared to other lakefronts due to the provision of kids play zone. The absence of children's play equipment at Futala and Sonegaonlake results in a lesser number of women visiting the place. On the contrary, the Ambazari lakefront garden and Gandhisagar Island garden are visited majorly by families. Conederaalso observed that older people prefer to visit nearby spaces for social contact while younger people are mostly driven by the desire to seek escape. This is evident from the fact that the elderly people majorly come from nearby neighbourhoods whereas younger people visit the lakefronts from all over the city and use it to enjoy, interact and have fun.

Hence it is found that certain design features endorse animation and influence the types of users and activities occurring there. It is prominent from all five cases that prime users at most of the lakefronts are adults and elderly as people like strolling and jogging along the lake as it gives them the opportunity to view the lake while walking. Provisions like an outdoor gymnasium attract adults and the elderly as they help them in exercising as well as serve as interaction spaces for them. Features that support passive engagements are equally cherished by the people at lakefronts. Here it is important to note that location and design of sitting arrangements tend to strengthen the symbolic connection of people with the water body, due to the functional relationship between sitting provision and water body (e.g., wider safety walls along water body or provision of benches facing water body). As such, it reinforces the relationship between users and water.

People tend to enjoy bio-diversity through passive engagement as it provides an indirect experience by involving interaction with the setting, without being actively involved, for instance, watching a spectacular sunset, observing a flock of birds or merely enjoying an attractive view in its natural setting whereas active engagement imparts more direct experience as it involves contact and interaction with others, whether with strangers or people known to them [35]. Bio-diversity serves as a major attraction for people as it gives them the opportunity to enjoy the scenic beauty as well as watch birds and wildlife in a natural setting. Also, people of different age groups and genders have different perceptions and expectations from the lakefront spaces which affect the use of such spaces.

B) Access and Linkages:

a) Connectivity: Physical configuration can be measured with respect to two key qualities; Centrality and connectivity. Places with centrality and better connectivity i.e. those which are strategically well-located within a city's movement pattern have substantial potential movement and thus have significant potential for different social groups to come together in space and time [36,37,38].

As such, the design of a place matters little in terms of density of use if it is poorly located within the city's local movement pattern, as it will never be appropriately used unless there are changes in the movement network or increase in connectivity due to some reasons. In accordance with the above, the findings at the lakefronts showed that the most preferred lakefronts are those which are closest to where the visitors live. Hence all lakefronts except Gorewada are visited by the people being strategically located within or near residential zones or well connected with the city's movement pattern. Gorewada though being admired for its scenic beauty is not much visited because of its location away from the city and less connectivity in terms of

local transport. Similarly, Gandhisagarlake, though being physically and visually accessible from all sides, still not much preferred by people except its island garden because of surrounding heavy traffic roads (Table 4).

Hence though there are differences in qualities of lakefronts, a major factor that affects visitations is the proximity and location of the lakefronts rather than whether it meets the specific needs of the users. But this might direct towards a lack of significant correlation regarding the perceived quality of lakefront and the visitation frequency at such spaces.

b) Accessibility: Accessibility could be studied in terms of physical as well as visual access. Visual accessibility or permeability is the ability to see into a place. Thresholds or gateways symbolize physical accessibility. As mentioned by George, potential access into a place can be obstructed by thresholds and gateways. Lake gardens present at Ambazari and Gandhisagarlake have entrance gateways that direct the users towards the lake. Apart from the garden side, Ambazarilake is not much accessible for the public from other places due to the high retaining wall along roadsides. It not only acts as a physical barrier but also restricts visual access. In contrast with this, high connectivity, visual permeability into the place and a lack of explicit entrances or thresholds enable greater access into it. This holds perfect at Futala lakefront where there is no specific entry and the entire lakefront stretch along the roadside act as the entrance as it is provided with descending steps at regular intervals which connects the road with the lake. This enhances physical and visual accessibility as well it results in the gathering of a large number of people specifically during evening times (Image 7&9). Such absence of control triggers free use of the space. Since physical barriers like steps exclude wheelchair users by making the

place less public, Futalalake is also made universally accessible by providing ramps are regular intervals.

Image 7: Visual Permeability of Futala Lake from road (Source: Authors)

Image 8: Lack of openness at Gorewada lakefront resulting in lack of sense of safety (Source: Authors)

On the contrary, Gorewadalake is accessible only from nature's trailside and entries from other sides are restricted being situated in forested areas. Being surrounded by forest, it is not even visually accessible from the roadside.
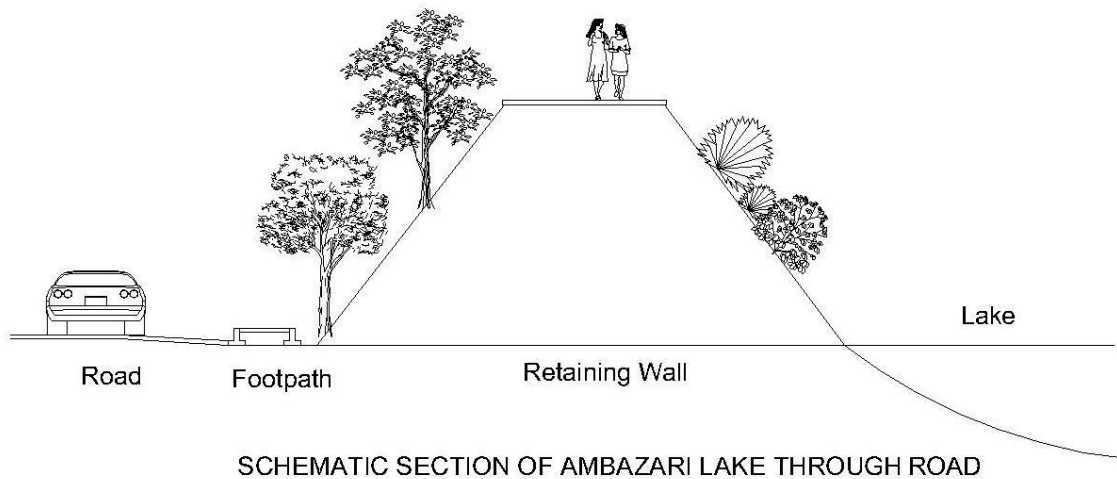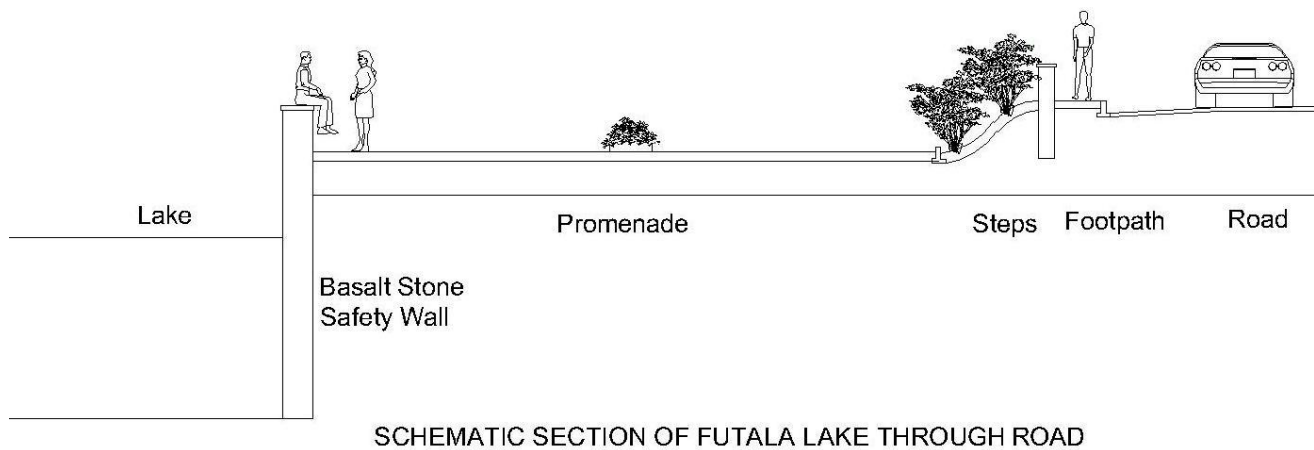
SCHEMATIC SECTION OF FUTALA LAKE THROUGH ROAD

SCHEMATIC SECTION OF AMBAZARI LAKE THROUGH ROAD

Image 9: Visual Connectivity between between Lake and Road (Source: Authors)

So features like retaining walls, dense vegetation isolate the lakes visually as well as physically from the streets thereby discouraging curiosity to visit the places whereas lakefronts which are physically as well as visually better connected, for instance, Futala lake enhances visitation frequency. Thus apart from physical accessibility, visual accessibility is equally important and affects the use of lakefront. Design features that restrict or control accessibility are less preferred as compare to features which render the space free to access and use.

C) Comfort and Image:
a) Comfort: Comfort refers to the state in which users feel safe, secured and at ease to conveniently move around a place in a stress-free manner [39]. It concerns with the sense of safety, security, ease of access, desirable microclimatic conditions, greenery, cleanliness, seating provision, walkability and readability of a place [40]. To achieve comfort, the design of a space needs to be ergonomically and anthropometrically sensitive[41,42]. Though all these attributes are difficult to find even in worlds good and highly visited public spaces, physical characteristics contributing to comfort incorporate design of street furniture, sitting provisions, pathway width, trees, shade and shelter, and landscape elements such as ledges and planters, etc. Hence the study articulates subjective assessment of comfort including a perceived sense of safety, climatic comfort, walking convenience, seating convenience, vegetation, etc.

b) Perception of Safety: Perception of safety i.e. whether the public space is considered to be safe strongly affects the extent to which it is used [43,44,45]. Stamps [46] has asserted that perception of safety is highly correlated with the openness of the environment and people prefer areas where the circulation of the public is more. The openness and circulation of the public are related to the design of the space which ultimately affects the uses and activities performed in the space.

In accordance with this, at all the lakefront, it is strongly observed that people prefer spaces that are well lit and have better visibility. Since all the lakes except Gorewada are having a considerable amount of openness and are well lit, they were perceived safe by the people. On the contrary, Gorewadalake being surrounded by dense vegetation all around, the degree of openness is less and hence has got the least preference in terms of safety which directly affects the visitation frequency and use of the lakefront(Image 8). Nonetheless, safety is often cited as the first concern by people at public spaces, over-securitizing and policing can make space perceptible unsafe [47]. Hence ensuring the constant presence of people can make the space self-policed thereby enhancing the sense of safety. Apart from acting as a cause of attention and interest, the presence of people enhances the perception of safety [48]. Researches have also shown that sense of safety is also dependent upon the physical condition and maintenance, type of use and presence or absence of and type of people using it. Under this premise, also it is observed that Gorewadalake being lacking in maintenance and presence of people is perceived as the most unsafe.

Taking into consideration the safety factor with respect to waterfront spaces, it is not only the safety against crime and anti-social elements but also involves safety from the water element. Hence hydrophilic activity at waterfront spaces involves recreational activity associated with certain risk factors. Consequently, taking the essential safety countermeasures to ensure the safety of the visitors is of utmost importance. For example, at Futala lakefront, the massive and wider stone safety walls ensure safety from the greater depth of the lake at the edge, apart from making provision for sitting. At the same time, it should also be taken into account that waterfront being an urban open space, its hydrophilic design should pay particular attention to barrier-free design as well.

The exact opposite is the case at Sonegaonlake where the stone decks lack such safety walls rendering it most unsafe against water whereas lakefronts like Ambazari and Gandhisagar are provided with safety railings and fencing though which cannot be used for sitting but contribute towards safety. Howbeit features like safety walls, railing while ensuring safety restrict the physical access to the water. In the case of Gorewadalake, though there is no physical barrier from water as the shoreline is inclined steadily towards the water and the depth of the lake gradually decreases towards the shore indicating ease of human access to the water. Hence people can safely come in contact with water, enjoy and feel the water physically (Image 10). Under this premise, it could be stated that the degree to which people are allowed to interact and physically come in contact with water should be decided based upon the safety factor needed depending upon the depth of water at that particular point.
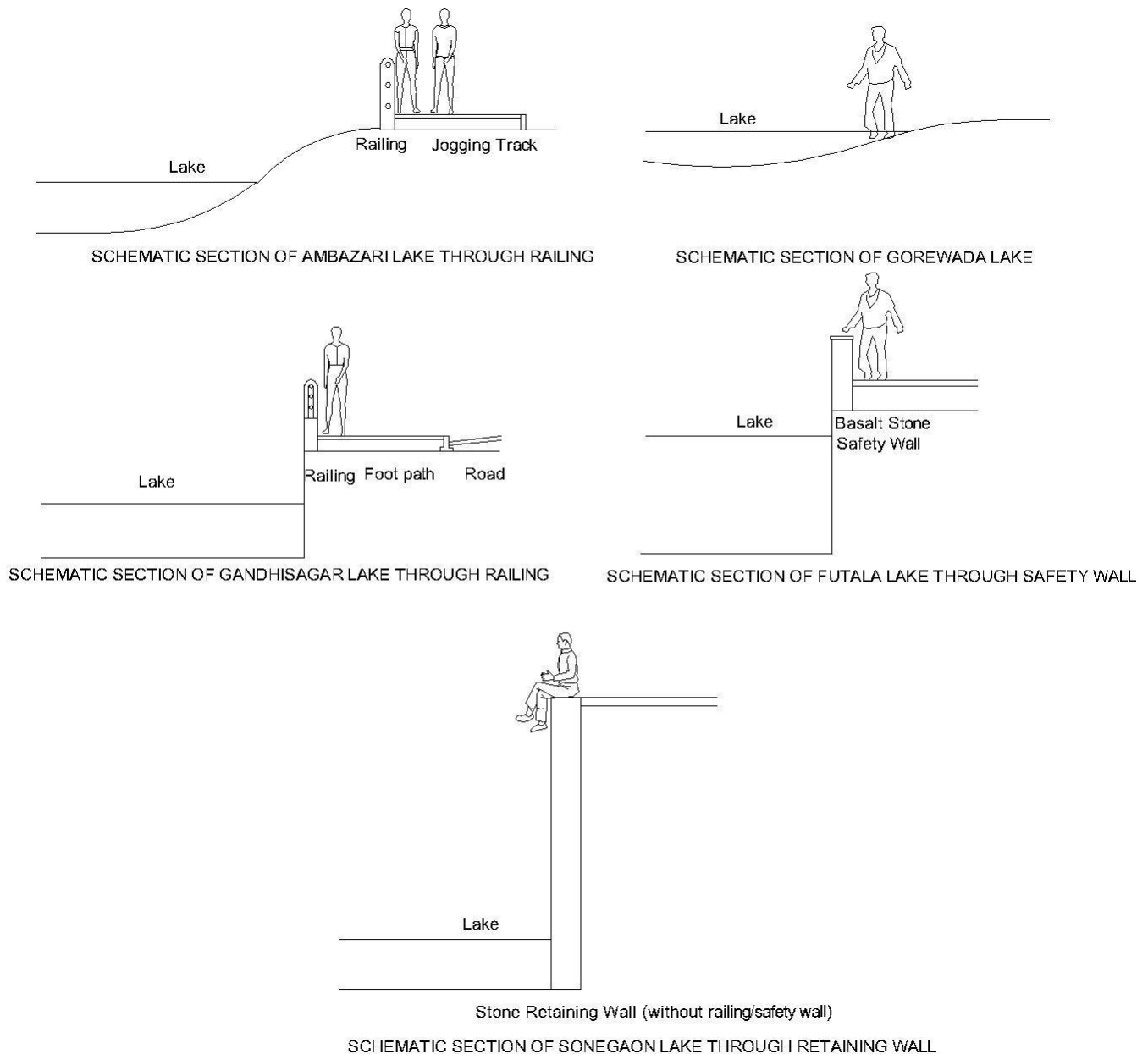
Image 10: Lake sections through safety elements (Source: Authors)

c) Vegetation: Though human beings can function in very challenging environmental conditions, the satisfaction regarding basic physiological needs like environmental comfort, protection from natural elements like sun, wind and rains and provision of sheltered spaces leads to higher-order needs like belongingness and self-esteem [49,50]. Literature concerning the effect of environmental factors on human behavior has also revealed that comfortable micro-climatic conditions are important in supporting outdoor activities in public open spaces, which include temperature, sunlight, shade, and wind[51]. Though sunlight plays a major role in imparting comfort in the winter season, people seek shady places in hot summer months. Hence providing better micro-climatic conditions becomes a prerequisite for supporting outdoor activities. Vegetation is found to play a major role in providing climatic comfort particularly thermal one. So there exists a relationship between public preference and the type and characteristic of vegetation [52]. In addition to this, research also suggests that vegetation cover improves the use of outdoor public space by enhancing social interaction [53].

Looking at the composite climate of Nagpur with hot summers, at all the lakefronts, it is found that shady trees are mostly preferred by the people. The benches which are provided below shady trees particularly as in the case of Ambazarilake garden and Gandhisagar island garden are found to be the most favourite places for sitting and relaxing. Looking at a considerable amount of large shady trees at Ambazari lake garden, it is found to be the most preferred picnic spot amongst the people and found to be used throughout the day. The large shady trees also help in reducing noise levels from heavy traffic roads. In contrast with this, Futala and Sonegaon lake lacking in vegetation cover, are used only during morning and evening times whereas dense vegetation cover though provides enough shady places at Gorewadalake, is perceived unsafe. As pointed out by Parsons [54], densely planted vegetation though support wildlife, people prefer more open grassy areas with moderately open settings. But in the case of Gorewadalake, people tend to prefer its wild landscape in which they experience the greatness of nature. Though the sense of safety is reduced with an increase in density of vegetation its relationship is complex since spaces used for outing and social events highly rate vegetation density [55]. Interest in wildlife also seems to be one of the reasons for preferring dense vegetation at Gorewadalake which supports wildlife and serves as a reason for attracting the people. Hence observing wildlife seems to be much-desired activity at lakefronts. Apart from this, dense vegetation also assists in reducing noise levels. Consequently, perception and preference of vegetation density depend upon the context, activity to be carried out, and safety factor as well.

Thus lack of shaded areas and appropriate sitting provisions could be looked upon as deficiencies that hinder maximum and effective utilization of the lakefronts. Addressing such deficiencies can result in making the space conducive for carrying out activities by more diverse user groups during different times of a day. In addition, the safety and coexistence of users should be given utmost importance while designing lakefront spaces.

d) Maintenance: Civility refers to how a public place is maintained and managed and comprises of cultivation of welcoming and positive ambiance. Hence it is related to maintenance and cleaning regime. A key factor is that the place should appear to be inviting and cared for. Lack of cleanliness and maintenance may affect adversely attracting a greater diversity of people.

Krellenberg et al. [56] found that people from different socio-economic backgrounds prefer well-maintained open spaces with better facilities, irrespective of the proximity of their house with such spaces. In terms of cleanliness and maintenance, all the lakefronts except Gorewada seem to be moderately clean and maintained with provisions of dustbins and washrooms. Gorewadalake found to be least maintained and appears to be neglected. But still, this is not perceived much negatively looking at the overall wild and natural character of the lakefront. But undeniably, the quality of water is not much maintained at all the lakes which result in great dissatisfaction amongst the visitors as it causes not only environmental pollution but also results in visual pollution disrupting the scenic beauty of the place (Image 11& 12).

Image 11: Polluted water of Futala Lake (source: Authors)

Image 12: Growth of wild vegetation and algae at GorewadaLake (source: Authors)

e) Sitting Provisions: It is also found that lakefronts where sufficient number of benches are provided at appropriate location (e.g. under shady trees or canopies which provide direct view of the lake) and better arrangement (i.e. placing in such a ways which will encourage interaction) help in enhancing comfort level as well as interaction amongst the visitors. Informal sitting spaces like wider safety walls along the edge of the lake or wider steps are also cherished particularly by younger people. Making sitting provisions around kids' play zone is valued as it ensures the safety of the kids and imparts comfort to the parents as they can relax at the same time keep an eye on the kids.

f) Imageability and Attractiveness: Lynch [57] describes imageability as a quality of the physical environment that evokes a strong image in the minds of the observers. Places where people sense and develop positive feelings, images and meanings, are more likely to be revisited as people find them comfortable [58]. Environmental psychology studies claim that images, meaning, and experiences in various environments affect the evaluation of the place by an individual [59,60,61]. Hence factors like physical features, natural features, and urban design qualities may affect the way an individual feels about the environment. Imageability could be articulated by assessing the relationship between individuals and these features.

Water element creates images that can be remembered easily and play a significant role in terms of urban memory. Spatial perception of water may vary based on its size, form, movement, colour, and reflectivity and can affect users in gaining tranquility, refreshment, dynamism, excitement, and enthusiasm [62]. At lakefront spaces, though water plays a dominant role, other natural features like trees, the sky along with manmade features like surrounding buildings, pavement, etc. collectively create an image of the place and tend to affect the human-environment relationships.

A major expression of human activities at urban lakes could be seen in the increasing number of manmade features around them. Though various studies have focused on identification and assessment of ecological issues at waterfronts, in recent years, visual impact assessment associated with preference for natural and manmade elements at waterfronts has also become an important concern. As such, it is crucial to study the perception of lake landscape which is referred to as a landscape comprising of view of the lake along with adjacent built or natural environment and features [63].

Gorewada is perceived to be the lake situated in nature dominant setting with a green cover on all its sides. The minimal human intervention appears to the viewers with no buildings seen at the periphery whereas exactly opposite is the case at Gandhisagar lake, situated in a busy commercial area, which depicts a very high degree of human intervention in the form of tall buildings and haphazard development at its periphery (Image 13). Though the island garden appears to be an interesting feature of the lake, it proves little significant when it comes to enhancing the attractiveness of the lake due to dominating the high density of built structures, vehicles and people as well. Gorewadalake with its wild natural setting seems to appeal to visitors the most in terms of attractiveness and aesthetics. Similar to Gorewadalake, Ambazari lake also shows minimal human intervention due to a lack of built structures on the periphery. But unlike Gorewada, it lacks dense vegetation in the background. However

the huge amount of water clear of obstacles present in the lake attracts the visitors to a greater extent. Looking at Futala, the wide lake promenade is formed by pavements with interesting pattern of grey paving tiles which complement with the black basalt stone safety wall whereas backdrop is formed by lush green cover along with large water surface of the lake because of which it serves as an example of how natural and manmade features could be balanced to enhance the attractiveness of the lakefront(Image 14).Sonegoanlake does not seem to attract the visitors in terms of imageability due to haphazard skyline formed due to low rise buildings in the periphery. Even its small size with less amount of water seems to be perceived negatively by the visitors.

Image 13: Haphazard development forming at backdrop of Gandhisagar Lake(Source: Authors)

Image 14: Balance of natural and manmade elements Futalalake (Source: Authors)

Hence lakefronts with more natural features like dense vegetation, clear water surfaces are perceived positively in terms of attractiveness of the lake. Moreover, when it comes to human interventions,

manmade features provided at lakefronts should be designed in such a way that, instead of dominating, they should complement the natural features present and overall composition should show a balance of natural and manmade elements.

D) Sociability:
Sociability can be defined as the ability of the environment to satisfy basic needs for eating, shopping, entertainment, etc. and special needs to gather, discuss, express, display, debate, demand, and even protest. Public open spaces render opportunities for people to meet other people with different customs, norms, perceptions, and behaviours thereby acting as places for informal and social encounters [64]. Not just the quality of space, but the kind of services provided also makes the place social and useful. Space becomes meaningful when it supports sociability and activities that are symbolically and culturally meaningful to individuals or groups. Social cohesion is an important aspect of sociability as it enhances the sense of belonging related to the socio-cultural interactions that occur between people [65,66].

a) Active and Passive Engagements: Passive engagement is the need for contact with the surrounding place without getting actively involved, most primary form of which is watching and observing nature and other people's activities, whereas active engagement involves more direct experience with the setting and the people in it. Passive engagement leads to a sense of relaxation. A most noteworthy example of passive engagement is that most used sitting places are those which are adjacent to pedestrian movement. Hence places which offer opportunities for people-watching are most preferred. Albeit some people get satisfaction in watching other people's activities, other people need more direct contact with the people, be it family, friends, or even strangers. Well animated places create opportunities for varying degrees of engagement at the same time have the potential to withdraw oneself from the contact. In order to enjoy the setting, people sometimes tolerate uncomfortable

situations.Meanwhile as correctly highlighted by Rey Gozalo G, et.al.[67], the promotion of active engagements in the form of physical activities should be the aim of today's societies looking at the ever-increasing problems resulting from modern lifestyles.

Hence design should encourage walking and other physical activities. Under this premise, the most preferred activity carried out at all the lakefronts is walking, jogging and exercising. Hence Ambazari lakefront garden and Gandhisagar island garden with facilities like paved pathways and outdoor gymnasium are rated high in terms of active engagement. However, walking activity is also found to be correlated with environmental factors like cleanliness and quality of air, water and noise level and social factors like the sense of safety. For instance, at Gorewada lake though nature's trail is highly rated in terms of attractiveness and better air and water quality as well as being away from the noisy street, still not much preferred by most of people for jogging and walking being perceived isolated and hence unsafe.

Looking at passive engagements, most frequent activities occurring are talking and interacting. These activities are found to be dependent upon the kind of sitting provisions provided. The more the variety in terms of sitting the more is the preference. Also, the position of benches, gazebos and other sitting facilities also affects the passive engagement. Hence as discussed earlier, benches that provide opportunities for watching other people's activities and which provide a direct view of the lake are most used. Apart from this, benches that are placed around kid's play zones are much preferred by parents as they can interact with friends or other visitors while keeping an eye on the activities of the children. Ambazari lakefront garden, apart from having a considerable amount of shady trees, is also having different types of gazebos providing a variety of sitting arrangements with shading provisions. Hence it is highly rated for social interaction. Thus sociability demands better facilities for sitting, walking and exercising [68].

b) Heritage, Events, and Celebrations: It is always argued that understanding the relationship between humans and their physical environment is a crucial element of urban design. Consequently, exploring people's cultural backgrounds is of utmost importance in order to understand how people interact with their environment, both natural and built. This is because people's perceptions, experiences, and decisions are based on their cultural values and background whereas human behavior associated with culture is dependent upon how the built environment supports or hinders human behavior. So alike physical attributes of the environment, who we are and where we come from becomes significant in carrying out perception studies particular at public spaces [69].

Looking at the Indian context, socialization is perceived to be multilayered. It has got varied dimensions of interaction where culture plays a very dominating role. Socialization occurs on various festive occasions at various religious places. Heritage structures at waterfronts play a vital role in keeping alive cultural values of the people particularly in India where cultural roots are still deeply embedded. They not only represent unique heritage resources in terms of the cultural legacy inherited from the past but also become instrumental in the promotion and communication of local history [70].

The massive basalt stone viewing desks at lakefronts like Futala, Gandhisagar, and Sonegaon historically built by Bhonslas serve as important heritage elements. Apart from it, the historic Ganesh and Hanuman temple at Sonegaon lakefront and Shiv and Ganesh Temples at Gandhisagar lakefront narrate and support the local cultural legacy left by the ancestors. Though traditionally these temples were used as worship places, now they serve various other purposes also like serving as meeting and interaction places particularly for elderly and women and stages for celebrations of various social and cultural events and festivals (Image 15&16). Tunbridge and Ashworth [71] refer to this

appropriation as 'the use of heritage as a leisure resource'.

Image 15: Ganesh and Hanuman Temple at Sonegaonlake (Source: Authors)

Image16: Historic Shiv Temple at Gandhisagar Lake serving as interaction space forwomen (Source: Authors)

Hence as stated by Sieber[72], preservation of this cultural heritage is necessary for fulfilling the needs of new users and the younger generation to get connected with the place and its tradition which could be done at waterfronts through approaches like environmentalism, history and heritage and public celebrations.

All the lakes except Gorewada serve as sites for celebrating social festivals like Ganesh and DurgaVisarjan*. Though actual immersion of idols in lakes is banned now looking at the environmental concerns, artificial lakes are formed at the banks of lakes for idol immersion. The lakefronts get flooded by families and social groups that involve themselves in various rituals and celebrate the festival enthusiastically. In the case of Futalalake, the promenade also acts as a multifunctional space by hosting orange city festival and other cultural events. As such, there is a need for providing spaces for organizing social events at other lakefronts also which will ensure the use of the spaces for a longer time period and at different periods of time. Such meaningful and participatory events have a positive effect on users' perceptions and experiences. More such programs will lead to greater multi-culturalism and higher opportunities for social interactions amongst locals thereby enhancing the sense of attachment. These interventions can contribute to the attractiveness of lakefront areas creating a portfolio of unique cultural resources. In this context, special attention should be given to actions that aim to encourage contact with the natural values as well as cultural heritage values present at lakefronts.

VIII. Proposed Framework for Perception Study of Lakefront Spaces

Based on the above study, a framework for perception study of lakefront spaces attributes is also proposed which is as follows (Table 3):
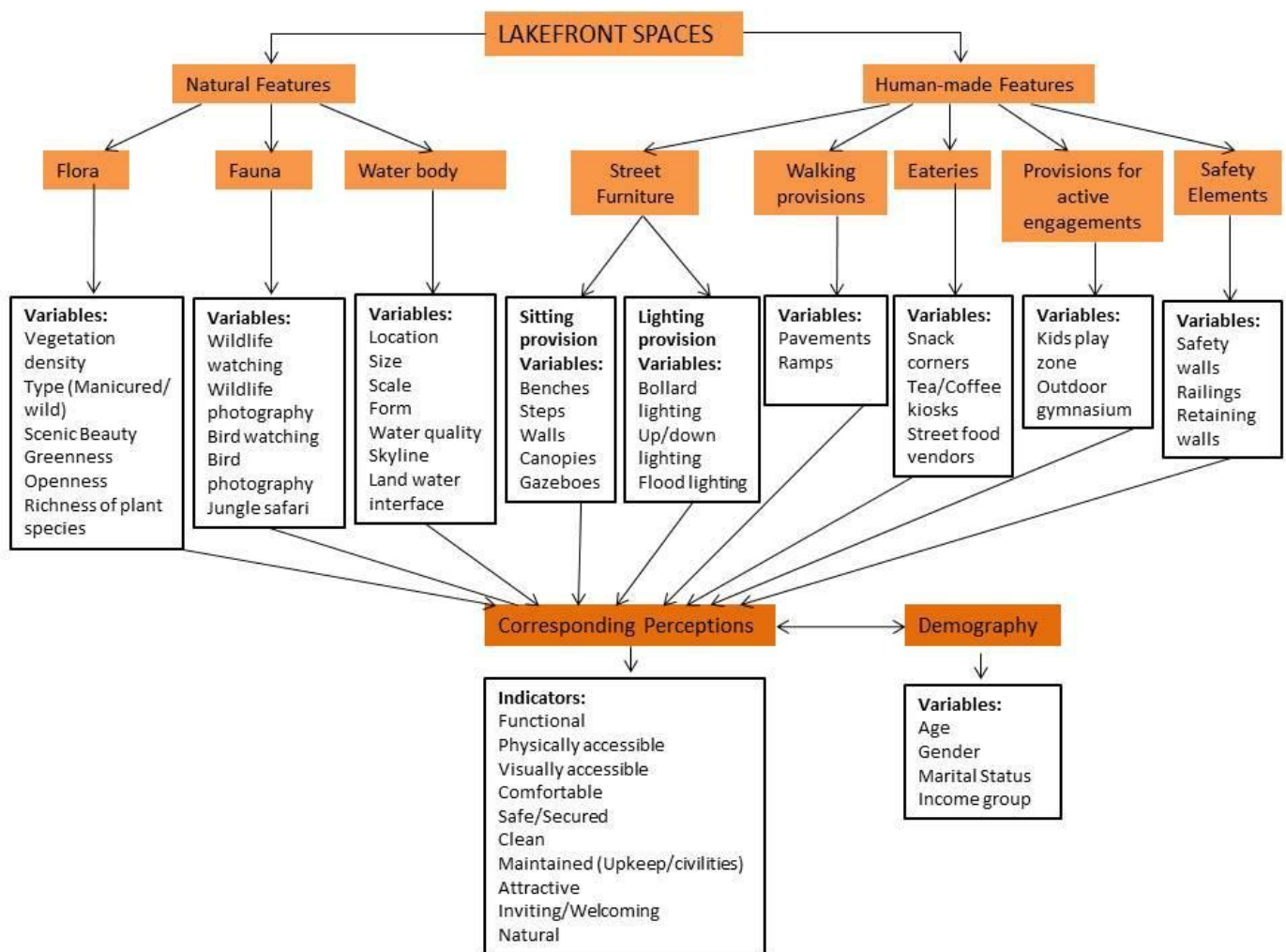
IX. Conclusions

The movement pattern of people is generally governed by design qualities of and amenities provided in the space which could be understood by recording the behavioral pattern along with character and types of activities carried out in the space by the users. This can assist in understanding the lake features which enhance peoples' activities and use of space catering to the specific type and the group of users. Addressing these deficiencies and making necessary provisions in terms of design can help in making the space more conducive for different user groups and during different days and times of the day. It is generally observed that people prefer design interventions that promote proximity to the water. Hence design elements that bring them in close proximity to water should be provided.

People are sensitive to ugly and irresponsible designs. Hence unplanned, neglected or non-maintained features including natural and manmade are the least preferred. Consequently, planners and designers must strive for maintaining and upgrading the treatment of the edge of the lakes.

Biodiversity plays an important role in enhancing people's satisfaction with urban lakefront environments since observing and experiencing flora and fauna in the form of green cover, wildlife, avifauna, etc. are highly valued motives of visiting lakefront spaces amongst the public. People like to be in the presence of nature and want to experience nature and bio-diversity present around. Accordingly, design interventions that support and are in harmony with nature should only be implemented. Landscaping elements should aid in enhancing the aesthetic quality of the space at the same time impart the desired feeling of being in nature.

The deliberate attempt of making people involve in active as well as passive engagements through provisions like outdoor gymnasium, kids play equipment and appropriate seating arrangements will help in providing opportunities for exercising, playing, interacting and chatting thereby enhancing the sense of cohesiveness. It should also be understood that both overt and covert socializing are sought for at lakefronts by the public and design should cater to it. Lack of shaded areas, outdoor furniture, and children's play equipment could be looked upon as deficiencies that hinder the maximum and effective utilization of the lakefronts. Addressing such deficiencies can result in making the space conducive for carrying out activities by a more diverse user group and at different times of a day. In addition, the safety and coexistence of users should be given utmost importance while designing such spaces.

Lakefronts should be acknowledged as landscapes comprising of natural and cultural components. Hence heritage structures at lakefronts should be conserved as they play a significant role in promoting local history, serving as a stage for celebrating festivals and cultural events and raising awareness regarding city heritage amongst local communities thereby reinforcing social and cultural connection amongst residents.

Rapport [73] asserts that apart from physical features, a place is perceived and decoded by the people based on their own expectations, experiences, roles, and motivations. Hence there is an urgent need to examine the interrelationship between present developments at lakefronts and people's perception and expectations about such developments.

*Ganesh and DurgaVisarjan: It is the formal concluding rite of ten days Ganesh or Durga Festival celebrated by Hindus, in which the clay idol of the deity is submerged into some water body.

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