Journal of Harbin Engineering University
Issn: 1006-7043

Vol 44 No. 7
July 2023

Select Street Analysis of Patna(India) in terms of Urban Design Qualities

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Abstract-This study attempts to analyse comprehensively the subjective qualities of contemporary urban streets environs. The study concentrates on five major urban qualities: imageability, enclosure, human scale, transparency and complexity. The study observes how physical characteristic of street contributes to urban design and conceived by the users. The diverse tools and techniques were used; field reconnaissance survey, observational study, synthesis map, ground and aerial level photography. The operational definitions of the urban design qualities were identified from significant literature. The qualitative difference between the operational definitions and the on-field measurements provide new insight into the behaviour of urban design qualities. The validation study is conducted on a commercial street of Patna (Bihar), which showcase the vivid character of the local Indian street. The findings could familiarize with the features of urban design qualities inter-relation in the organic, un-planned Indian streetscape.

Key Words: Urban streets, urban design qualities, synthesis map, Patna, India

1.0 Introduction

Urban design is at the interface between architecture and planning (Moughtin, 2003). Urban design or the art of building cities is the method by which man creates a built environment that fulfils his aspirations and represents his values (Rapoport, 1977). The design process is action-oriented (Moudon, 1992) concerned with the quality of the public realm (Carmona M., 2003). Moughtin (2003), revealed the main actor of the urban design in the book "Urban Design: Street and Square" as the square, street and the building (Moughtin, 2003). These features cumulatively create the public realm of cities. The public realm incorporates the packed picture of street, square, boulevards, and parks including the building facade. Streets and their sidewalks, the main public space of a city are its most vital organs (Jacobs, 1965)Hence, street demands appropriate form within the urban fabric, that can be socially, culturally and economically viable, and contribute to the vitality of the city. Street in addition to being a physical

element in the city is also a social fact (Moughtin, 2003), it brings people together and providesa physical setting for socio-economic activities (Jacob, 1993). Moreover, acts as a recreational for people than parks (Appleyard, 1981), and in setting like India, streets are the most preferred place for children to play (Whyte, 1980).

There are three analyses figured out for street in terms of that owns, uses and control it (Moughtin, 2003). It is important to know the purpose of building a street and its varying functionality in the social and economic domain. It also has a three-dimensional physical structure (Moughtin, 2003). It also acts as a link between the buildings, and in the city at large, facilitating the mobility of both pedestrian and vehicles. The streets hold a predominant visual impact on the image of the city, its spatial structure and how people perceive the city.

Henceforth, the study concentrates on the unexplored characteristic of urban design of street which gives form to the city. The study is important concerning the three-dimensional characteristic of Indian local streets. Indian local streets are generally evolved organically and serve to bind together social order or what in current parlance would be called the local urban community (Moughtin, 2003). These streets allow variations in activities in daily and used as a space for ritual observance (Moughtin, 2003), recreational activities, conversation and entertainment where people get conglomerate for their casual conversations.

In the following sections, study first discuss predominant urban design qualities; imageability, enclosure, human scale, transparency and complexity that was successfully operationalized and depicted through significant literature study in an urban context. Secondly, the methodology adopted to capture each urban design quality in the field. Here, a brief outline of the methodology is only scaled out along with study area description and reason for selection. Thirdly, the on-site fieldwork is executed to capture the true qualities of urban design as selected and discussed with validation from the literature. The purpose of capturing the sub-qualities and their interpretation in urban design quality is briefed out. Finally, the conclusion was derived in the context of urban Commercial Street and in what way urban design qualities are exhibited in Indian local streets.

2.0 Literature Study

The literature study is composed of a review of theoretical constructs organized in five categories of urban design qualities; Imageability, Enclosure, Human Scale, Transparency and Complexity. (Ewing & Handy, Measuring the unmeasurable: Urban design qualities related to walkability, 2009). The epistemological construct of urban design qualities is reviewed along with the operational meaning of the

qualities. The study concentrates on urban street and its users and the way they communicate with it. Since such communications are limited to the user's subjective faculties, the assessment of urban local stretch will be executed to fulfil the need of the study.

2.1 Imageability

The term imageability is coined by Kevin Lynch, "the quality of a physical object which gives an observer a strong and vivid image. It might also be called Legibility (Lynch K. , 1960). An image also refers to memory and this has become dominant in planning and urban design (Lynch K. , 1960). An image stands for a notion, stereotype, plan or map, plan of action, concept, and self-concept and so on (Rapoport, 1977). As a result, the state of coherency or completeness of a city hinges on its imageability, whichfacilitates people around to closely relate the sequences produced by the distinctive images in the city. These images are the organization of different city elements stored by observer imprinting the long-lasting impression. (Lynch K. , 1960), identified six different elements of imageability, such as; path, edges, district, nodes and landmarks. The location of these elements helps to make things noticeable, and paths are an utmost essential element.

Paths are the channels along which the observer customarily, occasionally or potentially moves. They may be streets, walkways, transit lines, canals, railroads (Lynch K. , 1960). The other elements in the physical environment are arranged along the path which people moving through it observe and perceive in their images. Edges are the boundaries between two phases, linear breaks in continuity: shores, railroad cuts, edges of development, walls. They are lateral references rather than coordinate axes (Lynch K. , 1960). Usually, edges are not considered as much as paths by observers. But, edges are important in organizing and holding together one area off from another, such as sea and land. The district is the medium to large sections of the city, conceived of as having two-dimensional extent., which the observer mentally enters "inside of" and which are recognized as having some common, identifying character (Lynch K. , 1960). It has internal homogeneity and can be distinguishable from outside. Nodes are the strategic spots or intensive foci in the city into which an observer can enter (Lynch K. , 1960). They gain importance due to physical characteristic like a crossing, convergence or divergence from one structure to another. Landmarks:Landmarks are types of point reference which are external and the observer does not enter within them (Lynch K. , 1960). These may be defined as a physical object such as; any building, sign or mountain. Some landmarks may be used as a radial reference seen from a distancewhile other is restricted and visible only from certain approaches. Landmarks have three attributes associated with it, it acts as visual termination /origin point, orientation

point, and contrast point in an urban scenario. "A landmark lifts a considerable area around itself out of anonymity, giving it an identity and visual structure". (Tunard & Pushkarev, 1986). Buildings with distinct characteristics make an important landmark. (Evans, Smith, & Pezdek, 1982) It could be an important heritage building, a public building serving a larger function, or a normal building associated with the famous incident, event or personalities. All the elements overlap each other creating a full image of the physical environment to humans providing them psychological well-being. The district is structured with node, defined by edges, penetrated by the path and sprinkled with landmarks (Lynch K. , 1960). Jan Gehl (1987), defines imageability as 'Sense of Place' with the illustration of city squares of Rome in which "life in the space, the climate, and the architectural quality support and complement each other to create an unforgettable total impression". (Gehl J. , 1987). In this manner, people hold a different image of the city based on their experience, and responsive emotion within them. The city itself dramatizes the event in the physical environment.

2.2 Enclosure

Urban design literature suggests enclosure as a function of the ratio of height to width and scale as well. The value of enclosure accentuates the notion of positive urban space reflecting good physical public space and in this case urban street.The enclosure is defined as "an outdoor space is positive when it has a distinct anddefinite shape, as definite as the shape of a room, and when its shape is asimportant as the shapes of the buildings which surround it" (Alexander, Ishikawa, & Silverstein, 1977).The positive urban space is explicitly eligible and defined; it is balanced with its defining masses (Alkhresheh, 2007). Following this, urban designer and planner incorporated enclosure as a device that has to do with the height of the building and width of the street, constructing a three-dimensional perspective of the street. The enclosure is a certain arrangement of buildings to create intentionally three-dimension space. (Headman, 1984). An ideal street must be a completely enclosed unit (Carmona M., 2003). These buildings become the walls of the outdoor room 'enclosure', the street and footpath become the floor, and the sky is the ceiling (Ewing & Sandy, 2009).The following points detail out the enclosure coupled with the ratio and scale.

Enclosure and Ratio: In urban street space, enclosure seems like an inverted U-shaped (Alkhresheh, 2007),which plays a significant role in determining the user's sense of comfort and safety judgment. Hence, enclosure emphasizedthe compositional quality of a street as a ratio of the height of the building and width of that street. Literature suggests the range of height to width ratio for the urban street as maximum enclosure ratio of 4:1 (Nelessen, 1993), minimum of 1:1 (Carmona M., 2003),and ideal

ratio of the range of 1:3 to 1:2 (Lynch & Hank, 1975).

Enclosure and Scale: likewise, the scale is again an important role player in defining the sense of enclosure in street space. Spaces with the same ration but different scale impose a different sense of enclosure. Human perceives a wide street, not as a whole entity rather involves a selection in segments. The huge street is neither sensitive to humans nor in intimate scale. Whereas, small and narrow street adds social and functional value; "small space makes people deal with each other" and bring a feeling of security (Jacob, 1993).

Furthermore, street trees contribute to creatingan enclosure in the absence of buildings. The long stretch of trees on both sides of the street encloses the vacant area, acts as a wall. Trees enclose the vacant areas horizontally while leaves and branches create an airy ceiling vertically (Arnold, 1993). Likewise, visual termination also creates an enclosure. Long streets terminated by a prominent building, square, monument, fountain etc. could create enclosure (Duany & Playter-Zyberk, 1992). Grid-iron street network reduces enclosure whereas; cul-de-sac creates a strong sense of enclosure. The irregular and organic street network create visual terminations.

Loss of enclosure is perceived when there is a break in the continuity of building a line to accommodate dead spaces like a parking lot, courtyard, driveway, vacant plot and all those activities which do not attract people. Large building setbacks create dead spaces, both in front and side of the space is not in active use. "Building setbacks from the street originally invented to protect the public

Welfare by giving every building light and air has helped greatly todestroy the street as social space". (Alexander, Ishikawa, & Silverstein, 1977)

2.3 Human Scale

The term human scale is inescapable in urban design theories. Designing to human scale suggest the human-centred design of physical elements to generate a positive outlook from users. A human-scale can also refer to how people perceive a city.It is the relationship between the building or part of it with humans. In the last 50 years, the architect has forgotten what a good human scale is (Gehl J. , 1987). It is essential to design any street to look appealing to human, a walking being standing at street level. A human-scale city advocates a close interaction between human and their physical surroundings. The height of the building also influences the urban environment and human scale.The resultant is the two-way process between observer and perceived environment. Therefore, different opinion from researchers concluded that buildings more than six storeys (Lennard, 1987), buildings more than four storeys (Alexander, Ishikawa, & Silverstein, 1977), more than three storeys (Blumenfield, 1953)are

beyond human scale. Trancik (1986) suggested the profile of the front façade of the building to raise the experience of the humans moving around. At street level, the lower floor of the building must spread out and upper floor steps back and then ascend. (Trancik, 1986).To design such a form, the width of the building along with height is also a fundamental requirement to definethe human scale.

Certainly, the perception of difference in speed of pedestrian and automobile needs to be thought of in a modernist urban environment. The motorist moving at a speed of 60 kilometres per hour and a person walking along the street has a different perception of the human scale. For example, the large font on billboards particularly designed for motorist on high speed may create confusion or disorientation to pedestrians (Davies & Kay, 1997) whereas, small font of lettering signboards are much more comfortable for pedestrians.

Personal interaction space is important in designing of Human scale. The prominent theories associated with personal interaction were advocated by many researchers. One of the pioneers is anthropologist Edward T. Hall in 1966, argued in his research of human use of space-based on cultural perception (Hall, 1966). He introduced the term Proxemics to illustrate four different spaces to show the interrelated observations. Though, the definitions vary according tothe cultural expectations that surround the individual.

- Intimate space – the closet bubble of space – 18" to contact
- Personal Space – may be physical contact - 4' to 18"
- Social space – consultative space with acquaintances as well as strangers – 12' to 4'
- Public space – relatively anonymous or impersonal interactions – 25' to 12'

Similarly,Gehl J., 1987, suggested distance as follows:

- Intimate distance: 0–1.5 feet
- Personal distance: 1.5–4.5 feet
- Social distance: 4.5–12 feet
- Public distance: 12 feet

Another important dimension is trees along the street. Street trees can likely pacify the degree or quality of negative effect tall buildingsand wide streets pose on a human scale. The canopies of the trees embrace pedestrian, providing an overwhelming experience of confinement within a large volume. Meanwhile, an additional line of trees planted on wide streets supposes 12 meters will ensure enclosure (Headman, 1984). There are many other physical elements to pose human scale on street in the presence of tall buildings like; building setback, fenestration, building height, street furniture, pavement texture, ornamentations on the building, window, doors, cars, etc. (Ewing & Handy, Measuring the unmeasurable: Urban design qualities related to walkability, 2009).

Many previous attempts to operationalize the definition of the human scale as the desired quality are more in qualitative terms defining the built elements relative to the human body. This is exemplified in Rockefeller Centre and Times Square which is compensating the monumental scale to human scale by use of physical elements at street level (Ewing & Sandy, 2009).

2.4 Transparency

The word transparency is synonymous to interpenetration or superimposition in the literature of contemporary architecture (Slutzky & Rowe, 1963). According to the dictionary definition, it is the quality of material that allows light to pass through so that objects behind can be distinctly seen. Thus, transparency is the quality most favourable in architecture that creates a connection between inside and outside space. Transparency is when internalactivities are 'externalized' or brought out to the sidewalk (Llewelyn-Davies, 2000). Transparency may be an inherent quality of substance, as in a glass curtain wall; or it may be an inherent quality of organization (Slutzky & Rowe, 1963). The classic example is how the passer-by easily peeks inside the shop and are invited for shopping from visual catalogue or dining purposely arranged on sides of the street to dramatize the street life. On the other hand, blank walls and garages reveal the absence of people (Jacob, 1993). Transparency, however, implies more than an optical characteristic; it implies a broader spatial order. Transparency means a simultaneous perception of different spatial locations (Slutzky & Rowe, 1963). The understanding of transparency is broadly under three major headings; Literal, Phenomenal and Experiential. The first two categories were elaborated in Colin Rowe'swork where he defined the twofold interpretation of transparency. Literal Transparency indicates the physical translucence characteristic inherited by the material. Admittedly, it is advantageous as an architectural element where the façade is made up of transparent material allowing the visual interaction between the interior and the exterior space. The visual boundary is diffused and there is no ambiguity in spaces in front or behind the material. On the contrary, phenomenal transparency, is achieved by the designed by purposely abstracting spaces by organizing or reorganizing the spaces in multiple grids like; the transition of spaces, landscape elements, etc. It is though not achieved in architecture exclusively with a transparency of the materials (Slutzky & Rowe, 1963). Space not only recedes but fluctuates in a continuous activity (D'Souza & Bimal Balakrishnan). Unlike literal transparency, phenomenal thrives in the interpenetration of spaces which brings multiple readings in the form. Thirdly, experiential transparency suggests ease of access to a building. The user experience all form interaction in an architectural space that provides access to the building.

Therefore, transparency played a vital role in urban design and inter-related it to urban life.

Through transparency, inside and outside is exposed to the public life on the street and enriched the relations between the building a public on the street. This can be further articulated with installations of street furniture, landscape elements, public art, etc.

2.5 Complexity

Complexity is related to the number of noticeable differences to which a viewer is exposed per unit time (Ewing & Sandy, 2009). Physical complexity at a scale of urban design creates a sense in humans, based on the information perceived by them from the built environment.The urban design streams on diverse typology to measure complexity butnot limited to temporal, visual, spatial, scaling, and connectivity dimensions in or around the built environment. This unpacks the aspects of complexity in urban form and design outcomes. The first dimension, temporal indicates the processes and change over time; there is unpredictability in the street life and people around. This adds to chaos throughout the day or night creating human movement, traffic jams, dynamic activities, and subsequently, operational economic and life to the place. The second dimension elaborates visual, how people perceive the built environment in terms of coherency, legibility, organization and interest. This generates a sense of enclosure, unity in form, variety in activity, building facades, building use, tress, canopy, street furniture, and signage, light and shadow patterns. Likewise, the third dimension, spatial creates complexity through mixed land use, the pattern of development, urban form, distribution of block shapes and sizes, etc. the fourth dimension, scaling discloses fractal patterns in urban form, buildings, ornamentation, architectural diversity or similarity across multiple scales. Lastly, connectivity discusses network and circulation. The communication and travel pattern of people in the area reflects the connectivity and permeability in the city. Thus, these key dimensions are sometimes over-arching though vital to assess complexity in the existing scenario, based on which proposals can be processed. The relation between order and complexity is definite to derive chaos that pertains to urban form. It is assumed that more disorderly, more complex the environment it will be and vice-versa. The level of noise add further complexity to the overall dimensions of the chaos(Kumari et al., 2023).

3.0 Method and Material

3.1 Site location –Boring Road, Patna

Boring road of the capital city Patna of Biharis the vital commercial street. The street emerged as one of the important locations for commercial activities, offices, coaching centres, hospital and residential too. The integration of land use eventually become non-existent due to mixed activities along the street.

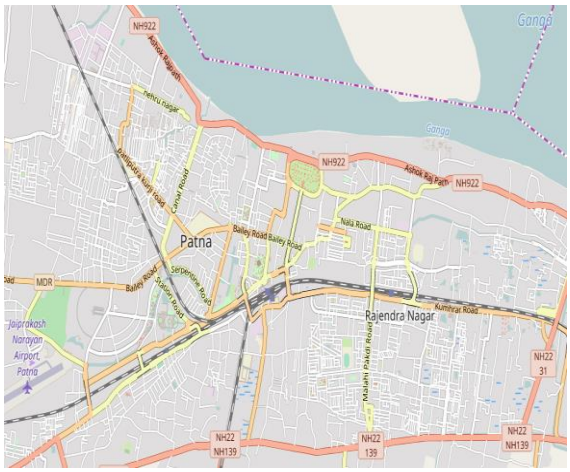


Figure 1 Map Showing Location of Boring Road

Source: openstreetmap.org

3.2 Method

The research used a diverse set of tool and techniques to capture the subjective qualities of urban design. Therefore, to execute the data collection on physical characteristics of urban commercial street, urban design qualities were bracketed in five different sets. The selection of the site was based on location, types of activities carried out and density of the area. The study then collected and analysedsecondary data through various implemented case studies in the field of urban design to identified different qualities that encapsulate the street environment. To initiate the primary data collection, the site was selected based on the different parameters, later we tried to incorporate open-source software to bring about the collection and analysis of the data on our fieldwork. The study incorporated field reconnaissance survey, observational study, synthesis map, aerial and ground-level photography.

During a field reconnaissance walk, the stretch length and alternative paths were noted with greater efficiency. It is of utmost importance in developing the preliminary plan to execute the study. This is followed by the observational study of the street environment, exploring and capturing the variety of information without altering the environment. The structured direct observation with aerial and ground-level photography had given the advantage to gather the information on the existing behaviour of the events or situationthat was readily available that results in qualitative data.

In addition to this, the application of Synthesis map approach was selected for its reliability and validity to systematically understand the complexity of different dimensions of the street. This systematic tool is used to collect and integrate the complex system of the physical characteristic of the street. The major advantage of synthesis map is to determine the complexities of the phenomenon and provide a holistic lens as a shared representation to understand the inter-relation for collaborative work ---- “rich picture”. The process involved the creation of a map to research, analyse, order, identify, streamline, summarizethe elements which are synthesised across the different field. Theexecution of the method establishesa “shared view” of the systemic problem.Different elements of Synthesis maps that illustrate and simplify the complex network includes; narrative, organizational diagrams, photos, illustrations,

iconography and key quotes. The collaborative nature of diverse methodology offered an advantage in characterising the nuance detailing of the street useful to know the intense nature of the subject.

3.3 Conceptual framework

Perception is a mechanism by which man makes sense of the environment (Ewing & Sandy, 2009). The perception is initiated with the communication with the environment, results in encoding, i.e. cognition, followed by evaluation and action (Rapoport, 1977). Individual perception depends entirely on their culture, experience and the interplay of the elements of the built environment. The conceptual framework for the study considersassessing the inter-relationship of physical features and urban design qualities and how this relationship ensures the qualities such as the sense of safety, comfort and level of interest in the observer who witnesses the built environment. Since the perception is different for different people therefore, the researcher measures the variable and articulate the integration between physical features of the study area and its connection with the urban design qualities.

Imageability	
Urban design Qualities	**Sub-qualities to be marked**
No. of People	Same side of the street
Proportion of Historic Building	Both side of the street
Courtyards	
Plaza	No. of each on both the side of the street
Parks	
Outdoor Dining	Y/N
Building with Non-rectilinear silhouettes	
Noise Level on street	
Major landscape feature	Unusual topography
	Marquee image, etc.
No. of building with identifier	Quality that evoke image in observe

Enclosure	
Urban design Qualities	**Sub-qualities to be marked**
Building height	Both side of the street
Proportion of sky across/project	
Street width	
Trees	Both the side of street
	Types of tree
	Height of trees
Fences	
Visual termination points	Prominent building
	Monuments
	Fountain, etc.
Layout of street network	Rectilinear
	irregular
Dead Space	Vacant lots
	Parking lots
	Driveways
	Any other space without human presence
Bye-laws codes	Building lines
	Setback
	Frontage of building
	Street width
	Abutting building height

Human Scale	
Urban design Qualities	**Sub-qualities to be marked**
Building Profile	Continuous Height of building
	Puncture in facade
Street tress	
Paving Pattern	
Street furniture	Number
	Types

Depth of Setback of building	
Presence of parked cars	Y/N
Spacing of windows and doors	
No. of long sight lines	
No. of planters	
Proportion first floor with window	
Transparency	
Urban design Qualities	**Sub-qualities to be marked**
Walls	Dead/blank walls
	glazed
Windows	
Doors	
Fence	
landscaping	
Opening to mid-block spaces	
Window as a percentage of ground floor façade	
Active use of street sides	Both the side of street
Proportion of street walls	
Complexity	
Urban design Qualities	**Sub-qualities to be marked**
Built Environment variations	No. of building
	Types of building
	Ornamentation
	Architecture Diversity
Landscape	Trees types, profile
Street Furniture	Street lights
	Fountain
	Benches
	Special paving
	Public Art
Signage	Location
	Shape
	Colour
	Direction
	Lettering Style
People diversity	Customers
	Shoppers
	Vendors
	Any other
Activities in place	
Pattern of development	Rectilinear
	organic
Integration of land use	Commercial,
	Residential
	Civic use
	Recreational
	Any other
Housing types	
Transportation modes	
Colors variation	buildings
Neighbourhood diversity	High
	low

3.0 Results and Discussion

The net effects of other urban design qualities collectively evoke strong image on viewer, making it more distinct, recognizable and memorable. These quality depict the quality of life and the distinct way in which activities take place in the busy commercial street. Imageability is related to the sense of place ((Gehl J. , 1987). Based on the field experience of the Boring Road, of length, 600 metres is a busy commercial street. There are a number of people visible in a scene including those standing, sitting and moving pedestrian or on vehicles. The noise level range 75 to 90 dB on the street during peak hour survey between 11 am to 12:30 pm. Though the noise level quality perception of imageability is detracted. The site comprises of quite a few buildings with identifiers, one such is pyramidal temple structure. This non-rectilinear silhouette is significantly distinguishable among other office hubs and shops of rectilinear forms. The informal vending of snacks along the street acts as a focal point that attracts a crowd and also

serves as a utility to shops. This shows the different urban dimension of the Indian street. The lack of significance of landmarks, plaza, parks, distinctive vernacular architecture, striking views and unusual topography forces us to rethink on the monotony of the place.

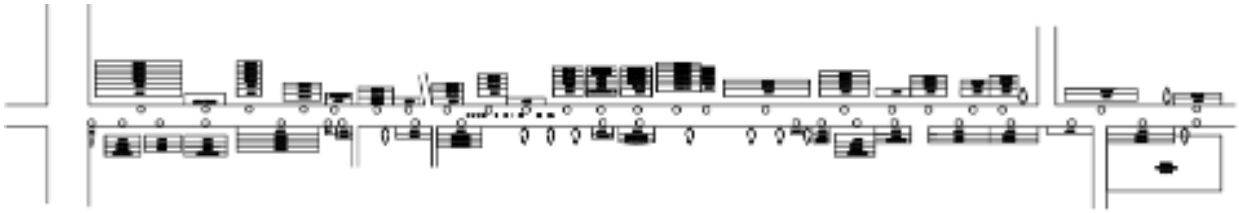
The enclosure is formed on Boring road by lining the commercial street with few broken building front because of the presence of parking lots and vacant plots. Though, the sense of enclosure is almost achieved as suggested by Allan Jacaobs (1993), as the proportion of building heights to street width should be a least 1:2. The road width is uniform (15 m) with buildings on both side of road some built on edge and some buildings with front set back. Building frontage length along with its height was tabulated. Out of total 600 m stretch about 345 m was flanked by buildings in

Sl. No.	Total Stretch under study (in M)	Width of Road (in M)	Building on the north of Road (in M)	Width of Building (in M)	Height of Building (in M)	Enclosure Ratio to the north	Building on the South of Road (in M)	Width of Building (in M)	Height of Building (in M)	Enclosure Ratio to the south	Shared width of Building face to face(in M)
1			Building 1	3.6	12	0.8					3.6
2			Building 3	15	14.2	0.95	Building 2	41	23.2	1.55	15
3			Building 4	17.5	11.2	0.75					17.5
4			Building 6	21	14.2	0.95	Building 5	19	10	0.67	19
5			Building 9	40	17.2	1.15	Building 7	14	23.2	1.55	14
6							Building 8	11	11.2	0.75	11
7			Building 11	5	5.2	0.35	Building 10	12	8.2	0.55	5
8			Building 12	6	8.2	0.55					6
9			----	----	----	----	Building 13	11	11.2	0.75	----
10			Building 14	7.5	5.2	0.35	Building 15	16.25	8.2	0.55	8
11			Building 17	17.6	14.2	0.95	Building 16	11.25	14.2	0.95	6
12							Building 18	9.5	14.2	0.95	3
13			----	----	----	----	Building 19	15	5.2	0.35	----
14	600 M	15	----	----	----	----	Building 20	13	20.2	1.35	----
15			Building 22	11	8.2	0.55	Building 21	15.8	20.2	1.35	11
16			Building 24	15.25	12	0.80	Building 23	11.5	20.2	1.35	11.5
17			----	----	----	----	Building 25	14	20.2	1.35	----
18			----	----	----	----	Building 26	8	17.2	1.15	----
19			Building 28	9.5	5.2	0.35	Building 27	44.25	11.2	0.75	7
20			Building 29	13.5	11.2	0.75	Building 30	24.3	17.2	1.15	5
21			Building 31	20.13	14.2	0.95					19.3
22			Building 33	15	11.2	0.75	Building 32	15.5	5.2	0.35	15
23			Building 35	20	11.2	0.75	Building 34	12.25	14.2	0.95	9
24							Building 36	13.5	11.2	0.75	7
25			Building 38	32	11.2	0.75	Building 37	14	14.2	0.95	14
26			Building 39	22	5.2	0.35	Building 40	36	8.2	0.55	13
27			Building 41	30	11.2	0.75					12
28			Building 43	24	44.2	2.95	Building 42	24	8.2	0.55	24
29				**345.58**				**406.1**			

the North of the Road while South of the road it is about 406 m. The height of the building in the North varies from 5.2 m (G+1) to 44m (G+13) while in South it varies from 5.2 m (G+1) to 23.2 m (G+7).

of enclosure created by the building and trees along the street.

Human scale as suggested byTrancik, 1986, is increased by the application of stepback on



Analytically we are able to establish that the sense of enclosure is highly lacking in the entire stretch of study area. Required height is partially achieved in Southern side of Road but to complement it the Northern side fails to provide the enclosure. Even the tree masses are missing which could have brought the sense of Enclosure.

.As suggested by Henry Arnold, 1993, trees define spaces both horizontally and vertically. On both, the side of the roads 11 deciduous trees are planted of height range of 9 to 15 meters. The tree line plays a dominant role as they define the street space by forming a ceiling by their canopy. A visual termination plays an important role in the sense of enclosure. There is no monument or unique architectural element except the pyramidical temple, which may act as a visual termination. Since the street is not strongly defined by the architecture of the building, the use of the building acts as a focal point and maintain visual linearity in the organization. The rectilinear layout of the street creates a strong sightline. The straight-line undermine the sense

upper floors of the building along the street. The commercial street has continuous building profile without puncture or stepback as the building ascends. In addition to it, depth of setback is minimum 3m and a maximum of 9m for the tall building measured on field survey also relate human scale. The relationship of building to human beings determines human scale. The visual assessment of component of the building breaks the components into smaller units. Firstly, the opening of the ground floor which was mostly of rolling shutter considering the safety aspect of the stores. Secondly, the fenestration mostly on the first-floor range between 45 per cent to 75 per cent in some cases. The style does not represent a monumental scale or feeling of grandeur. The spectrum of relationship range from intimate to monumental. Within a 600m of stretch, 9 deciduous trees, 5 advertisement hoardings, 4 traffic lights and 6 transformers add variance in human scale ratings. The presence of such elements increases the perception of human scale. The 2 long sightlines in the opposite

direction along the street stretch also contribute to the perception of the human scale.

Transparency is utmost at the street level. The active use of the street is for commercial activities, and it is where effective interaction needed between indoor and outdoor. A dead wall of one building of three-storey and lack of landscaping along the street is a classic example of a design element that reduce transparency. Whereas, 75 per cent of the display window and doors on the ground floor façade contribute to transparency inviting passerby to look inside the shops. Reflective glasses in quite a few cases detract transparency. Physical element such as the opening to mid-block influence transparency. Trees of height 9m to 15m also contribute to transparency, as their canopies act as a partial transparent tent. This gives a sense of habitation especially the one close to a blank wall. By contrast, small tress in most urban setting work against transparency (Arnold, 1993).

The built environment comprised some noticeable difference for the viewer. Total 43 buildings of the whole stretch studied, out of which 32 were commercial shops, 6 mixed-used, 1 residential, 1 petrol pump, and 1 temple. The predominant use of the street is under commercial activities with no special feature that may emphasize the style of architecture. The nagara style temple is usually the centre of attraction because of its diverse style. The variant activities in front of the shops and offices of the commercial street show vividness and chaotic experience. All different modes of transport are operated in the street from cyle, auto, car to busses. The environment provides three levels of usual information: elements are too similar like deciduous trees, street lights and advertisement hoarding, although numerous and varied, use of the street is predictable though hold a diversity of people such as customers, shoppers, vendors and others. The walking distance seems shorter by virtue that the trip is divided naturally into manageable stages (Gehl J. , 1987). Thus, too unordered for comprehension because the block face included residential, commercial as well as mixed-use neighbourhood exemplifying high diversity.

4.0 Conclusion

The study illustrates the important physical characteristic of the commercial street environment that adds to more abstract urban design qualities. Although five prime qualities have been discussed in the study which is significant and show a substantial relationship with different scenes in the field. These parameters can easily be measured by urban designers both qualitatively and quantitatively to explain the use of public space, pedestrian movement, activities, etc. moreover, the physical environment study will help planners to assess the public space requirement to identify problems and develop strategies for potential outcomes. the study concentrated on Indian

commercial street of a metro city, Patna. It might not be applied to other settings. It seems likely that users street space would react in exactly the same may as researchers observation on field survey explain the overall quality of life.

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