

## **INFLUENCE OF NEIGHBORHOOD STREET PATTERN FOCUSING DEAD-END STREETS AS SOCIAL COHESION OF NEIGHBORHOOD: DELINEATING PHYSICAL ATTRIBUTES OF DEAD-END STREETS IN MOHAMMADPUR, DHAKA.**

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### **Abstract**

With the accelerating growth rate of rural-urban migration, Dhaka is teeming with dense urban formal and informal settlements. To aggravate the situation, numerous housing projects are sprouting without expert opinions and overlooking the need for open public place and proper connectivity. The changing nature of the physical characteristics of Dhaka City is caused by the prevalent urbanization process where open spaces and water bodies are being converted into built-up areas. The paucity of open spaces related to the very liveability of Dhaka threatens community, culture and social value of inhabitants, thus compelled them to look for new resolutions. The intention of this study is to contribute to how physical characteristics of dead-end streets adjacent to housing areas and inadvertent organic as well as inorganic patterns of the neighbourhood streets, particularly the dead-end shape the public space quality. The spatial analysis based on current gathering points of inhabitants in murky neighbourhood streets of Mohammadpur, Dhaka is carried out via Space syntax using depth map and behaviour mapping. The research is deeply concerned with the quality of life in these areas, from a perspective of sufferer, like the elderly and children. The findings will focus on (1) to analyse changing behaviour pattern at different dead-end street comparatively and also (2) to identify the major driving forces behind the changes in street connectivity applied in evaluating the street as a great public space.

**Keywords:** *Urban public space, Street life, Behaviour mapping, Space syntax, Accessibility*

### **1. Introduction**

Dhaka, the capital of Bangladesh, one of the densely populated cities in the world, the city of culture and diversity is being saturated day by day because of migration and population growth. Millions of population is adding with the existing number of population per year. Leaving their poor rural surroundings, they migrate to Dhaka with the high hope and aspiration for an opportunity of having a decent and modest living. Dhaka with the municipalities making the greater Dhaka have a total population of 18 million and the population growth of this megacity is of about 4.2% annually. (World population review.) This extra population is creating more problems in urban conditions like housing problem, shortage of drinking water, lack of proper sanitation, traffic jam and so on. To solve the problem of proper shelter facilities, there developed many formal and informal settlements in different areas for different groups of people of which most of these are unplanned and developed randomly. These housing projects without proper planning and supervision create many problematic features in urban condition. Lack of enough open spaces, poor connectivity from one block to another, insufficient spaces for public gatherings, linear road networks for motorized/non-motorized vehicles, insufficient/no pedestrian access to the housing etc. are very common problems derived from these unplanned housings. Moreover, the open spaces and the water-bodies are converted into build up areas to meet the growing need of housings without considering the need for open spaces for the neighbourhood. This changing nature of the physical characteristics of this megacity has agitating tremendously the appropriate urbanization process which has been threatening the liveability of community. The paucity of open spaces in the neighbourhood is affecting the culture and the social value of the inhabitants which are creating the new resolutions for the need. In this study, it is shown that how the physical characteristics of the neighbourhood street patterns specifically the dead end streets adjacent to the housings created spontaneously in an inorganic way shape the physical conditions of the public space quality. The connectivity and accessibility of dead and streets will be identified using space syntax and the behaviour map will let to understand the actual possible events happening in the dead end streets of the neighbourhood.

## 2. Literature Review

### 2.1. NETWORK OF STREETS AND STREET PATTERN

The concept of a microscopic street networks developed by Marshall (2005). The city to city and connection over a substantial portion of the city is considered as The Macro-level(continuous).The neighborhood street network for residents travel which are not continuous are considered as the Micro-level. Marshall (2005) then combines the four types of Citywide Street network types (linear, tributary, radial, and grid) with the two types of Neighborhood Street network (tree and grid) to describe the street hierarchy in a city (Marshall & Garrick, 2010, 2011).Another approach to classify street pattern in a community is formed by Southworth & BenJoseph (2003).They classified street patterns into five categories: gridiron, fragmented parallel, wrapped parallel, loops and lollipops, and lollipops on a stick.

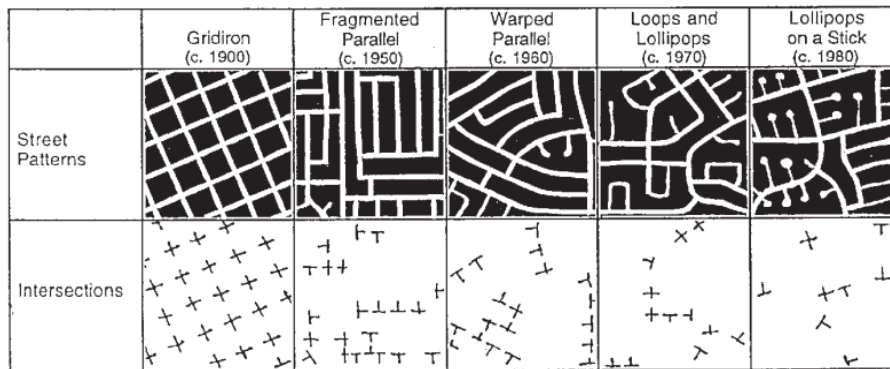


Figure 1, Types of Street Patterns (Source: Southworth and Ben-Joseph, 2003)

The loops and lollipops pattern is characterized by the presence of loops and cul-de-sacs. Loops and lollipops create a non-directional pattern of streets that tend to loop back on themselves. Interconnection is limited to several through streets not readily apparent in the plan. As this pattern has limited route choices and few access points, it creates quiet streets that are relatively safe for children. It also limits pedestrian access and increases auto trips but concentrates them on the few existing arterials (Southworth & Owens, 1993).

The lollipop on a stick street pattern is formed by branching off dead end cul de sacs from a few easily recognized through streets. It maximizes privacy but limits intersections, route choices and access points substantially. This limited access design maximizes the number of house lots on short dead-end streets and hampers pedestrian movement to a great extent (Southworth & Owens, 1993)

Planners are seeking alternatives to the contemporary network practice where a branching hierarchy is used so that local streets only link into connectors, while connectors only link to arterials (CNU, 2012). The circular bulb used to enable the uninterrupted turn of an automobile at the end of a cul-de-sac is the defining characteristic that makes it distinguishable from a traditional dead-end street. Cul-de-sacs were first created as short and straight streets, and were designed to form a common public space for residents, while they also provided a safe environment that inhibited through traffic and limited the speed of vehicles (Othman & Said, 2010).

The walkability within neighborhood is compromised as walking distance desired by residents are generally far from 5 minutes walking distance. Walkability demands both a conducive street pattern and a land use arrangement that make amenities accessible to pedestrians. Pedestrian friendly streets are crowded and disconnected and frustrated the drivers.

Our research involves exploring existing planning and sociological literature to identify the key points concerning the public space activities could be performed in dead end streets in case where accessible open public spaces is limited. The study is the assessment of how social interaction is enhanced by dead end streets in a dense neighbourhood condition of Dhaka city where the unplanned dead-end streets have an enormous impact on their social life.

## 2.2. STREET AS A SOCIAL PLACE

The origin of street is linked to the evolution of public and private spaces. Street works as micro level network of communication in between neighborhoods and macro level communication system within the city. In neighborhood the linkage provide social interaction and exchange, empowering the quality of a community. In addition to being one of the most noticeable elements of the built environment and the foundation for numerous modes of transportation, street networks connect destinations that are spatially separated to facilitate the movement of people, goods, ideas, and wealth (CNU, 2012). The quality of a street depends on both physical and operational attributes .Operational attributes depend on Street life, visual interest, social status and population density whereas the physical attributes ensures the safety, security and comfort. Thus ensuring the physical and social attributes a resident in neighbourhood gets a memorable image of living within a city. Sadly,the sociability largely affected by car traffic. Although a wide and well-connected street in a neighbourhood invites traffic. To enhance sociability, particularly with regard to children's safety and play, most traffic experts recommend discontinuous street patterns of the kind found in conventional loop and cul-de-sac suburbs. Such street patterns consistently show a lower rate of accidents and a higher level of perceived security. Hochschild (2014) displays evidence that strong social networks on cul de sacs may create a greater sense of neighbourhood interconnectedness than is typically found on grid streets.

## 3. Methodology

### 3.1. SPACE SYNTAX AS A TOOL FOR CONNECTIVITY MAPPING

Space syntax is a method for analyzing the relation between spaces and the use of that space. Space syntax is a kind of graph theory which describes and measures quantitatively the configurational properties of urban spaces and urban morphology (Hiller & Hanson, 1984). Space syntax aims at categorizing the rational properties of urban open spaces on basis of the use of individuals of different open spaces and the relationship among the spaces. This theory hypothesizes that the built environment as well as the system carries movement from one space to another within the system. For example, a better physical connection from one space to another and longer lines of sight cause better densities of movement. Movement is that kind of syntactic property of space which can be testified by implementing space syntax theory (Peponis & Wineman, 2002). Space syntax generates the theory of understanding the usage and activities of spatial configuration by means of social and cultural attributes and these social and cultural configurations shape the social interaction in the built environment (Dursun, 2007)

This methodology has been widely used for analyzing city structures and connectivity. In Space syntax, the spaces are considered as voids (streets, squares, rooms, Field, etc.) between buildings, walls, fences and other obstructions that restrain (pedestrian) traffic and the visual field. Among several methods for analyzing a city via space syntax methodology a common way is to prepare an axial map for further analysis. An axial map is an appropriate representation of spatial structure of the quantitative syntactical measure like road networks. This map is a network of intersecting lines that consists of the longest sets of lines of sight that pass through all the open spaces of the study area (Kim & Penn, 2004). An axial map shows the least number of straight lines covering study area. All combined syntactical measures of axial lines of an axial map represent connectivity, control and integration among the open spaces (Baran, Rodri' guez & Khattak, 2008).

In this study, space syntax is working as a tool by generating an axial map from the site plan of the two neighbourhood dead end streets with peripheral area (study area). This axial map will indicate the probable connectivity and spatial conditions of the streets both regular and dead end streets. The axial map will identify the different location of dead end streets at that area and stipulate the necessity of the connection among the street pattern and also determine the probable dead end streets can be redefined as public open space of that neighbourhood.

### 3.2. OBSERVATION: WALK-BY OBSERVATION AND BEHAVIOR MAPPING

Observation and behaviour mapping as a combined technique in studying the environment-behaviour relationship has been a known and used method for some decades (for example, Ittelson et al, 1970).For

behaviour mapping, walk-by observation was done in two different neighbourhood dead end streets of Mohammadpur to record the stationary and residual activities of people at those locations where people gather and perform different types of activities. In recording and gathering the walk-by observation data, several methods were used in different structured and non-structured way. Physical survey was done at several times and the activity, usability and spatial capacity of the spaces were recorded and addressed accordingly. Duration of stay and gathering activities were also recorded on survey. The walk-by observation will address the behaviour mapping of those dead-end streets at various times from morning to evening. . Data from the dead-end streets were collected in August 5, 2019. A day observation has two sections: morning (10.00-12.00) and afternoon (14.00-16.00).A good overview across a place was provided. The onsite physical evaluation was done by walk through the dead end streets and observing the physical attributes of the spaces in particular three criteria: (1)access and linkage of the dead end streets, (2) uses and activities of the dead end streets and (3) sociability :social interaction.

#### 4. Study Area

The study area consists with two different neighborhoods in Mohammadpur. The neighborhood develops in a private housing named Chand Mia housing LTD. They deliberately filled the nearby canal from the Buriganga river and encroached the riverbed. To gain more profits they developed an unplanned zoning without considering the social cohesion of a sustainable neighborhood. As a result this private housing developed in an unplanned way only to consider more buildings and profits. Hardly any private housing in Mohammadpur considers the need for public spaces for the residents. Therefore, within 5 minutes and 10 minutes walking distance there is no park or playground accessible publicly.

Streets in these neighborhoods don't follow any standard neighborhood design standard. Random streets are connected each other and created dead-ends where another plot located. Maximum road width of connectors streets are 20-22 feet. Neighborhood 2, Baitul aman housing is comparatively old. Yet this housing also exhibits similar issues regarding street pattern and neighborhood street activity.

Case studies represent two urban neighborhoods with similar characteristics such as size, density, cultural significance. Both neighborhoods is located in Mohammadpur thana with a highly dense urban condition without necessary open spaces for gathering. In this respect, they have a similar atmosphere in terms of their daily routine.

Lack of planning, illegal encroachment of land has been reduced the public open spaces for gathering and social activities. Together with vague standards, irregularities and guidelines for open space, this resulted in low quality of new residential developments, lacking communal open spaces to accommodate the outdoor activities.

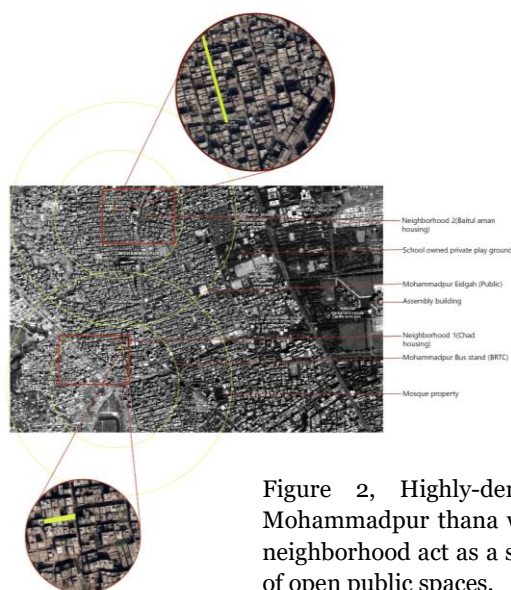


Figure 2, Highly-dense urban condition is shown in Mohammadpur thana where dead-end streets in two different neighborhood act as a social platform for gathering due to lack of open public spaces.  
(Source: Google map)

## 5. Findings and Discussions

### 5.1 IDENTIFYING CONNECTIVITY USING SPACE SYNTAX

The axial map generated in space syntax indicates the connectivity and spatial conditions of the study area. There is different colour coding to identify the actual spatial condition of the streets. The bluer coding indicates less or poor connectivity of that street as well as open spaces. And accordingly bluish green, green, greenish yellow, yellow, orange and red indicate less to extreme connectivity of that area. After generating the axial map, the connectivity and usage condition of the dead end streets are identified and from that simulation, two particular dead end streets have been selected for further survey which is behaviour mapping.

This axial map indicates the actual movement condition and connectivity of study area and identifies the possible dead-ends which can be used as public spaces at different times.



Figure 3, Axial map in Space syntax ( Study area 1, Study area 2)

### 5.2. WALK-BY OBSERVATION AND BEHAVIOUR MAPPING

From observation in different dead-end streets, behaviour maps have been produced to illustrate different activities in dead-end streets. The distribution of behaviours throughout the space has been analyzed. The behaviours of residents in the neighbourhood changed frequently at the dead ends. During day time at the morning from 10.00-12.00 and at the afternoon from 14.00-16.00 social activities among different age groups has been noticed. Children, an age group from (4-16) years has been noticed to play during afternoon. Elderly and adult age group (40-70) years have been seen to walk around on the dead-end streets. The evaluation of this quality indicates that the study areas appear to be lively with activities that are distinctive in its way. Lots of activities take places along, and within the dead-end streets simultaneously. The activities are visible in a particular time during the day, and residents enjoy the character of these streets. The changing activity pattern appears to be very dynamic providing a sense of public place, where people tend to meet, bring friends and family and to interact with one another.

Observed dead-end street activities in neighborhood, Mohammadpur (Table 1)

Observed Activities	Study Area 1	Study Area 2
Walking in the evening ( different Age group people)	✓	✓
Children Playing in the Afternoon after school	✓	✓
Walking with a child	✓	
Free hand Exercise	✓	✓
Chit chatting with one another	✓	✓
Standing in front of the gate	✓	✓
Standing and Observing from the balcony of the neighborhood buildings	✓	✓
Standing beside the boundary wall	✓	
Sitting and Gathering beside boundary walls	✓	

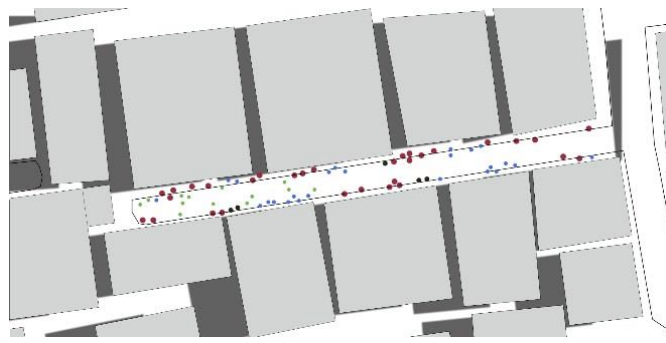


Figure 4, Observed activities that reflect social linkage performed in dead-end street : Study area 1  
(Source:Authors)

Mapping Legend : Red Dot- standing and chit chatting with others; Blue Dot- Walking and Gossiping; Green Dot- Playing ( different aged children); Black Dot- Parking of various vehicles such as motorbikes, car, bicycle etc.



Figure 5, Observed activities that reflect social linkage performed in dead-end street : Study area 2  
(Source:Authors)

Mapping Legend : Red Dot- standing and chit chatting with others; Blue Dot- Walking and Gossiping; Green Dot- Playing ( different aged children); Black Dot- Parking of various vehicles such as motorbikes, car, bicycle etc.

The evaluation on the diversity variables within dead-end streets. The residents in neighborhood engage themselves in passive and active activities such as sitting, listening, chatting, street food eating etc. Most of the activities are seen to perform in a group with neighbors, family and friends with a happy environment. Social interactions have seen vivaciously performed at every dead-end streets. Though there is “dead” in the word of “dead-end”, yet these dead-end streets are bustling with life. From observation the data provides and empirically shows that these dead-end streets could be place to meet public open space demand in case of unplanned zoning and organization of forms.



Figure 6, Neighborhood 1 and neighborhood 2 exhibits with similar activities in each dead-end streets.(  
(Source:Authors)

Physical characteristics of dead-end streets in neighbourhood, Mohammadpur (Table 2)

Attributes	Condition	Study area 1					Study area 2				
		5	4	3	2	1	5	4	3	2	1
Access and Linkage of the dead-end street	Street condition		○				□				
	Accessibility in respect of different vehicular mode		○				□				
	Pedestrian facility				○			□			
	Pedestrian leads to adjacent area				○			□			
	Vehicular interruption with pedestrian		○				□				
	Pleasant walk	○					□				
	Sufficient room for walk	○					□				
	Enough arrangement for sitting					○					□
	Enough space for playing for the children		○					□			
Uses and Activities of the dead-end street	Uses different age people at the same time		○					□			
	Space used throughout the day	○					□				
	Space used as shopping from vendor			○							□
	Place for parking facilities	○					□				
	Different activities happening at the same time		○					□			
	Suitable for public gathering	○					□				
	Space appears special at times			○						□	
Socialability : Social Interaction	Allows interaction of different age group people	○					□				
	Uses as meeting point		○					□			
	Space for evening gathering with friends and neighbours	○					□				
	Space used for chit chatting		○				□				
	Space used as shopping from vendor			○							□
	Do people sleep at that place					○					□

Evaluation Format 1: (5) Very Good; (4) Good; (3) Satisfactory; (2) Poor; (1) Very Poor

Evaluation Format 2: (5) Extremely Likely; (4) Very Likely; (3) Neutral; (2) Unlikely; (1) Not at all

The table focuses on pedestrian comfort and their relation with the streets. It clearly signifies the physical attributes of these dead-end streets and co-relates the activities with the pedestrian.

## 6. Conclusion

The study finds out, the lack of proper parks and public open spaces compelled the neighbours towards a different approach of using dead-end streets differently. The unnoticed dead-end in these neighbourhoods are becoming a place-A social gathering space for the residents. Unplanned and arbitrary development forced these residents to find a replacement for social bonding and togetherness. Certainly, it is undeniable truth that the culture and context of urban Dhaka needs social cohesion for the safety and security of neighbourhood as well as fulfilling the necessity of public open spaces. The research finds out the changing nature of the dead-end streets and behaviour of the residents. The physical attributes and functions clearly shows that these extemporaneous streets could be an effective public place. The study area has more potentiality to be further studied to enhance the social life of urban neighbourhoods in Dhaka. Surprisingly no dead-end streets have been found without social activities during observation. The outcome of the mapping shows the overall physical qualities of the street appears to be good to encourage social interactions and to investigate factors in transforming public space sociability.

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