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Assessing the Connectivity of Community Parks and Fields toUnderstand the Propensity of Use by the Neighborhood: A Case atUttara Residential Area, Dhaka

Saiful Hasan Tariq [a], Ajmeri Nusrat Shoma [b] and Irfat Alam [c]*

[a]*Assistant Professor, Department of Architecture, American International University-Bangladesh (AIUB). tariq@aiub.edu*
[b]*Senior Assistant Professor, Department of Architecture, American International University-Bangladesh (AIUB). ajmerinusrat@aiub.edu*
[c]*Assistant Professor, Department of Architecture, American International University-Bangladesh (AIUB). irfat.alam@aiub.edu*

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ABSTRACT

Uttara, a planned residential area in the northern part of Dhaka city center is the home to thousands of inhabitants in different sectors having fields, parks, and waterfront as public open spaces. This study tried to find out the connectivity of Community parks and fields with their surrounding neighborhood and assess its propensity of use by nearby community through space syntax analysis and questionnaire survey of park and field users of the Uttara residential area. The outcome helps to understand the relationship between accessibility and the propensity of use, within and beyond its surrounding neighborhood.

1. Introduction

Parks, fields, and open spaces have significant impact in the daily and social life of urban dwellers. Urban parks and green spaces provide vital environmental services like water and air purification, noise filtering, and stabilization of microclimate. In addition, quality time spent in parks and green spaces can reduce stress and provide a scene of tranquility. It also enhances the psychological and mental health, and promotes the development of social ties (Chiesura, 2004). Planned residential areas of Dhaka city have neighborhood parks and open fields in the master plan since they were implemented in the early 60′s and 70′s in the central and northern parts of Dhaka. Uttara, a satellite town, was created to address the housing needs of the middle class in the 70′s, modeled on housing solutions done in the 60′s in central Dhaka (Rashid, 2002). The Master plan is divided into several sectors, and most of the sectors have parks or fields to provide recreational facilities to the inhabitants. Despite being well planned, some open spaces perform better and cover a larger catchment area for the users. Some open spaces serve specific functions, while others provide facilities to arrange multiple cultural, rituals, and other community functions. This study intends to seek the connectivity of the fields and parks with its adjacent neighborhood, which impacts the accessibility and propensity of use by the inhabitants in the planned residential area of Uttara.

2. Objective

1. To find out the connectivity of community fields and parks with the nearby neighborhood through space syntax analysis
2. To find out the user behavior of the open spaces through field visits and questionnaire survey which impacts the accessibility and propensity of use by the inhabitants

3. Methodology

A literature study has been conducted to understand the relationship between accessibility and connectivity. First, scholarly articles and book references provide vital information to understand different parameters to assess accessibility. Then, the mapping of the 3-minute walking

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distance from the center of the accessible greens on the satellite image of the Uttara residential area was made, which provides a visual reference for the theoretical threshold of accessibility range found in literature studies.

In the analysis phase, the axial map (prepared by drawing a set of intersecting lines on an accurate map through the spaces of the urban grid) of Uttara residential area has been prepared and analyzed through UCL Depth map X (version 7.0), which is a multi-platform spatial analysis tool to assess spatial networks. The relationships between spatial and social structure are described and analyzed by Space syntax, where the street intersections within the urban grid are considered as an intersection of axial lines surround every urban block. Integration, the most crucial measure is the relative depth or shallowness of any spatial system seen from any point within it, and the values are rank ordered from the most integrated to the most segregated line. The set of most integrated streets is collectively known as the 'integration core' whose nature, shape, size, coverage, etc., depends on the urban system's shape, connectedness, geometry, and growth mode. Choice (CH) is another measure, which expresses the extent of choice on shortest routes from spaces to all other spaces in the system. Connectivity (CN) is a local syntactic measure, which refers to the number of immediate neighbors connected to a space (Khan, 2014).

Last part of this research encompasses the assessment of the connectivity of residential blocks with nearby accessible greens in terms of their position in the master plan and radius of 3 minutes walking distance. The outcome from connectivity analysis was then compared with the user behavior collected through field visit and a questionnaire survey (having 20 sample size randomly selected for each park) to find out the relationship between the connectivity and accessibility of the open spaces in Uttara R/A, which is one of the prominent planned residential areas in Dhaka city.

4. The relationship between accessibility and connectivity

Open spaces in urban residential areas are composed of parks, fields, waterfronts, community gardens, and small urban forests. There are three functions, which an open space serves (Khan, 2014),

1. Through recreation amenities, an open space can fulfill both physical and psychological human needs.
2. It can enhance and protect natural resources like air, water, soil, plants and animals.
3. Economic choices like development patterns, tourism and real-estate values can be affected by the presence of an open space.

Besides these, open spaces have environmental impacts on the surrounding neighborhood regarding visual comfort, ventilation, and air movement. Therefore, according to Mark Francis (2003), suitable open spaces have some criteria to assess their quality, e.g.,

Table 1: For this study, the criteria of accessibility have been emphasized

Ingredients	Criteria	Measure
Accessibility	Linkages, Walkability, Connectedness, Convenience	Behavior, Mapping of use, Pedestrian activity, Traffic data
Activities	Uses, Celebration, Usefulness, Sustainability	Property values, Changes in land use, Retail sales
Comfort	Safety, Good places to sit, Attractiveness, Cleanliness	Crime statistics, Building conditions, Environmental data
Sociability	Friendliness, Interactivity, diversity	Studies of street use. Diversity of users. Social networks

For this study, the criteria of accessibility have been emphasized.

Generally, the accessibility of open space is assessed by its connectedness with its surrounding neighborhood through the pedestrian movement and urban mobility. According to the national recreation and park association (NRPA), a standard neighborhood park should be linked with community pathways and sidewalks, uninterrupted by non-residential roads or other physical barriers. In addition, it must provide easy access within at least ¼- ½ mile service radius from residences, especially for children and senior adults (Tabassum & Sharmin, 2013). Christopher Alexander discussed accessible green in the chapter 'PATTERN 60', where he mentioned that "…. *people need green open places to go; when they are close, they use them. However, if the greens are more than three minutes away, the distance overwhelms the need"* (Alexander et al., 1977). Three minutes of walking distance covers around 240m or 787 feet in a straight direction, as a person covers 80m (average) in a strait path at normal speed in one minute (Barton et al., 2003).

5. Observation and Findings

5.1. Community Parks and Fields in Uttara R/A

Uttara, a planned residential area in the northern part of Dhaka city, has been divided into several sectors designed in the grid-iron pattern. The main master plan is divided by a national highway, where most of the sectors are located in the west part of it. Most of the sectors have a central park or playfield, except sector 01, sector 05, sector 9, and sector 10. A beautiful lake runs through the edge of different sectors from south to north, having waterfront walkways and riparian greens.

Figure 01: Satellite image of Uttara R/A, showing sector boundaries and 240m radius as 3-minute walking distance from the center of each neighborhood park/field.

The road network of Uttara has a hierarchy of primary, secondary, and tertiary roads. Primary roads (36m wide) are connected to the main highway and are defined as 'Sarani' or 'Janapath.' Secondary roads (18m wide) are termed 'avenues,' and they define the boundary of sectors in most cases. Finally, the tertiary roads (9.14m wide) are defined by numbers, and they are the internal connection of residential blocks within the sector and define the boundary of the parks or fields as accessible greens.

Parks, fields, or both characterize the open spaces within the sectors. The field survey found that the open spaces, which are predominantly field and have peripheral walkways with green canopies, are more welcoming for multipurpose functions. It allows different age groups of people to visit for different purposes. The open spaces like in Sector 6 and Sector 7, which are predominantly parks with internal walkways and a green canopy over the whole area, provide limited facilities, e.g., morning or evening walk and recreation facility for kids. The occupants from sectors 6 and 7 visit the fields of other nearby sectors if they need to avail sports facilities or to attend community or religious programs. Available facilities and characteristics of parks and fields in different sectors are given in Table 01

Table 01: Facilities and characteristics of parks and fields in different sectors

Field/Park	Available Facilities				
	Open Field	peripheral walkway with green canopy (park)	Defined Children zone	Dedicated sports zone	Use for religious and cultural functions
Sector 03, Uttara	√	√	√	√	√
Sector 04, Uttara	√	√		√	
Sector 06, Uttara		√	√		
Sector 07, Uttara		√	√		

Sector 11, Uttara	√	√	√	√	√
Sector 12, Uttara	√	√	√		
Sector 13, Uttara	√	√	√	√	√
Sector 14, Uttara	√	√	√	√	√

5.2. Connectivity assessment through spatial analysis

An axial map of the Uttara residential area has been prepared for the study, covering all the most populated sectors [Fig 02], except sector 10 (which has no accessible green as a park/field).

A = SECTOR 3 FIELD
B = SECTOR 4 PARK AND FIELD
C = SECTOR 6 PARK
D = SECTOR 7 PARK
E = SECTOR 11 FIELD
F = SECTOR 12 FIELD
G = SECTOR 13 PARK AND FIELD
H = SECTOR 14 PARK AND FIELD

Legend
High
Medium
Low

Figure 2: Axial map of Uttara, showing the connectivity (CN) and location of parks and fields

The axial map has been juxtaposed on the satellite image to understand better the relationship between the connectivity and accessibility of open spaces [Fig 03].

Figure 03: Juxtaposed Axial map of Uttara, showing the connectivity (CN) and location of parks and fields

The juxtaposed map shows that the fields/parks accessed by at least one tertiary road, directly connected to a secondary or primary road, have better connectivity. The connectivity comparison of different parks is given in the following table

Table 02: Connectivity comparison of different park boundaries

Field/Park	Connectivity Value (CN)				AVG.
	Road (East)	Road (North)	Road (West)	Road (South)	
Sector 03, Uttara	4.0	4.0	4.0	11.0	5.75
Sector 04, Uttara	7.0	2.0	12.0	7.0	7.0
Sector 06, Uttara	3.0	5.0	2.0	3.0	3.25
Sector 07, Uttara	9.0	9.0	13.0	5.0	9.0
Sector 11, Uttara	2.0	5.0	8.0	7.0	5.5
Sector 12, Uttara	17.0	3.0	3.0	3.0	6.5
Sector 13, Uttara	7.0	5.0	8.0	5.0	6.25
Sector 14, Uttara	3.0	2.0	2.0	3.0	2.5

The numerical values of the connectivity have been extracted from the axial map data. Findings from Fig 01 and Fig 02 show that the park or field in different sectors covers its adjacent neighborhood within three minutes of walking distance when they are placed at the center of each sector, i.e., Parks/Fields of Sector 3, Sector 4, Sector 7 and Sector 13 (Fig 01). A large block of Sector 11 neighborhood is deprived of its park, as this sector has been divided by one secondary road (Garib-E-Newaj avenue), and the sector 11 park serves the eastern blocks prominently. The park of sector 12 is in the eastern part of the sector, leaving the neighborhood blocks of the west most part away from three minutes walking distance. Sector 4 park and field is one of the largest, but it is located at the southernmost end of the sector, and a large portion of the neighborhood is away from a radius of three minutes of walking distance.

5.3. User behavior in open space

A questionnaire has been prepared to understand the

user behavior, in terms of using the park or field [Appendix 01]. The feedback from the questionnaire was recorded on the weekend evenings, when the parks and fields are visited by the maximum number of visitors. Randomly selected 20 samples were taken from each park having different gender and age group. The respondents provided information regarding their age, gender, their resident sector, the purpose of visiting, intensity of the visit and average duration of each visit to the park or field. Their feedback helped to understand which parks or fields are receiving visitors from adjacent and distant areas in which proportions. It also helped to understand how the nearby facilities have an impact on the user number of parks and fields, based on their response on purpose of the visit. From the questionnaire survey at different open spaces at Uttara, some user behavior regarding accessibility and catchment range has been identified. The findings are given below,

Table 03: Percentage of users at different Parks/Fields

Field/Park	Visitor from same sector (%)	Visitor from nearby sectors (%)
Sector 03, Uttara	70	30
Sector 04, Uttara	60	40
Sector 06, Uttara	80	20
Sector 07, Uttara	70	30
Sector 11, Uttara	60	40
Sector 12, Uttara	90	10
Sector 13, Uttara	80	20
Sector 14, Uttara	65	35

Sectors 3 park/field was found to have 30% visitors from other sectors, as the field is also used as practice grounds for different sports and serves as a venue for community functions. Kids and teenagers are most of the users who visit sector 3 field from other sector, mostly for the purpose of practicing football and cricket. On the other hand, Sector 4 park had 40% visitors from the nearby sectors and outskirts of planned residential area. It was found from the field visit that many visitors from distant locations come here after dropping their kids to private tutors nearby and wait here until the tuition is over.

Sector 6 park had 20% visitors from other sectors, mostly the guardians of the kids, who visit the park and stay there for 1-2 hours after attending their kids to private tutors. The presence of a major school in sector 6 has a significant impact on the user behavior of nearby parks/fields. Sector 7 park also has a moderate number of visitors, i.e., 30%, from neighborhood sectors. Its location and surrounding infrastructure play a significant role here. The visitors from adjacent Mosque, Madrassa, and Community High school are a significant part of the visitor here who come from distant or nearby sectors.

Figure 04: Sector 14 park cum field (Left) and sector 11 park cum field (right) with dedicated sports facilities

From the questionnaire, it was found that sector 11 has 40% of visitors from other sectors, although it has inferior connectivity with neighborhood sectors according to Fig 02 and Table 02. A significant number of visitors came from sector 9 and sector 10. Both sectors have no field except waterfront walkways. While Sector 12 park has 90% visitors from sector 12 and few from nearby sectors like sector 11 and outskirt of the planned area.

Sectors 13 park cum field was found to have 20% visitors from other sectors, as the field is also used as practice grounds for different sports and serves as a venue for different community functions. Dedicated Park for kids and female visitors beside the main play field welcomes visitors coming for morning or evening walk from nearby sectors. Sector 14 park and field have similar findings to that of sector 4. It also has a significant number of visitors, i.e., 35%, from the nearby sector (like sector 5) and outskirts of the planned residential area, although it has comparatively low connectivity with primary and secondary roads (Table 02). Being a park at the zone where an unplanned residential area ends and a planned area begins, it equally serves the inhabitants of an adjacent unplanned residential area.

6. Discussion on Findings

Table 02 and Table 03 suggest that the fields/parks accessible by at least one tertiary road directly connected to a secondary or primary road have better connectivity value. The parks/fields of Sector 4, Sector 7, Sector 12, and Sector 13 show better average connectivity, and at least one boundary-defining road shows strong connectivity. These four parks cum fields serve not only its nearby neighborhood blocks, but also visitors from distant locations and nearby sectors. Sector no 12 park serves a part of sector 11 neighborhoods, which are visited either by pedestrian or vehicular means. Similarly, Sector 13 park/field serves a part of sector 14 neighborhood.

The parks/fields seem to be more preferred by the visitors from other sectors, which perform muti-purpose functions.

Sector 3, Sector 13, and Sector 14 park cum field have sports academies and club activities and act as a venue for religious and cultural programs, like meetings, fairs, Durga Pooja, and Eid Prayer. Sector 4 parks/Fields also work as a venue for multipurpose activities and sports facilities.
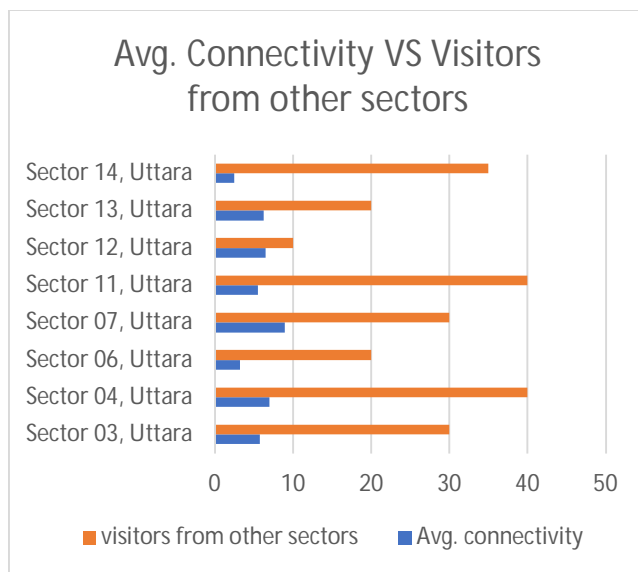
Figure 05: The relationship between Avg. Connectivity of parks/fields and percentage of Visitors from other sectors

Fig 05 shows that inferior connectivity of the peripheral roads has little impact on the percentage of users from distant areas. Although sector 14 park and field have average connectivity value of 2.5 based on its peripheral roads, but it receives many visitors from neighborhood sector like sector 5, and adjacent neighborhood from unplanned residential area. On the other hand, Sector 6 Park has inferior connectivity, and it serves within the sector mostly.

Another important aspect is the relationship between the user patterns and the open space typology. For example, park-like open spaces are accessed by the nearby residents and are visited mainly by pedestrian means.

Therefore, the catchment area is mostly limited to the nearby neighborhood sector. On the other hand, the open spaces which serve as parks cum fields, i.e., in Sectors 3,4,11, 13 & 14, have a greater catchment area and remain more active during evening and weekends (Fig 04).

The outcome from Table 01 and Table 2 and the user interviews suggests that the connectivity of parks and fields with its neighborhood determines the propensity of use by the adjacent residential blocks. The findings are as follows,

a. The open space located at the center of the sector might have inferior connectivity with the distant neighborhood, but it serves well within the adjacent neighborhood that lives within 3 minutes walking distance.

b. Embedded functions in the open space impact accessibility and user group. 'Park cum Field' has a more elaborate catchment area than only 'parks' to invite visitors.

c. The fields or parks have better accessibility when connected by at least one tertiary road directly connected to a secondary or primary road.

d. Superior connectivity to distant neighborhoods enhances multipurpose functionality of the open space, resulting in better social mixing among the inhabitants of different sectors.

e. The open space with inferior connectivity with distant neighborhoods might perform better if nearby neighborhoods from different sectors lack similar open spaces like parks or fields.

f. The presence of an educational facility significantly impacts the number of visitors from distant neighborhoods in the parks and field at some sectors.

7. Conclusion

This study tried to understand the relationship between accessibility and the propensity of use, within and beyond its surrounding neighborhood residential blocks in the planned residential area of Uttara. The outcome suggests that greater connectivity allows for better urban mobility, which enhances the accessibility of open spaces beyond the threshold of three minutes walking distance, and creates scope to generate multifunctional activities, making a lively and healthy neighborhood. The questionnaire outcome also suggests that embedded multi-functional activities in open spaces, i.e., Parks and fields allow more visitors from outside of the sector, irrespective of superior connectivity.

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Appendix

Questionnaire for the park/field users of Different sectors at Uttara

1. Age of the Respondent: ……………………………………….
2. Male/Female: ………………………………………………….
3. Resident Sector: ……………………………………………….
4. Visiting Park/Field: …………………………………………
5. Purpose of Visit [add tick mark where appropriate]

Exercise/Walking	Sports	Baby sitting	Relaxing	To Attend community events	Other

6. Mode of transportation used for visiting park/field [add tick mark where appropriate]

Pedestrian means	Private car	Non-Motorized vehicle	Motorized three-wheeler	Public Transport	Other

7. Intensity of visiting park/field [add tick mark where appropriate]

Daily	Weekly	Monthly	Randomly

8. Spent time in Park/Field when visited [add tick mark where appropriate]

30 minutes	1 hour	2 hours	Not specific