Chapter 6
From Grey to Green: Rethinking Setback and MGC Rules as a Sustainable Growth Strategy of Residential Areas – A Case Study of Anannya Residential Area of Chittagong, Bangladesh

Rezuana Islam, Kanu Kumar Das, and Samira Binte Bashar

Abstract At the moment urban agglomeration sees how cities grow and expand within a shorter period by overlooking the existence of natural ecosystem and green spaces. Natural and built components of the urban environment are the main focal point for sustainable regeneration strategies of a city, but unfortunately the small-scale green areas which are closed to people in the cities are given poor attention and as a result various environmental problems are created. This phenomenon raises globally growing concern for sustainable urban development. To ensure sustainable development and healthy living environment, every country sets some obligatory codes of development. In Bangladesh to control urban development and boost living environment, Bangladesh National Building Code (BNBC), a comprehensive document, is enacted as officially obligatory codes of development in urban areas, in which setback and maximum ground coverage (MGC) are the two major and foremost important rules to maintain for better area planning. Chittagong is the second largest city and commercial capital of Bangladesh and is enriched with mountains, forest, rivers, canals, coastal belt, ancient shrines, and historical structures. In Chittagong city, urban areas become a junk of concrete with its grey pockets lacking green spaces resulting from insensible planning and irresponsible behavior of its citizen. The Anannya Residential Area was developed in 2004 by Chittagong Development Authority (CDA) in Chittagong City which is not fully developed yet. The main concern of this chapter is to rethink residential setback and MGC rules of BNBC from a sustainable regeneration strategy perspective and to suggest several ideas of creating green spaces that can be taken into consideration to recover and enrich the sustainable environmental quality of the urban areas.

The original version of this chapter was revised: The original version of this chapter was published with some citations missing which has been included now. The correction to this chapter is available at https://doi.org/10.1007/978-3-030-25879-5_27

R. Islam · K. K. Das (✉) · S. B. Bashar
Chittagong University of Engineering & Technology, Chittagong, Bangladesh

M. Ghosh (ed.), *Perception, Design and Ecology of the Built Environment*,
Springer Geography, https://doi.org/10.1007/978-3-030-25879-5_6

Keywords Building setback · Grey pocket · Green spaces · Sustainable regeneration strategy

Introduction

Provision of environmental and ecological services as well as social and psychological development of human societies is dependent on urban nature which enhance human life with meanings and emotions. But rapid and uncontrolled urbanization is associated with change in urban ecosystem as the development phenomena always overlook the existence of green spaces though availability of natural environment is one of the major conditions toward healthy and quality urban living (Majumder et al. 2007; Karim 2006; Urban Design Compendium 2007).

Unplanned urban growth is experiencing various sorts of problems related to urban development and planning issues and management. One of the major problems is the lack of strong implementation of development control rules. Due to population increase, recent urban expansion in Bangladesh experiences the growth of buildings without much approval of the authority. However, if there is any, the proper rules are not maintained after approval. Setback, one of the major and foremost important rules which control the spacing between buildings, is included in building code thinking its environmental benefit.

Chittagong city is located toward southeast of the capital city of Dhaka which is around 280 Km. from the capital. Chittagong city is situated on the bank of Karnaphuli River, and the city is surrounded by rich natural resources like the green Hilly Terrain and the Bay of Bengal on the west. With a population of 4.1 million people in 168.1 square kilometers of land, the density of Chittagong is 24,390 persons per sq. km, which is very high. The city is the commercial capital and largest port of Bangladesh situated 16 km upstream from the Bay of Bengal and faces rapid urbanization, which has resulted in a loss of the city's existing open spaces in the last few decades very rapidly (Jafrin and Beza 2018).

In the first regional plan in Chittagong in 1961, this problem was noted and tried to be addressed for the first time as the city's lack of public parks, playgrounds, and small children's play areas. The document provided several strategies at planning level to mitigate such as proposed 26 new parks and other open spaces to meet the needs of the city's population, consisting 2935 acres of land scattered around the city in small parcels (Jafrin and Beza 2018). From 1989 to 2001, open space was reduced by 76% as a result of urbanization process in Chittagong which was further reduced by 72% between the year 2001 and 2013 (Chisty 2014).

Chittagong being the 2nd largest city of Bangladesh faced with tremendous pressure of overpopulation. To accommodate the large population, the local government organization Chittagong Development Authority (CDA) has developed and has been developing planned residential areas in Chittagong. But like other developing countries, these residential areas lack green spaces resulting in a junk of concrete because of insensitive planning and negligent behavior of its inhabitant.

WHO suggests that the availability, accessibility, quality, and security of public green spaces may vary in metropolitan regions, and this so-called green environment is one of the indicators of healthy cities (WHO 2012). WHO suggests a standard of 9 square meter per capita, and the cumulative existing open space in Chittagong is 0.18 square meter per person (Jafrin and Beza 2018).

Though all of these strategies to mitigate lack of open space especially green areas are majorly implemented at planning level, small steps with building by-laws or urban design guidelines can often create a cumulative effect for a positive outcome. From this perspective, regeneration of green space by rethinking the residential setback rules of building bylaws may be useful. For individual plots this area is insignificant, but in a combined view in a neighborhood, this change can cause noteworthy differences in the appearance and environment of the neighborhood.

The level of urbanization in Bangladesh is low, but the rate of growth of urban population is very high, and due to large total population, the absolute number of population is also large. The impact of large influx of population in the city has been quite strong on the overall environmental situation in the city. The rather poor environmental situation in the city is evident from secondary data, field observation, and from opinions of the residents (Majumder et al. 2007).

In Anannya Residential Area, Chittagong, unlike other residential areas of Bangladesh, the planned residential plots are arranged in grid-iron pattern having two rows of plots between two roads. That means that every individual plot has a front road, and each backside is actually the backside of another one. Literature review shows that for protection of the property from the encroachment of the adjacent one, the common tendency among people is to raise a boundary wall around the plot. Therefore when one keeps the coded setback according to BNBC, it becomes a shallow useless space occupied by extension of parking or accommodating with poor greeneries or simply a space for dumping waste making grey pockets of residential areas. So that the coded setbacks are not well utilized and projected setbacks are not entirely contributed with its neighboring context as the people don't feel the inherent sense of the rule and hardly show any interest to obey this setback rule properly, though if implemented properly, the adjacent green setback of two plots can be served as small community green spaces reviving the natural ecology of the area as well as enhancing the living quality of the people of that area. The main aim of this chapter is to find out feasible planning of residential block considering all the officially obligatory codes regarding setback and MGC of BNBC which will help enhance green spaces within the residential area from a convenient point of view.

Floor Area Ratio (FAR) and Maximum Ground Coverage (MGC)

The general definition followed around the globe for FAR and MCG are as follows:

Floor area ratio (FAR) means the quotient obtained by dividing the total covered area in all floors, excluding the areas as exempted by rules, by the plot area, i.e.,

$$\text{FAR} = \frac{\text{Total Covered areas in all floors}}{\text{Plot Area}}$$

Maximum ground coverage (MGC) means the maximum area of the building footprint at ground level, considering all horizontal projections in all floors, excluding the cornices, chajjas, and architectural features up to certain level of projection as exempted by rules.

$$\text{MCG} = \frac{\text{Area of the plot covered by building when vertically projected on ground level} \times 100}{\text{Total area of the plot}}$$

BNBC and Building Construction Rules of CDA

BNBC was prepared to regulate the technical details of building construction and to maintain the building construction standard. CDA follows the "Imarat Nirman Bidhimala, 2008" and all kinds of BNBC rules for residential construction and implementation. In BNBC the minimum side, rear, and front open space requirements and MGC of a plot for buildings of various occupancy are specified in Appendix 1 and 2, respectively. Tables 6.1 and 6.2 show only the rules of setback and MGC which are relevant to this study. Besides these according to BNBC, one can construct boundary wall around the plot not higher than 3 m of which maximum 1.75 m can be solid and rest of the portion will be grill or net, and the height will be measured from the top point of the adjacent road.

Table 6.1 Setback requirement of a plot

Building height (all occupancy type)	Plot size (sq.m.)	Front setback (m)	Rear setback (m)	Side setback (m)
Up to 10 stories or 33 m	Over 134 to up to 201	1.5	1	1
	Over 201 to up to 268	1.5	1.5	1
	Over 268 to up to 1206	1.5	2	1.25

Table 6.2 Road width, MGC, and FAR for residential building

Plot size (sq.m.)	Plot size (katha)	Road width (m)	FAR	MGC (%)
Over 201 up to 268	Over 3 up to 4	6	3.5	62.5
Over 268 up to 335	Over 4 up to 5	6	3.5	60
Over 335 up to 402	Over 5 up to 6	6	3.75	60

Selection of Study Area

Aiming to enhance usable green spaces within a residential area, Anannya Residential Area has been selected as case study for this chapter. It's an ongoing residential plot project beside Oxygen-Kulgaon road (Fig. 6.1) with a total of 174 acres of land area. The minimum plot size of this project is 201 sq.m (3 katha) and maximum 402 sq.m (6 katha). In this project a total of 57.75% land is used for residential plot. The land use details are given in Table 6.3. The main reason for selecting this project as case study is that it is an ongoing project with a huge number of residential plots, and this project has less green open space where still there is scope to enhance the usable green space through initialization of different policies.

Fig. 6.1 (**a**) Internal road and plot of the site, (**b**) main road of the site

Table 6.3 Land use details of Anannya Residential Area, Chittagong

Sl no	Description	Total number	Total area, acre	Percentage area
A	**Residential**			
1	Plot area, 3.00–3.99 Katha (normal)	482	1522.77	57.37
2	Plot area, 3.00–3.99 Katha (corner)	102	325.47	
4	Plot area, 4.00–4.99 Katha (normal)	605	2448.55	
6	Plot area, 4.00–4.99 Katha (corner)	174	713.65	
7	Plot area, 5.00–5.99 Katha (normal)	129	648.39	
8	Plot area, 5.00–5.99 Katha (corner)	47	242.16	
B	**Apartment saleable**			
	16.00–25.00 Katha	07	155.16	1.50
C	**Commercial and community**			
	Shop, specialized hospital, commercial plot, taxi parking, kitchen market	58	636.44	6.19
D	**Special utility plots: saleable on special price**			
	Pump house, substation, P.O., P.S., etc.	06	41.16	0.04
E	**Plot schedule (utility): non-saleable**			
1	Utility services	14	718.14	34.54
2	Road and canal		2879.00	
	Total			100

Source: Chittagong Development Authority

Comparison with Other Similar Cities Bylaws Regarding FAR and MGC

1. **Kolkata**

Kolkata is the capital of West Bengal district of India formerly a river port city and capital of British India. The Kolkata Municipal Corporation has a population of 44,96,694 (Census 2011) in an area of 205 sq.km. Thus the density of the city is approx 22,000 persons per sqkm, which is similar to Chittagong. Kolkata is also has a similar climate, being a part of the same river delta.

FAR rules as per Kolkata Municipal (Building) Rules, 2007, as amended in 2016 are as follows:

Sl no.	Width of means of access (m)	FAR for residential buildings
1	Up to 2.4	0.00
2	2.4–3.5	1.25
3	3.5–7.0	1.75
4	7.0–9.0	2.00
5	9.0–14.5	2.25
6	14.5–20.0	2.50
7	20.0–24.0	2.75
8	Above 24	3.00

Setback rules as per Kolkata Municipal (Building) Rules, 2007, as amended in 2016 are as follows:

Height of building (m)	Front open space (m)	Open space side 1 (m)	Open space side 2 (m)	Rear open space (m)
7.0	1.2	1.2	1.2	2.0
7.0–10.0	1.2	1.2	1.2	3.0
10.0–12.5	1.2	1.2	1.5	3.0
12.5–15.5	2.0	1.5	2.5	4.0
15.5–20.0	3.5	4.0	4.0	5.0
20.0–25.5	5.0	5.0	5.0	6.5
25.5–40.0	6.0	6.5	6.5	8.5
40.0–60.0	8.0	8.0	8.0	10.0
60.0–80.0	10	15% of the height of building or 11.0 m whichever is less	15% of the height of building or 11.0 m whichever is less	12.0
Above 80.0	12.0	15% of the height of building or 14.0 m whichever is less	15% of the height of building or 14.0 m whichever is less	14.0

Comparing the setbacks of two cities, it is evident that the setbacks for a ten-storied building (33 m approx) and the setbacks required for Kolkata are much higher in spite of having similar densities. Therefore the surrounding areas can be much effectively planned after leaving circulations for car parking and other utilities. The 2 m rear setback for the same class of building in Chittagong is actually very inadequate for vehicular circulation as well as natural ventilation and lighting. The FAR in Kolkata is also much less than that of Chittagong for similar class of building. For example, for a road width of 6 m irrespective of plot size, FAR in Kolkata is only 2.00, but the same for Chittagong is 3.5–3.75 depending on the plot size. So not only the incidental open space will be high, but the height of building will also be much higher in order to consume maximum FAR. The incidental open space may in this case look and feel like narrow and very high corridor.

Therefore one general suggestion may be to revise the setback rules as per environmental conditions.

Findings

In the Anannya Residential Area, as a common strategy to apply for arrangement of plot planning, the total master plan follows "grid-iron" pattern (Fig. 6.2). There are footpath, open pucca drain, and service line by the side of the road, and road width includes the drain width and footpath width. The north-south main axis road is 22 m and the main internal road is 12 m wide and maximum other internal road is 9 m and few roads are 7.5 m wide. Due to such arrangement of plots, all plots, being separated with adjacent plots creating a barrier with surrounding neighborhoods, have a front road and a backside with a back of another plot. In the total master amount out of 174 acres, only 6–7 acres of land are proposed as play area. Not only that total master plan lacks the necessary green spaces. In this condition with a boundary wall of 1.75 m solid portion, if an owner obeys all the respected codes of BNBC and CDA regarding setback and MGC, still it will not be possible to ensure usable green within the residential area.

Discussions

Nowadays global effort is toward promoting more and more green for sustainable living environment. Just after the Local Agenda 21 (UNSD 1992) consultations, some cities have been developing their own sustainability indicators focusing to boost the quality of living environment. Aspects such as "amount of public green spaces per inhabitant," "public parks," and "recreation areas" are often given important priority to make the city inhabitable, pleasing, and attractive for its people. Enhancement of the abiotic and biotic aspects alone can't stand for sustainable city development but also about the social aspects of city life and about people's

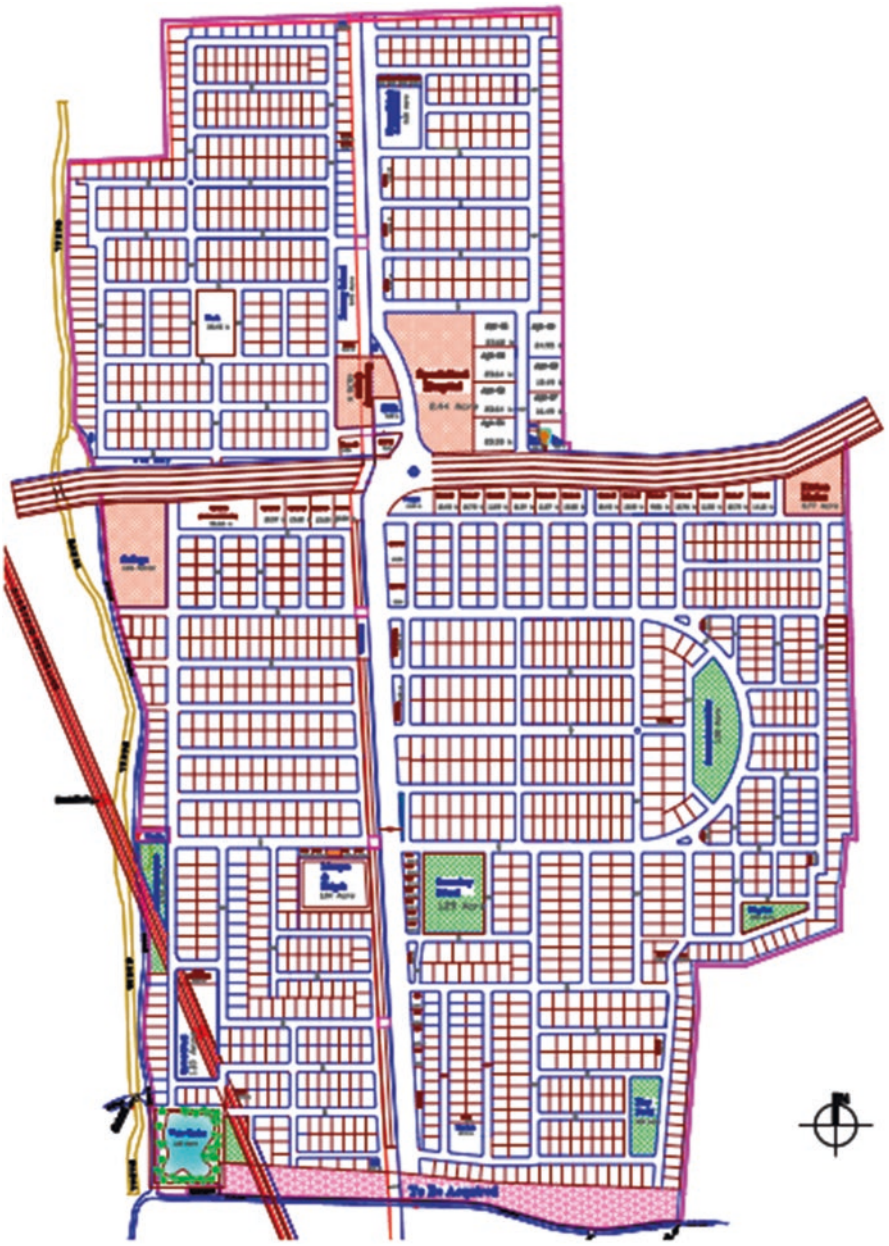


Fig. 6.2 Anannya Residential Area master plan (Source: CDA)

satisfaction, experiences, and perceptions of the quality of their everyday environments (Chiesura 2004; Beer 1993).

As a step forward toward sustainable living city development, the BNBC, setback, and MGC rules can be rethink from enhancement of social aspect perspective. In the study area based on plot size, minimum and maximum FAR is 3.5 and 3.75 with a MGC of 62.5 and 60%, respectively. From that perspective it can be said that buildings will not be higher than eight stories (ground for parking which is FAR excluded + maximum seven floors for residential purpose which is FAR included). For discussion this study considers the situation of maximum MGC with minimum setback condition as the given guidelines will be applicable for the other plots of the study area. Plot size 201–268 sq.m. falls in this category. This study assumes a mean plot with a size 234.5 sq.m.

Figure 6.3 considers the current trend of residential plot development. In the figure it is seen that with a boundary wall in each 234.5 sq.m. plot, possible green area ranges from 37.5 to 40.0 sq.m. but as per code.

Amount of permeable or soak able green that is needed to be kept in each individual site is 47.25 sq.m. It is also clear from the figure that because of the column footing the total green is segmented resulting a useless green space. That's why in practical situation, it is really hard to maintain proper permeable green space within the site area. And most of the time, these areas actually turned into a residential grey pocket and space for dumping or illegally occupied hard surface areas.

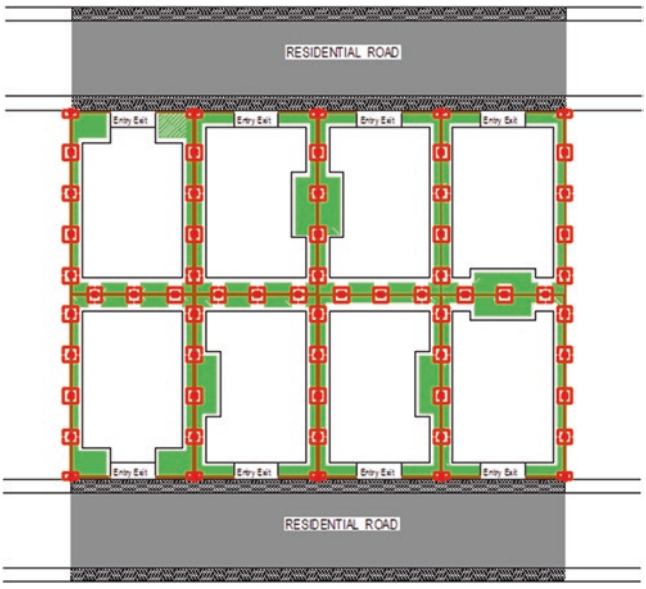
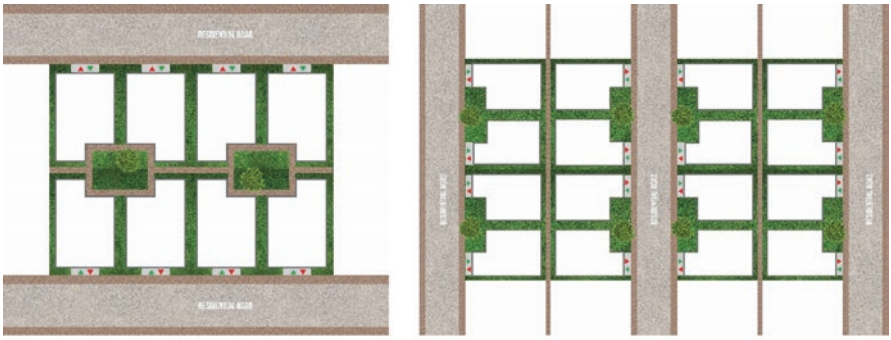


Fig. 6.3 Conceptual plan of current trend of individual plot development

Recommendations for Transforming Grey to Green

Figure 6.4a shows a possible layout option for plot development. In this layout the conventional idea of boundary is excluded to create a continuous green space connecting the side and rear open space of different plots. If the soak able green of four adjacent plots are connected together at the rear side of the building with the previous one, a large chunk of green space can be provided which will contribute as (Fig. 6.5) neighborhood communication space, children play area, pedestrian walkway, and most importantly as a deliberate space for community greening space. In this option green area (48.5 sq.m) results in 36.25% increase in each individual plot.

As another possible option (Fig. 6.4b), soak able green of the two individual plots can be joined at the front side of the plot to create a chunk of usable green. At the same time, if the side and rear open spaces are connected together, it will result in continues residential green corridor. The road side green chunk can be used as



(a) *OPTION 01* (b) *OPTION 02*

Fig. 6.4 Proposed conceptual plan

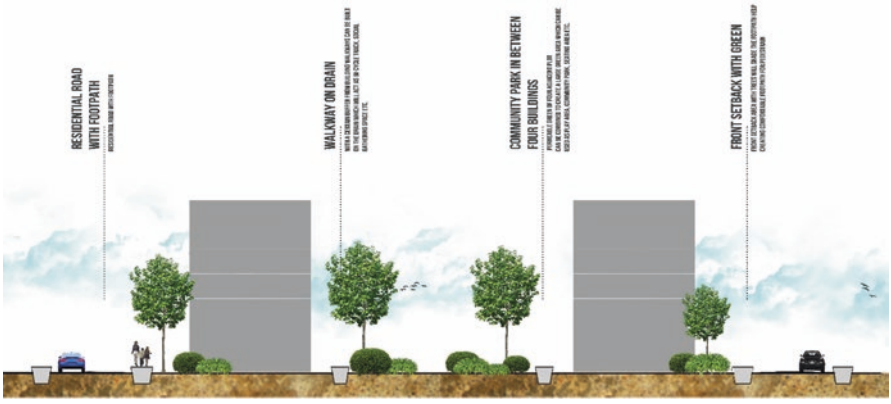


Fig. 6.5 Section (only setback area) of proposed building of plot without boundary wall

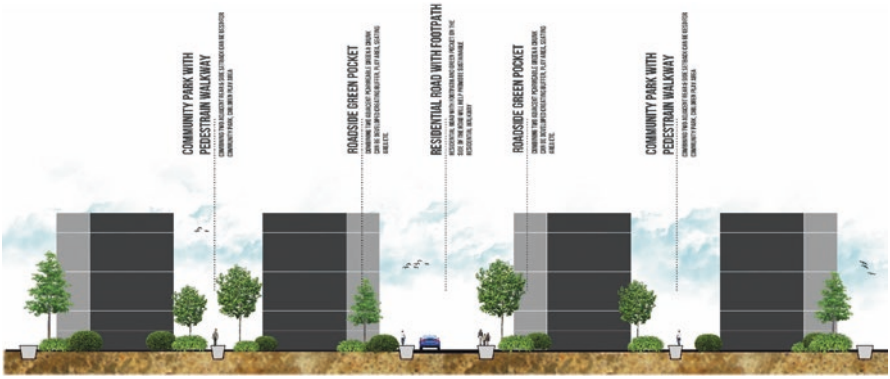


Fig. 6.6 Section (mandatory open space) of proposed building of plot without boundary wall

community interaction area, small roadside park, or space for trees. This option results in an increase of 58.42% green space (53.77 sq.m.) at each individual plot (Fig. 6.6).

Benefits of Green Pockets in Urban Sustainability: Environmental and Social Impacts

Transforming residential grey pockets into green one has twofold benefits. Firstly, the small park located in between buildings can be used either as a community gathering area or as community adhesive and will accommodate other social activities in it as a park is not only a green area of the city but also a place where people do activities. Urban park space contributes to fulfill various social functions and psychological needs of citizens. Children use it as play area, while adults and aged people of the community use it as their social interaction space. On the other hand secondly, the transformation of the grey spaces to green spaces will have a direct positive impact on the city environment. If the small grey spaces in between buildings can be turned into green one, it will help introduce biodiversity, reduce water clogging, and also reduce ambient temperature (through evapotranspiration process of trees).

When green pockets produce a green network, it helps to reconnect people with nature, so they provide immediate benefits for people and extend the effectiveness of these benefits to communities. Ecologically, green pockets develop small scattered habitats and ecosystems, they prevent soil erosion, and they absorb rainwater, thereby improving drainage and protecting against the urban heat island.

Socially, green pockets may have recreational uses like a “parklet” which is a very common concept in many developed countries: a place to play, meditate, gather, or rest. They give people the sense of place, of identity, and of belonging and enhance feelings of family kinship and solidarity and increase the sense of community.

Environmentally, green pockets provide a high-quality life through assimilating nature into the urban environment and stimulating the senses with their simple color, sound, smell, and motions. They play an important role in reshaping the urban spatial pattern and establishing connectivity for a wide variety context across the city.

A continuous backyard green pocket as a natural environment corridor with pedestrian pathway can form an important part of sustainable transportation system.

Regarding these benefits, green pockets are a sensitive response and crucial tool toward urban sustainability, which are at present unutilized, but once used can be a source of rejuvenation.

Conclusion

Compared to the vast range of core residential lands, grey pockets are often negligible, but combined effect can't be overlooked as it ultimately become a huge environmental concern for the city. The ignorance toward these developments comes not only from the city authority but also from the private owners. With proper implementation of urban planning initiatives as well as detailed pioneering ideas mentioned above, a huge enhancement can be made ensuring the environmental sustainability of these spaces. The setback and MGC rules and codes of BNBC can be reviewed to incorporate these neglected spaces to the sustainable residential development. To better shape the society, responsiveness from all sectors and consciousness from very early stage are necessary. Being a prototype, the design ideas can serve as a successful example that can be repeated in the prospect. Moving toward a better sustainable social and environmental living can be possible by providing proper care to this space.

Acknowledgment Dr. Qazi Azizul Mowla, Professor Department of Architecture, BUET
Mr Amit Imtiaz, Lecturer, Department of Architecture, CUET (for Image Render)

Appendices

Appendix 1

Building height (all occupancy type)	Plot size (sq.m.)	Front setback	Rear setback	Side setback
Up to ten stories or up to 33 m	134 or less	1.5	1	0.8
	Over 134 up to 201	1.5	1	1
	Over 201 up to 268	1.5	1.5	1
	Over 268 up to 1340	1.5	2	1.25
	Over 1340	1.5	2	1.5
Over ten stories or above 33 m	Any size	1.5	3	3

Appendix 2

Plot size		Building type (residential)		
Sqm	Katha	Road width (m)	FAR	MGC %
134 or less	2 or less	6.0	3.15	67.5
Over 134 up to 201	Over 2 up to 3	6.0	3.35	65.0
Over 201 up to 268	Over 3 up to 4	6.0	3.50	62.5
Over 268 up to 335	Over 4 up to 5	6.0	3.50	62.5
Over 335 up to 402	Over 5 up to 6	6.0	3.75	60.0
Over 402 up to 469	Over 6 up to 7	6.0	3.75	60.0
Over 469 up to 536	Over 7 up to 8	6.0	4.00	60.0
Over 536 up to 603	Over 8 up to 9	6.0	4.00	60.0
Over 603 up to 670	Over 9 up to 10	6.0	4.25	57.5
Over 670 up to 804	Over 10 up to 12	9.0	4.50	57.5
Over 804 up to 938	Over 12 up to 14	9.0	4.75	55.0
Over 938 up to 1072	Over 14 up to 16	9.0	5.00	52.5
Over 1072 up to 1206	Over 16 up to 18	9.0	5.25	52.5
Over 1206 up to 1340	Over 18 up to 20	9.0	5.25	50.0
Over 1340	Over 20	12.0	5.50	50.0
Any size	Any size	18.0	6.00	50.0
Any size	Any size	24.0	6.50	50.0

Bibliography

Anon, United Nations Conference on Environment & Development (UNCED)", Rio de Janerio. *UNSD-United Nation Sustainable Development*, "Agenda 21', 1992: Brazil

Anon (2007) Urban Design Compendium (UDC), "Urban design compendium-1,". London: Llewelyn Davies: English partnerships and the housing corporation.

Beer AR (1993) Urban greenspace and sustainability. In: van der Vegt et al (eds) Proceedings of a PRO/ECE-workshop on sustainable urban development: research and experiments, Dordrecht, Netherlands,

Chiesura A (2004) The role of urban parks for the sustainable city. Elsevier 68:129–138

Chisty K (2014) Landslide in Chittagong City: a perspective on hill cutting. J Bangladesh Inst Plann 7: 1–17

Jafrin M, Beza BB (2018) Developing an open space standard in a densely populated city: a case study of Chittagong City. Infrastructures 3(3): 40

Karim AKMR (2006) Best practice: a perspective of "clean and green" Chittagong. In: First 2006 workshop population and environmental protection in urban planning. Asian Urban Information Centre of Kobe, Kobe

Majumder AK, Hossain ME, Islam MN, Sarwar MI (2007) Urban environmental quality mapping: a perception study on Chittagong metropolitan city. Kathmandu Univ J Sci Eng Technol 1(iv):35–48

World Health Organization (WHO) (2012) World Health Organization (WHO). Health indicators of sustainable cities. Rio de Janeiro, Brazil, s.n