

Implication of building attributes to compensatory green: A case study of residential building in Dhaka city

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Abstract

The growing pressure of urbanization is turning the cities into a concrete jungle. Compensatory green is an attempt to reclaim lost greenery by the building onto the building itself and it tries to bring back the same effect that built areas lose when they hack away vegetation. Question is that, Are these recreated grounds on the building sufficient for the building users or Can it really be a replacement for the ground greens? This paper attempts to evaluate the contemporary practice of recreated vegetation (building integrated green) in residential buildings of Dhaka. The study will include a field survey and plan analysis of two selected buildings (Designed to incorporate compensatory green). The analysis of the plan includes comparison of different building attributes of two residential buildings which has impact on the total green roof area and the per person green area. Some guidelines have also been suggested to improve the present scenario.

INTRODUCTION

The urban area is a sharp manifestation of transformation where the land is acquired and put under concrete at a very fast rate. As a result of this, vegetated area decreases. Because of urbanization people start to migrate to urban area for jobs and better life standard. To mitigate the demand for land, a basic requirement for any development becomes high. Then the pressure on the land becomes intense and unused green patches are lost. There is a high demand for land because people are willing to pay huge amount of money for buying land. In such a situation it becomes economically less attractive to conserve the homestead garden.

Identification and Monitoring the Change of Land Use Pattern Using Remote Sensing and GIS-A Case Study of Dhaka City

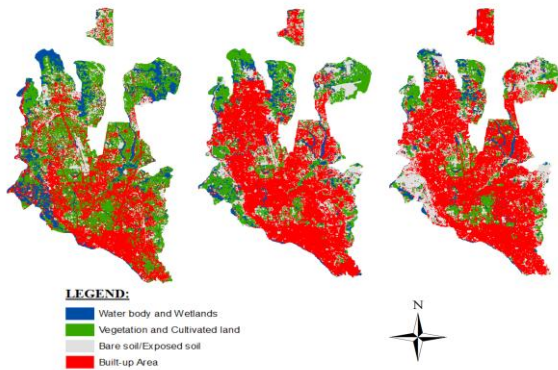


Figure 4 Land cover map of the years 1990, 2003 and 2010

Fig. 1. Land cover map of Dhaka City of the years 1990, 2003 and 2010 [2]

There is a tendency develop as much as of the plot as possible giving rise to various problems, e.g., indiscriminate increase in density, heat island in summer, invasion of privacy, lack of open space and vegetation. [1] The interpretation of the 2003 and 2010 land cover maps, however indicated that Dhaka is being started to expand in all directions, specifically to north-east, south-east and southern parts by filling up low lying areas

Fig. 1 and Fig. 2 demonstrates that between 1990 and 2010, urban built-up areas increased approximately 3210 ha while vegetation and cultivated land decreased 3180 ha. [2]

According to the statistics of Sustainable Development Networking Program, Bangladesh (SDNPBD), 2005, the open space in Dhaka city including 12.12% agricultural land is accounted only 21.573 % of its total area which should be at least 25% for any ideal city. But, the old part and new part of Dhaka has only 5% and 12% of green open spaces respectively (DMDP, 1995) [3].

According to World Health Organization (WHO) there should be 9 sq. meter green space per city dweller for ensuring better life. But we hardly think of per person green space.

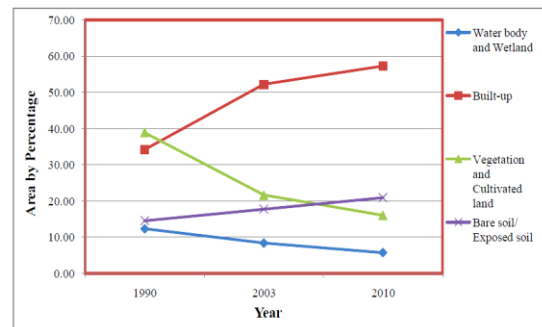


Figure 5 Temporal pattern of land use/cover change

Fig. 2. Temporal pattern of land use/cover change [2].

In the city of Dhaka the present scenario is multi-storied and high-rise buildings are taking the place of low rise buildings. Most houses built on these plots in early 80s, were low-rise 3 to 4 story's with maximum utilization of floor spaces. Plot sizes at Dhanmondi vary from 350 to 1400m². It was common that most houses are occupied 50% of land keeping rest spaces free for open space like green or garden and also separate garage. But now land coverage varies from 70% to 80% even more in practice. Multi-storied apartments seem to be a feasible solution to housing need of an increased pressure of population. [5] [6]. At the end of 90's apartments are started to build even on small plots leaving almost no space in and around them [4]. A massive concentration of inorganic mass onto small patches of land due to rapid urbanization calls for a compensation of the losses of biomass on the ground. One of the ways could be to introduce as much compatible organic matter as possible in the form of diverse vegetation on the roof tops and terraces [7]. But are these recreated grounds on the building sufficient for the building users? This paper will try to investigate how much we can compensate by planting plantation in the form of vertical gardening, roof gardening and replantation. There should be a balance between green space and built up area in the built form.

MATERIALS AND METHODS

Two residential buildings are fundamentally chosen as topic for this study considering their long time use by the inhabitants. These buildings were selected because these buildings were designed with building integrated garden. Most of the gardens were intensive and pot plantation type.

The first building (Case study 1) is a single family residence, where road side part of the 2nd floor terrace was transformed into a green lawn.

The second building (Case study 2) is a multistoried apartment building situated at Gulshan has an attempt to recreate ground on its built up environment. This apartment building is 66' feet height, leaving limited spaces for ground-level greenery. The ground green coverage is inordinately low.

At first Green Area ratio and Green area per person of the two case studies are going to be analyzed. Table 1 and table 2 shows a brief summary of the building attributes (Built up area, amount of vegetated cover, population density and Building height) of case study 1 and 2 respectively. These attributes of the two buildings are analyzed and compared to find out the influence of Building height and ground coverage in the per person green area.

RELATIVE TERMINOLOGY

Green roof: A green roof is usually constructed to cover a large area in the most economical and efficient means possible with an emphasis on improving the insulation and/or improve overall energy efficiency [9]. Green as a passive cooling mean, its related thermal benefits are essential for architectural design strategy in Warm humid tropical climate of Bangladesh [8].

Ground green coverage: Ground green coverage is the percent of green space at the ground level in relation to the site area.

Roof area ratio: Roof area ratio is the percent of roof area in relation to the site area. **Green Area ration:** is the percent of Green area in relation to the site area.

RESULTS AND DISCUSSION

A. Study Unit 1

Plot no. 443/c(old),50(new) , road no.13 (old),6/a (new), Dhanmondi residential area, Dhaka. Proposed 4-storied residential building for Mr.Adnan Ahmed Choudhury.



Fig. 3. Images of single family residential building

Table 1. Different building attributes of single family residential building

Floor	Built up Area	Green		Water body	No of people
Ground Floor	8295.1363 sft	3018 sft	Soakable Green	907 sft	6
1st floor	7184	x	Some pot plantation on verandah	x	
2nd floor	7426 sft	1810 sft	Intensive Green	x	
Roof	980sft	x	x	x	
Total	23,885 sft	4828 sft		907 sft	

Area : 14,400 SFT
Green Area Ratio : 33.5%
Green Area Per person : 804 SFT
Building height : 45'

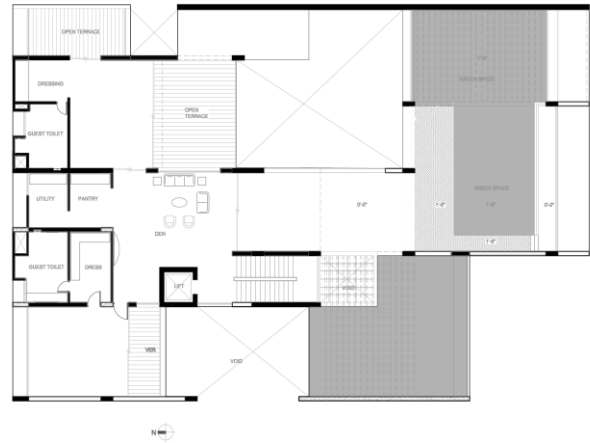


Fig. 4. Ground floor Plan of single family residential building

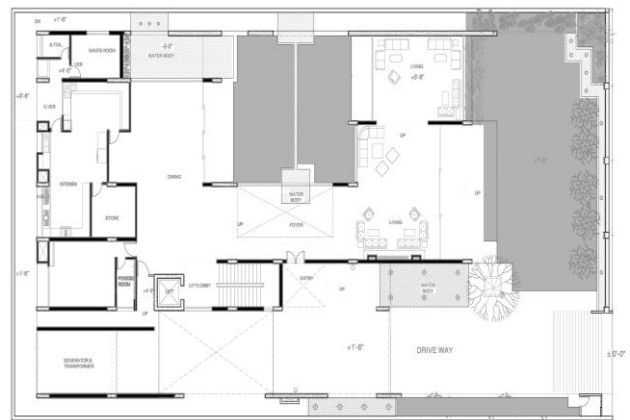


Fig. 5. 2nd floor Plan of single family residential building

B. Study Unit 2

6 storied apartment building at 48 park road , Baridhara

Table 2: Different attributes of multistoried residential building

Floor	Built up Area (sft)	Green		Water body	No of people
		Area (sft)	Type		
Ground Floor	4243.17	3018	Soakable Green	x	0
Mezza nine floor	1002	x	x	x	3
1st floor	4310	65	Intensive Green	x	6
2nd floor	4407	160	Intensive Green	x	6
3 rd floor	4407	160	Intensive Green	x	6
4 TH floor	4310	65	Intensive Green	x	6
5 th floor	4305	160	Intensive Green	x	6
Roof	1790	1050	Intensive Green		0
Total	23,885	4828		907	6

Site area : 5972.49 SFT
Green Area Ratio : 78.33%
Green Area Per person : 141.75 sft
Building Height : 66'



Fig. 6. Image of multistoried residential building at Baridhara

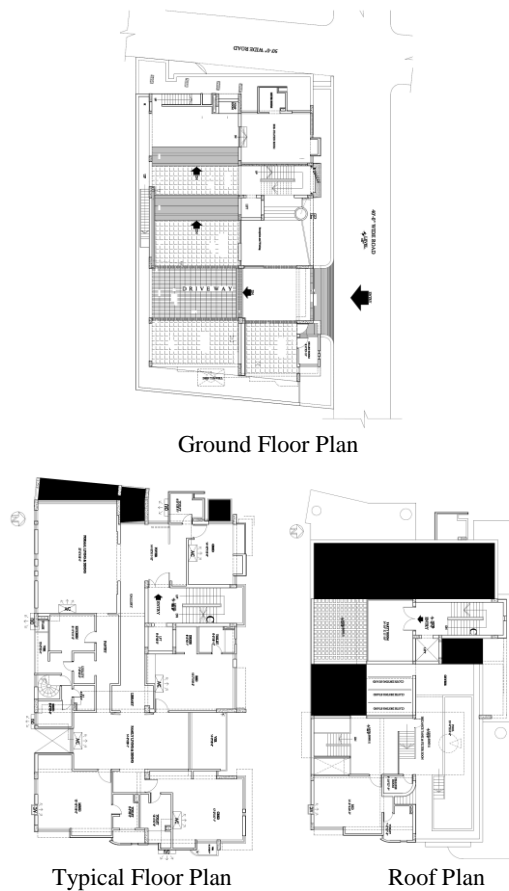


Fig. 7. Plan of multistoried residential building

Plan analysis of Study Unit 1 shows that 4828 sft of total green can be created where the site area is 14,400 sft with building height 35 feet. The Green was distributed in two levels, ground and Terrace green which is shared by the family members.

In the case of study unit 2, the total green was distributed in ground 6%, each floor level 12% at verandah which every single family unit can use, and community green at roof 82%.

The study shows that the green roof area is directly proportional to Ground coverage and inversely proportional to height. In this case per person green area decreases and shared green spaces increases with additional built up spaces and height.

Building with larger footprints can provide more space for green roofs. We are increasing the ground floor when we increase height. But only the roof garden is not enough for tall buildings. Green roofs will be difficult to accomplish in a small area with a thin finger like building.

SUGGESTIONS

- Vertical Green Area Ratio should be included both in Bangladesh National Building Code (BNBC) and Bangladesh Imarat Nirman Bidhimala. Installation of green roof should be mandatory for all new constructed buildings by the owners.
- Government can subsidize a significant amount of green roof installation cost to home owner and developers. This will encourage owners and developers.
- Awareness among people should be raised by proper campaign program, advertisement regarding importance of green roof in wider scale to achieve a healthy urban living environment.

CONCLUSION

The concept of integrated building garden is relatively new in our country. Most of the cases here in Bangladesh, these gardens are used for aesthetical purpose only. The prime dominant factor affecting the compensatory green are: Building Height and Roof area and population density. This paper investigated the need for green area ratio along with the floor area ratio while designing a built form. There is generally a lack of knowledge about compensatory green and green roof. We have to think to compensate the green we are destroying and use it effectively in building design decision making.

RECOMMENDATIONS FOR FUTURE STUDY

Further studies can be done to find out the actual amount of green plot ratio determined by the type of use, such as residential, commercial, institutional etc and area of building and considering LAI(Leaf Area Index)

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