

# Assessing Past Models and Theories Related to Green Space Use for Sustenance of Gated Residential Communities

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**Abstract-** Presently in most of the Indian cities, there are two major concerns, one is the rising population which developed the housing demand and another is a hasty urbanization. These concerns are directly impacting the urban land parcel availability and per capita green space of the city. For unplanned growth and urbanization, government policies for housing finances are also responsible, which provided encouragement for the growth of real estate sector. The Urban and Regional Development Plans Formulation and Implementation guidelines 2014, suggest that 50-60% of land use must be under residential use. The Housing Start up Index, developed by Reserve Bank of India, highlighted the role of Real estate sector in construction of the Gated Residential Communities, which reveals that it constitute the major share when compared to other types of residential Communities. In today's perspective, the location of gated residential communities at periphery area in Indian scenario itself is a greater challenge in terms of safety-security and access to city level green spaces to avail the benefits. Which in turn means that, the population accommodated in gated communities need to depend upon its available green spaces due to lack of access to city level green spaces. Theoretically, on one hand, varied school of thought describes the gated residential communities as socially unsustainable due to boundaries and limited accessibility to the amenities. Whereas, on other hand, past models indicates the qualitative-quantitative green space as sustainability indicator for residential communities. Hence this paper is an attempt to evaluate sustenance of the residential communities for present context, by examining the theoretical construct of the past models pertaining to green space as well as present criteria of provision of green spaces. To understand this dynamism of green space, case studies of gated residential communities of Bhopal city of Madhya Pradesh, categorized as per density are examined and evaluated. The results shows that theoretical construct needed to be reframe in terms of accessibility i.e. along with physical accessibility, the role of visual accessibility for green spaces also shows a strong impact in sustenance of the gated residential community by enhancing livability conditions.

**Keywords** –Gated Residential Communities, Green Space, Sustenance, Accessibility

## I. INTRODUCTION

Urban green space plays a crucial role through direct and indirect provision of essential social ecosystem services. High population density is one of the reasons for under development of urban greenery sector in India [18]. This indicates that by loss of trees and vegetation in urban area, quality of life and livability conditions of citizen also impacted. Increasing population and rapid urbanization brought two major concerns for urban areas. First concern is the urbanization and secondly the housing demand which encouraged the growth of real estate sector. This played an important role in existence of gated residential communities in Indian cities also supported by Housing Start up Index, developed by Reserve Bank of India [20]. In India, minimum per capita green space standards required to maintain green in urban areas as, mentioned in Urban and Regional Development Plans Formulation and Implementation guidelines (URDPFI-2014) is 10-12 sqm /per city dweller and it also suggests for 50-60% of residential land use of municipal area. Due to this, vegetation and trees had been cut down to provide land for these projects [26]. This mechanized workshop of housing deliverable market raises the question about the sustainability of these gated residential communities for future cities. Many Indian cities are having per capita green space below standards due to increasing population. The important aspects of green space in urban form are Quantity (percentage of the urban area filled with green space), Quality (ability of the green space to improve urban biodiversity and provide better ecosystem services), Connectivity (inter-connection between the green spaces) and accessibility (% of population with access to green space) [9]. But per capita green space deals with quantity and accessibility of green spaces but user satisfaction deals with Connectivity and Quality. Hence, it is essential to know the byelaws and development control standards mentioned in planning documents whether they are sufficient to address the provision of green space in gated residential communities and meet the statistics as mentioned in guidelines. In today's perspective, the location of gated residential communities at periphery area in Indian scenario itself is a greater challenge in terms of safety-security due to unavailability of land in urban areas. Due to distance it is difficult to access the city level green spaces to avail the benefits is difficult to the residents of gated residential communities. Which in turn means that, the population accommodated in gated communities need to depend upon its available green spaces due to lack of access to city level green spaces. There is a need to study and streamline the prevailing standards for green spaces of residential area which helps in enhancement of livability condition of residents.

### 2.1 – Existing physical attributes in byelaws for provision of open space in residential area

Detailed studies reveals that open space standards stated in specified planning document of Indian cities are basically in terms of distance, percentage of area of total land and density [2]. Insufficient physical parameters are provided for open space by laws for residential area in development plans of the city as mentioned in table no-1 below.

Table -1 Status of provisional criteria for open spaces

S.no	Type of residential development	Setback	Area	Density
<b>Housing development</b>				
1.	Plotted residential	(Front , rear .L.H.S,R H S)	-	-
2.	Group housing and Multi unit residential	Front MOS as per abutting road width and three side set back for service lane	10% of total area minimum left as per open space in residential development	-
3.	High rise development	The side and rear open spaces of the building shall not be less than 12 meters and front open space shall not be less than 7.5 meters.	33% of total area is maximum ground coverage and rest is for other infrastructure like roads , setbacks, service lanes and open space	-
<b>Neighborhood level</b>				
1.	Tot lot at housing cluster level	-	0.0125 ha	250
2.	Housing area park	-	0.5 ha	5000
3	Neighborhood	-	1 ha	1000

Source :( Model Byelaws)

There is no mention of any social attributes which make the provisional criteria user eccentric. So it is essential to identify and integrate that physical parameter in provision of green spaces in residential area which provides user satisfaction and enhance quality of life by providing social benefits.

### 2.2 Conceptual preliminaries of various sustainability models pertaining to green space

Most of the Indian cities are far behind in quality as well as quantity of urban green spaces than their counterpart in Europe and America [18]. Urbanization leads to rapid decline in open spaces across our cities. One of the obvious indicators of urban sustainable development is the quality and quantity of green spaces in the city [25].Consequently urban sustainability will be a critical challenge, particularly for developing nations like India[11]. European’s contributed a lot in the field of urban green space planning and used to emphasize that the green environment of urban areas is about more than just parks and playing fields [19]. URGE model is an output of European thought for development and management of green spaces at city and site level. It is based on four criteria’s i.e. Quantity, Quality, Use and Planning -management of urban green space system. URGE model emphasis upon the physical characteristics of green space in residential area. Social criteria are evaluated based on the extent of interaction between user and site. Similarly many International efforts can be seen for contribution towards development and management of green spaces like CABE (commission for architecture and the built environment) space for maintenance strategies and funding models (CABE SPACE 2009), BUGS (Benefits of Urban green space) helps in evaluating impact on climate, pollution, noise levels and traffic congestions [3],RUROS (Rediscovering urban realm and Open spaces) is coordinated by the centre for renewable Energy resources (CRES), Greece, focusing upon the improvement of comfort, functionality and safety of large open spaces at city level [22] and the GREEN COM [5] looking forward towards the communication in the management and development.

Some past models highlight the relationship between physical characteristic and social benefits. A model for benefits of urban green space by Bedimo-rung etal 2005 describes the relationships between park benefits, park use, and physical activity, and the antecedents/correlates of park use. In this classification scheme, the discussion focuses on park environmental characteristics that could be related to physical activity, including park features, condition, access, aesthetics, safety, and policies[1]. A study [8] shows that positive association between neighborhood features such as parks and ‘collective efficacy’ or the ability of residents to interact positively. It was found that 83% more individuals engaged in social activity in green spaces as opposed to sparsely vegetated or concreted ones [22].

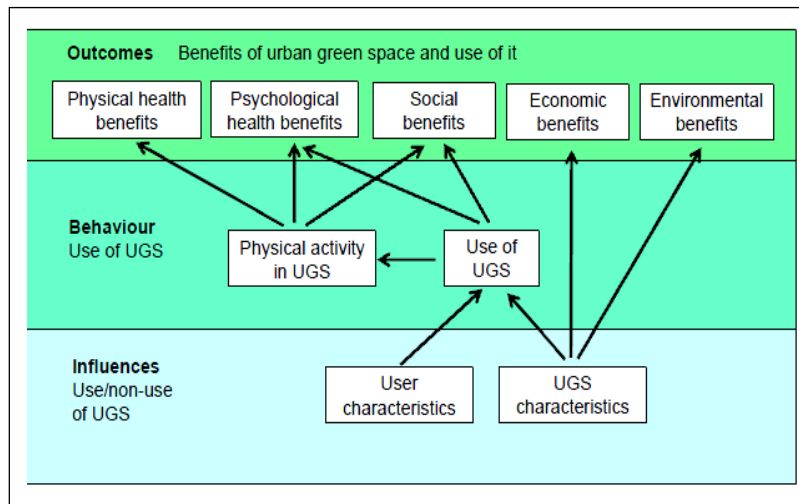


FIGURE 2.2 A MODEL FOR THE BENEFITS OF URBAN GREEN SPACE SOURCE: BEDIMO-RUNG ET AL. (2005)

The facilities available within green spaces also impact upon usage. For instance, green spaces with a variety of attractive attributes such as landscaped features, ponds, trees and lakes can encourage higher levels of use. Green spaces also need to facilitate diverse uses since single-use spaces, such as sports fields, do not encourage undedicated use. Where one green space site cannot accommodate all users or serve a full range of purposes, the wider spread of green space provision in an area as a whole is required. All above said model is specifically focusing upon the role of physical characteristics of green spaces and its impact on social interaction for gated residential community.

### III. methodology of study

Growing concentration of people in urban areas has resulted in a wide gap between the demand and supply of housing, both in terms of quantity and quality [16]. The public sector faces scarcity of resources and has limited access to modern technology aimed at developing modern real estate at a mass scale within stipulated timelines. Hence, housing demand encouraged real estate sector [9]. Keeping this in purview one of the million plus city Bhopal is selected as study area. Bhopal is a capital city of Madhya Pradesh state. The gated residential communities are flourishing in this city. As per BMC (Bhopal Municipal Corporation) registered colonizers are 588 in numbers as well as non registered colonizers are 198 in numbers. Looking towards this quantum one can understand the possibility of number of gated residential colony in City. Criteria adopted for study are as follows:-

- Age of gated residential colony should not be less than 3 years of occupancy from till date(Jan 2014)
- Size of gated residential should not be less than 60 household.(As lowest density for provision of tot-lots in residential area is considered as 250 (BDP,2005) and assuming the household size as 5 the density is coming out to be 300 for 60 household)
- Density threshold will be followed as per master plan document of particular city.
- Sample size will be minimum 10% of the total household and location of sample collection depends on the location of open space.

Table-2 showing the different categories for sample selection in gated residential area

Gated residential colonies			
Medium density residential gated colonies			High density residential gated colonies
(A) Row housing Typology(G+2)	(B) Group Housing Typology(G+2), (G+4)	(C) Multi unit residential typology(G+4 to G+6)	(D)Multi unit residential typology(G+10 or above)
Tulsi vihar colony , BHEL Bhopal of 80 household with three open spaces	Sagar royal villas, Hoshangabad Road , 550 household with seven open spaces	Geetanjali complex , Mata mandir, Bhopal One single open space	Platinum plaza ,New market , Bhopal One single open space

Selected Physical parameters to be analyze as sustainability indicator are Quantity of Urban Green Space –Surface area of urban green space, Shape Index, Inter patch distance to nearest neighboring patch, connectivity to other green spaces, Soil sealing , shaded area.(Primary survey) Quality of Urban green space-naturalness, Surface disturbance , aesthetic Value, Cultural aspects, local identity, awareness of physical, emotional benefits derived from urban green spaces (Questionnaire).Secondly these results are compared with Usability of urban green space.

3.1 Case study-1 (Tulsi Vihar Colony)

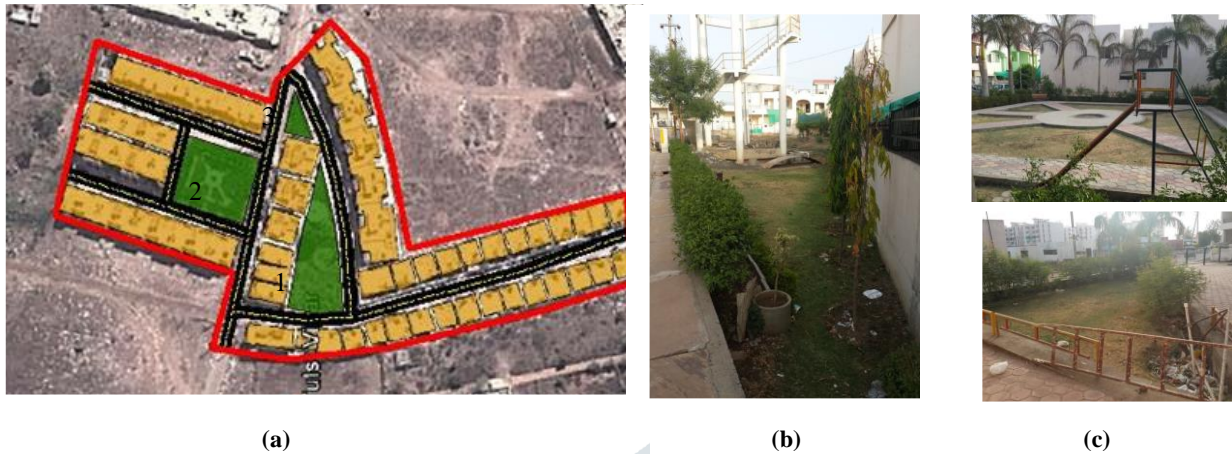


Figure 1. (a) Colony layout (b) Green space-1 (c) Green Space-2 and 3

Name of the colony is Tulsi vihar situated in BHEL, Bhopal. It sprawls over an area of 2.52 acres under Row housing scheme, TNCP (town and country planning) permission was obtained in 2007 and BMC (Bhopal municipal corporation) permission in 2008. It comprises of 80 household units of G (Ground) and G +1 (Two floors) structure. It comprises of three green Space; one is functional of approximately 687.73 sqft area, and other two are not functional of about 737.98 sqft.

3.2 Case study-2 (Sagar royal villas )

The gated residential community, namely Sagar Royal Villas, is situated on Hoshangabad road, near Habibganj railway station of Bhopal City. It occupies an area of about 11.32 acres. It comprises of Row housing ,Multi unit housing and conventional shopping centers. Approximately 750 residential units are there. There are six green Space on the premises. Few of them are regular and few irregular in shape and size. The green Space namely P1, P2, P4, P5, P6 is situated with rectangular shape arrangement spatially in between the row housing. But the green Space namely P3 is only space which is square in shape and has more catchment area compared to others. Lack of green Space in front of multiunit residential, make the residents to use the prominent green Space, i.e. P3, P4 and P5 because of their physical accessibility. Most of this green Space are passive in Nature.



Figure 2. Colony layout

3.3 Case study-3 ( Gitanjali complex)



Figure 3. Colony layout

The Bhopal Development Authority (BDA) has implemented several development projects aimed at beautification of the city of Nawabs. The Gitanjali Complex is also one such project. This project spreads over 7.50 acres of land where 386 flats have been built. This colony was developed in 1984, and has two green Space in this vicinity. The size of the green Space namely P1 is about 193.07 sqm and size of green Space namely P2 is about 102 sqm. Both of them are passive. So below mentioned table no-3 clearly depicts that need of green space is more than what provided in all these case study. On the basis of this the primary survey data for sustainability indicator of green space i.e. quantity, quality and usability of green space is collected and compared.

Table-3 Showing need of actual green space as per density

Case study	Provided open space area (sqm)	Required per Capita green space per person (9sqm /per person)
1	1425.53	3600
2	2895.11	14625
3	1642.05	11250

IV. ANALYSIS

The Sustainability of the Gated Residential Communities is assessed by three criteria i.e. Quality, Quantity and Usability of green spaces because of its varied size, shape and location within the boundaries.

Table-4 Sustainable Indicator -1 (Quality of green space)

S.no	Sustainability indicators	Case study-1	Case study-2	Case study-3
A.	Quantity of UGS			
1.	Surface area of open space (Usable)	687.73 sqm	2895.11 Sqm	1642.05 sqm
	(Not usable or non functional)	737.98 sqm	-	-
2.	Shape Index ( No. of regular shape open space)	1	7	1
	(No. of Irregular shape open space)	2		
3.	Inter patch distance to nearest neighboring patch (least distance)	15 m	50 m	0
	(Maximum distance)	35 m	80 m	0
4.	Presence of different types of green corridors that links a site to other urban green spaces	absent	Linear patch of trees and shrubs in central verge of road and along the corner bungalows	Fragmented tree canopies with in the colony interconnect with large one
5.	Proportion of soil surface (pervious: impervious) or green	3:1 (Open	1:0	1:0

	cover (Functional green space) (Non functional green space)	space-2) 1:2 (Open space-1)  1:0 (Open space-2)	Nil	Nil
6.	No. of trees with radius of canopy more than 3.0 meters Within functional UGS	Absent	Absent	28 no's within planned UGS
7.	Surface disturbance (Proportion of surface which is heavily worn)	1:2 of non-functional open space	Nil	Nil

Table -5 Sustainability Indicator-2 (Quality of green space)

	Social Parameters	Case study-1	Case study-2	Case study-3
B.	Quality of UGS (weight age)			
1	Naturalness(Proportion of indigenous /exotic, rare and protected species in relation to the total number of species found at the site)	1	3	5
2	Aesthetic value (Statements from local residents with regard to the aesthetic value of the green space)	.2	4	3
3	Cultural aspects (Identification of cultural components in the context of the planning and management of the site)	1 {adaptive spaces are used to perform cultural aspects)	4	3
5	Local Identity (Statement from local residents regarding the importance of the site to local identity)	1	1	1
6	Awareness of physical, emotional benefits derived from urban green spaces	. 1 (No awareness)	3	1

Weightage-1- least, 2-less, 3-moderate, 4- more , 5-most

Table -5 Sustainability Indicator-3 (Usability of green space)

C	Use of UGS	Case study-1	Case study-2	Case study-3
1	Catchment area (No. of potential users per urban green space) (a- 1 to 10, b- 11-25, c-above 25)	a	b	a
2	Accessibility			
	Most common forms of access by users	Walking	Walking	Walking , by-cycling
	Obstacles to access	Main master plan road adjoining one of the periphery	60' wide master plan road adjoining one common edge of three UGS out of seven.	No obstacle
	No. of entrances to urban green spaces	1	1 or 2 maximum entrances	2
	Width of the road	6.0 m (3 sides) 9.0 m ( 1 side)	7.5 meters (3 sides) and 18.0 m road for three Green space but rest of four are surrounded by 6.0m road.	6.0 m wide by all four side
3	Daily recreational need			

	Activities of people on site	Children play area and adults monitoring children	Playing, excersie, morning walk, yoga	Playing , morning walk
	Forms of recreational use	1-8 years children play area-outdoor games	Children ,teenagers Playing, outdoor sports like badminton, un availability of hard surface other sports in incidental open areas.	Teenagers Playing, outdoor sports like badminton as the space is cusp of hard and soft.
	Frequency of use	32% -daily use 18%-once in week, rest not use	42% -daily use 58%-once in week	46% -daily use 4%-once in week 50%- other outside recreational area
	Timing of user	Evening	Morning and Evening	Evening
	Duration of stay by users	1 hour	3-4 hours in evening and 1-2 hours in morning	1-2 hour
	Supply of equipment for recreational use	Availability of basic play equipment.	Availability of play equipment in three green space	Very limited, negligible
4	Sport and play facilities			
	The use of green space for sports facilities	No	Yes	yes
	Type and amount of sports facilities	No	Badminton net , volleyball	No
	Children's Play equipment	yes	Yes	Very less
	Quality of pathways for sport and other use	Poor	Yes- jogging tracks	Poor
5	Life strategies			
	Level of socialization while using the green space	Very poor	Moderate	Poor
	The use of green space connected to other daily activities	Not used for any other purpose apart from children	Multi functional- apart from recreational , Cultural also.	Only for limited recreation
6	Social inclusion			
	Heterogeneity of user groups	It is homogeneous	Yes heterogeneity	No it is homogeneous
	Evidence of social intolerance	yes	No	No
7	Safety			
	Evidence of patrol//warden in and around the green -space	yes	No	No
	Types of incidents in the urban green space	Not comfortable for females as convenient shop is nearby.	Not seen	Not seen
8	Conflict of use { Evidence of conflicts of use)	Considered as doorstep parks rather than local parks	No	Considered as doorstep parks rather than local parks
9	Multi functionality (No. of permanent functions related to the total area of the UGS)	No	Yes	No

V. DISCUSSION:

The whole study is carried on the basis of past models and theories, which describes about benefits of urban green space and the relationships between park benefits, park use, and physical activity, and the antecedents/correlates of park use. In this analysis it mainly focuses on park environmental characteristics that could be related to physical activity, including park features, condition, access, aesthetics, safety, and policies. (Ariane L. Bedimo-Rung, 2005). Dynamism of green space is seen differently for all the three case studies. Argument is that, in all the three case studies, the byelaws and standard as per the legal document is same, but why usability is different?.

**In case study -1**, In spite of three green spaces, two of them are not in use because of irregular size, shape and deprived of recreational facility. As a result, the open space-2 which is equipped with children play area, street furniture's more than its potential (area is less as per the density usage) more often used. But due to the location of this green space -2 which is in front of master plan road and near conventional shop made it less secured place for female user. Hence, as a result that green space is used only at the extent of visual access even though it is physically accessible.

**In case study -2**, There are seven managed green space, out of which three are facing to 18.0 m wide road and rest are arranged in between residential plots as mentioned in the figure. However these green spaces are of different shape and size with diverse sports facility. The inter linkages of park through avenue of linear green patch made it more successful. Due to its equal sprawl in residential arrangement, each of them act as a neighborhood green space. Hence spatial and visual accessibility made the green space more secured and usable.

**In case study-3**, There is only one green space is available of regular shape and size with limited park facility but good amount of canopy cover within and around the made it usable. In spite of limited facility, use of this open space is evident because of canopy cover %, which increases its passive activity. But due to its eccentricity in location the usage of green space as expected is less. Moreover other recreational activities are performed by different age group users at various internal circulation places. It is assumed that due to lack of visual access the adoptive spaces are used more for recreational activity in spite of planned one.

Table-6 Showing the physical parameters impacting over sustainability green space indicators

S.no	Factors	Case Study-1/ No. of designated Green Space			Case Study-2/ No. of designated Green space							Case study-3/ No. of designated Green Space
		P1	P2	P3	P1	P2	P3	P4	P5	P6	P7	P1
	Green Space →											
1.	Physical Accessibility	X	√	X	√	√	√	√	√	√	√	X ( restricted only for catchment area)
2.	Visual Accessibility	√	√	√	√	√	√	√	√	√	√	X (only for catchment area)
3.	Shape	IR	R	IR	R	R	R	R	R	R	R	R
4.	Green space Area in line as per catchment	N	N	N	N	N	N	N	N	N	N	N
5.	Passive activity	X	Y	X	Y	Y	Y	Y	Y	Y	Y	Y
6.	Active activity	X	X	X	Y	Y	N	Y	N	N	N	Y
7.	Isolatedness	Y	Y	Y	N	N	N	N	N	N	N	N
8.	Inter patch connectivity	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y

**VI. Conclusion:** - Three case studies of the Gated Residential Community are analyzed on the basis of three green space indicators (Quantity, Quality and Usability) of sustainability. Primary survey dealt for all case studies shows variance in spite of opting same provisional criteria as mentioned in model byelaws for green space. Many researches on gated residential communities agree that they have less degree of social cohesion compared to non gated residential area. Then question arise what parameters or aspects are impacting over the green space indicators for gated residential sustainability. After carrying detailed analysis of quantitative and qualitative data of green space in gated residential community it is inferred that few physical factors are impacting over green space indicators as shown in table-6. Above case studies also depicts the tangible and intangible benefits of green in open spaces like social interaction, health and environmental benefits, which had been discussed in past models. Here it is observed that physical parameters used as per model bye laws for provision of open space in gated community i.e. set back ,area and density are not sufficient to cater the green space facilities to user end. It is important to add three more parameters or aspects which came out of these case studies are accessibility (physical and visual), functional (shape, area as per active and passive recreation to be catered for catchment area) and location (Isolatedness or inter patch connectivity) which enable green space to act as a indicator for sustainability of gated residential communities of future Indian cities. Study also depicts that more passive green spaces enhances the social cohesion and presence of softscape helps in increase of per



capita green space per person at neighborhood level which in turn enhance sustainability, quality of life and livability conditions. Hence for sustenance of any gated community quantity, quality and use of gated residential community is essential.

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