

**B**uilding **IN**clusive **U**rban **COM**munities

# **Accessibility of Designated Open Spaces to Informal Settlements**

A Study of K West Ward in Mumbai

Ekbote, Abhijit

2019



Funded by the  
Erasmus+ Programme  
of the European Union



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Kamla Raheja Vidyanidhi Institute for Architecture and Environmental Studies

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**Abstract:**

Designated open spaces are protected public open spaces as per the development plan which is prepared by the city's municipal corporation every 20 years. A comprehensive study carried out by the Mumbai Metropolitan Region Environment Improvement Society (MMR-EIS) in 2012 published the available open space per person in Mumbai to 0.84 square meters. This is based on an average of all wards consisting of diverse densities within the city. With about 42% of its population residing in informal settlements, which have very high densities, knowledge about their access to the protected public open spaces is absent. This paper is an inquiry into this issue through the curriculum of Geographic Information Systems (GIS) towards understanding the accessibility of designated open spaces to informal settlements.

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# List of Abbreviations

DP	Development Plan
DOS	Designated Open Spaces
LTPA	Leisure Time Plan Activity
GIS	Geographical Information Systems
MMREIS	Mumbai Metropolitan Region Environment Improvement Society
ODK	Open Data Kit
UDPFI	Urban Development Plan Formulation and Implementation
URDPFI	Urban and Regional Development Plan Formulation and Implementation
MoUD	Ministry of Urban Development
QGIS	Quantum GIS
SQL	Structured Query Language

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I am grateful to all the students of 3 different batches, who showed great enthusiasm in learning new methods, visiting sites for data collection and compiling the same for analysis. Without their keen involvement in the GIS course, this research would have remained incomplete.

Lastly I thank KRVIA for giving me the opportunity to formulate a course in GIS through which this research was carried out.



# 1 Background

A designated open space, in this case, refers to an open space, which is planned and protected, as per the city's development plan. It is assumed that when an open space is designated in the development plan, it is equally accessible to all. This paper is an inquiry into this assumption.

The purpose of choosing designated open spaces<sup>1</sup> for measuring accessibility is that there is an intention of protecting them as public open space amenities by the municipal authority. Hence it would be useful to assess and gauge the extent to which they have been successful and, if they are, to whom are they truly accessible and what is the level of disparity. Considering that a large part of the city's population (42%) lives in informal settlements<sup>2</sup> this paper chooses to focus on the status of their access to the designated open spaces. This could help in understanding the extent to which the development plan has been successful in this context.

The present study aims to develop a method / framework of identifying and weighing relevant qualitative parameters, which can be used as a tool for representing the nature of accessibility of protected open spaces, in context to the western suburbs of Mumbai. It will focus on finding out the extent to which these protected open spaces are accessible to informal settlers in its vicinity through the curriculum of Geographic Information Systems (GIS).

## 1.1 Starting position and research goal

Henri Lefebvre in 1968 coined the idea of Right to the City, which was further elaborated on by David Harvey in 2008, where the latter says that the kind of city we want cannot be divorced from what kind of people we want to be, what kind of social relations we seek, what relations to nature we cherish, what style of daily life we desire, and so on. He argues saying that it is much more a collective rather than an individual right, since changing the city inevitably depends upon the exercise of a collective power over the process of urbanization. The present study will use this as a starting position to argue that the public open spaces (in this case referred to as the designated open spaces) form crucial elements of the city, and the study of accessibility will help in understanding the nature of collective right.

A recent study from the Netherlands suggested that green space is associated with health in both urban and rural areas, and may partly explain urban-rural differences in health. A greater provision of green space, in general, has been associated with better health and wellbeing. Though, this relationship changes when it comes to income deprivation and urbanity, for instance, areas with a higher income have their own domestic gardens and hence, municipal green spaces are less important to them. Increasing the quantity of green space alone, disregarding an understanding of income levels, may not bring health benefits (Richard Mitchell 2007).

As Charleux defines accessibility, in her research article while quoting Morris et al., as "the ease with which activities may be reached from a given location using a particular transportation system". Poor

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<sup>1</sup> A designated open space in the context of this paper refers to an open space that is reserved by the city's development plan as a public open space to be used either as a garden, playground, recreational ground or a park.

<sup>2</sup> Informal settlements in this context refer to dwellings which are usually constructed in unplanned areas and make use of temporary or sub-standard materials and also usually lack access to basic infrastructure, such as health, education and sanitation.

accessibility can be due to several reasons, apart from just the means of reaching the destination and could adversely impact the welfare of the population and if some 'sub-groups are systematically more affected' this would lead to social injustice (Charleux 2015). This is a very important observation, which relates to the context of Mumbai, where about 42% of its population lives in informal settlements and whether the designated open spaces are truly accessible to them.

A study on the determinants of leisure time physical activity (LTPA) carried out in the United States lays out the correlation between diverse ethnic backgrounds and LTPA (Wilcox et al. 2000). This is an important finding, which states that the barriers to access open spaces and engage in LTPA are much higher in lower socio-economic backgrounds.

In context to India, the Ministry of Urban Development has prescribed norms for the provision of open spaces of several kinds, which include different hierarchies of developed open spaces and types of natural areas. In the built up area (excluding recreational space, vacant land, flood plain and forest) the National Building Code suggests 3 square meters per person as a minimum norm. In terms of accessibility, it only specifies an independent means of access to each recreational space and the structure on it (MoUD 2014, pp. 632-633). The development plan of Mumbai follows a standard of 2.5 square meters per person as a standard for designating open spaces. While standards are useful in setting baseline requirements, they tend to generalize the availability of open space based on a total population, disregarding the differing densities and socioeconomic backgrounds. Hence the question of access is never truly addressed.

If we take the case of Mumbai, the present available open space per person is less than 0.9 square meters (Adarkar Associates 2012). This calculation holds good for a certain global density, which is an average of several different densities across the city. Formal housing, which has a relatively lower density as compared to the informal settlements, has a better access to open space amenity, either within their gated communities or outside (Richard Mitchell 2007). Informal settlements on the other hand, which are substantially denser as compared to the formal housing areas, have little or no access to designated open space amenity. This indicates a disparity in the degree of accessibility to designated open spaces across different populations. Hence the numerical figure of 0.84 square meters per person, in case of Mumbai could be grossly misleading as it averages out the glaring differences, and indicates an inequitable access to open space amenities.

The research goal of this study would be to analyse existing data, and add additional parameters to be mapped to understand the accessibility of designated open spaces available to the informal settlements, which could be a crucial finding towards knowing the degree of disparity. The paper discusses the curriculum of GIS which is designed towards this goal. The findings of this study will be useful in arriving at facts and figures which makes the disparity of accessibility explicit. The learnings could subsequently be useful in formulating the future stages that this study could pass through (as described in 2.1).

## **1.2 Research objects**

The study will consider the following elements as research objects:

- a) Designated Open Spaces: These are open spaces indicated and reserved as open spaces in the chosen ward for study as per the city's development plan.

- b) Linkages: These are network connections, which exist in the form of roads or pathways connecting neighborhoods with designated open spaces.
- c) Informal Settlements: These would be slum areas, which would be essentially informal housing areas, unplanned areas, having poor infrastructure, disadvantaged communities, areas with diverse ethnic backgrounds, deeply connected with proximity to livelihoods or areas with economic depravity.

### **1.3 Assumptions**

The research assumes that certain factors such as caste, class, gender, degree of developed infrastructure, land values, size, proximity, etc. have a direct impact on the degree of accessibility to designated open spaces with respect to informal settlements. Another crucial assumption is that the formal housing not only has a better access to designated open spaces, but also has open spaces within their gated communities (Richard Mitchell 2007).

These assumptions will be substantiated through an analysis of the objects mentioned above, located in the K West ward of Mumbai. The K West ward of Mumbai, as shown in Figure 7, is taken as a case, since a broad diversity of housing conditions, both formal and informal, are found in this ward.

## **2 Methodology**

Lincoln et al., argue and state the reasons for the enormous emphasis that has consistently been seen on qualitative research methods in the last two decades or so. They further argue that methodology is inevitably interwoven with and emerges from the nature of particular disciplines (such as sociology and psychology) and particular perspectives (such as Marxist, feminist theory, and queer theory). Hence, the various paradigms are beginning to interbreed such that two theorists previously thought to be in conflict are now informing one another's arguments. (Lincoln, Lynham & Guba 2011) Mixed methods seem to have a great advantage towards addressing complex issues where both quantitative and qualitative methods are fused. They can help in capturing the best data and in analysing the same from both methods, which the present study will adopt.

The method used for this study, and thereby followed through the curriculum of GIS, is a combination of both the quantitative (Stage 1 as described in 2.1) and qualitative methods (Stage 2 and Stage 3 as described in 2.1). The study uses the existing quantitative data available from the MMR-EIS on the open spaces of Mumbai, so that it helps in understanding the accessibility index of these protected / designated open spaces from the perspective of informal settlements.

The following section will describe the method and the stages of study.

### **2.1 Stages and Scope of Study**

The stages of study are broadly divided in three parts, where each stage has a set of steps that are followed and are connected with the intended learning, since the study has a relationship with the GIS curriculum.

### 2.1.1 Stage 1

The first stage (as shown in Fig.4) undertakes a quantitative method, where the existing data obtained from MMR-EIS is compiled through sorting, geo-referencing, vectorizing and joining using an open source GIS desktop application, QGIS (Quantum GIS). The intended learnings at this stage are towards organizing data, creating a base layer, understanding attribute structure, creation of vector data and selecting the parameters from the perspective of accessibility.

**Table 1: Table showing Stage 1, its method and intended learnings.**

Project Schema <b>STAGE 1</b>	Method	Intended learnings
Converting the existing raw data in GIS	<p><b>Sorting</b> of existing available data on the open spaces in a ward.</p> <p><b>Geo-referencing</b> the ward sheets showing open spaces with site numbers.</p> <p><b>Vectorizing</b> open spaces and entering respective site numbers as attribute.</p> <p><b>Joining CSV data</b> table to the vector file and cleaning the parameter names.</p> <p><b>Compiling</b> the existing MMR-EIS data for all open spaces in the ward.</p>	<p>Data Organization</p> <p>Method of creating a base layer</p> <p>Design of Attribute Structure</p> <p>Vector Data Creation</p>

**2.1.2 Stage 2**

For the purpose of setting a method, which can then be applied to varied context throughout the city, this stage will begin by organizing data collection groups according to the councillor wards to gauge the accessibility index. The criteria of selection of data collection points within the councillor wards (in the K West Ward) will be based on the contrasting conditions of accessibility derived from the initial screening of MMR-EIS parameters & sub-parameters in the earlier stage. The second stage (as shown in Figure 5) involves visiting the identified sites of informal settlements and listing the next level of qualitative parameters which need to be mapped through interviews and visual perception. The actual mapping of these new parameters will be carried out in this stage and will form a primary database for deriving conclusions. The learnings intended at this stage are about understanding the relationship between designing an attribute structure comprising of parameters, sub-parameters, attributes and generating desired accessibility maps through SQL, which help in analysis.

**Table 2: Table showing Stage 2, its method and intended learnings.**

Project Schema <b>STAGE 2</b>	Method	Intended learnings
Identifying and collecting data for additional <b>qualitative parameters</b> indicating degree of accessibility.	Identification of Qualitative Parameters which will be mapped through cognitive mapping.  Creating a list of Qualitative Parameters and coding a mobile data collection form, which would help in understanding the nature of accessibility.  Visiting the designated open spaces in the vicinity of informal settlements, mapping their perception through interviews and creating a user-perception database.	Using GIS to document softer and non-measurable parameters.  Identifying the gaps in data and designing a data collection form to fill those gaps.

The database, which was sourced from the MMR-EIS, was primarily a detailed documentation of the open space itself in terms of its general condition and use. However, specific knowledge of how the informal settlers perceive these open spaces is missing. The 2nd stage of this study intends to bridge this gap by designing a data structure for documenting the users (informal settlers) perception of such designated open spaces in their vicinity.

**2.1.3 Stage 3**

The third and the final stage of study (as shown in Fig.6) will involve learning methods of publishing data using simple HTML formats towards representing the accessibility index of designated open spaces from the perspective of informal settlements. The actual publishing method would be outside

the scope of this paper, this last stage intends to conclude with making the accessibility of designated open spaces explicit, based on the new qualitative parameters listed and mapped.

The present paper limits its scope till the second stage, where the accessibility of designated open spaces in the councillor wards will be compared. Stage 3 shows the future trategy this study, towards making this information public.

**Table 3: Table showing Stage 3, its method and intended learnings.**

Project Schema <b>STAGE 3</b>	Method	Intended learnings
Developing a WebGIS Tool for representing and publishing the degree of accessibility of open space data for Mumbai.	Learning HTML & Javascript coding languages, along with open source WebGIS platforms such as OpenLayers, Leaflet and GeoServer.  Conceptualizing modes of visually representing degree of accessibility.  Publishing data.	Degree of accessibility can inform the nature of strategies to ensure equitable distribution of open space amenity.

### 3 Understanding existing data structure

This section will discuss the existing data structure of MMR-EIS, in terms of all the parameter, sub-parameter and the related attributes. This section intends to eventually list the parameters and sub-parameters which can help in understanding the accessibility to designated open spaces by informal settlements. Only these parameters will be chosen and additional parameters will be added for data collection.

As described in Stage 1, the existing data structure was in a tabular format with no reference to location coordinates. However, each designated open space was given a unique code number which was used by the present study as the attribute to join the table with the shape file in QGIS. Table 1, shown in the Appendix section, shows each parameter, sub-parameter and relevance of each with respect to informal settlements, which is stated in the `remarks` column. This extensive data was studied to choose the parameters and sub-parameters relevant for this study and further develop it for data collection from the perspective of the users of open spaces from the informal settlements. Table 2, shown in the Appendix section is thus arrived at for data collection using ODK Collect<sup>3</sup> app and setting up an ODK Aggregate<sup>4</sup> server. Data collection was carried out in such a way that groups were made according to councillor wards within the K West ward. Questions were asked to dwellers residing in informal settlements to understand the manner in which they are accessing open spaces around them.

<sup>3</sup> ODK Collect is an android based app which works on mobile phones running Android operating system. This app can be downloaded on the phone through the Playstore.

<sup>4</sup> ODK Aggregate is a server based program which is a platform for receiving the data collected through ODK Collect.

The mobile survey table which was coded in XForm using Microsoft Excel can be found here <https://drive.google.com/file/d/1zSallNqVgGEJQ1e94q-gD7YaiwaLP5p/view?usp=sharing> . The findings of the data which was collected are discussed in the next section, and can be found here <https://drive.google.com/file/d/1sfncFWtzBz0dM-XPpqsg32Oy6KX7Sr2/view?usp=sharing> .

## 4 Conclusions

Designated open spaces which were and are even today marked on the development plan as green polygons, have been done so by the municipal corporation, without assessing the ground reality. In several cases they have been marked on large land parcels which already had informal settlers residing on them. There seem to be two predominant reasons behind doing so. The first reason being the assumption that the informal settlements would be eventually be relocated so that the vacated land would then be available as a public open space. And second reason being that the municipal corporation had to meet certain planning standards of open space as per the then prevailing UDPFI guidelines (now referred to as URDPFI guidelines), which are merely based on the size of population and the required open space per person. It thus became most convenient to mark the open spaces on existing informal settlements.

The total designated open space in K West ward is 265.3 hectares (as per the MMR-EIS data analysis and the study carried out in Stage 1), out of which 26.61% is not open to sky, or is built upon. The area of designated open spaces, which are incorrectly marked on existing informal settlements is 60.6 hectares, out of which only (14.95 Ha) 24.6% is open to sky. Hence, as a future scope of study, it becomes important to study the areas which are incorrectly marked on informal settlements and the nature of actual present use.

The MMR-EIS data shows that the available open space per person considering the entire city of Mumbai is 0.84 square meters per person. The study on the other hand indicates that a certain section of the population (those belonging to the middle class / upper middle class / higher income) have a very good access to public open spaces, which are designated open spaces as marked by the municipal corporation. The informal settlers on the other hand have practically no access to them due to private appropriation in some cases and largely due to negligent process of planning which is devoid of understanding ground reality.

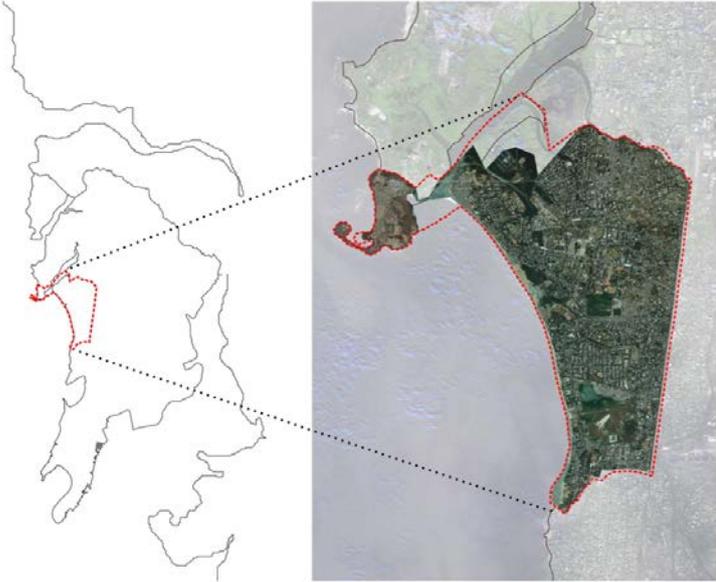
It has been observed through this study that the informal settlements have a unique relationship with the city in terms of livelihood which is manifested in the way they use open spaces. Of the open spaces which were accessible, several livelihood related activities, such as sorting of raw materials, drying, hawking, parking their vehicles, etc take place in open spaces which abut the informal settlements. The data collected shows that about 14% of the sample survey used the open spaces for livelihood related activities, however they requested the surveyors to avoid including this data as they feared that some action may be taken against them. This use is misconstrued by the municipal authorities and a large section of the upper class as a 'misuse' of open space. It is specifically observed that the open areas of designated open spaces, which are partially occupied by the informal settlements, are used by them for activities related to their livelihood. This nature of use is very different from the way the city planners imagine use of public open space.

Apart from the above use (14% for livelihood), about 11% used such open spaces for parking their vehicles and the remaining 74% used it for recreational purposes, if we look at only those open spaces which are accessible and are located in their close proximity. About 23% responded that either the open spaces around their settlements were inaccessible or had a restricted entry.

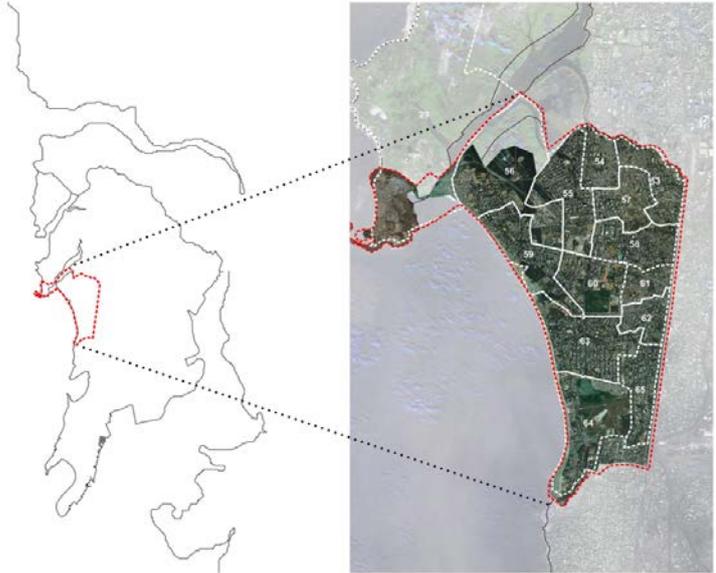
The upper class on the other hand uses designated open spaces as spaces dedicated for their physical and mental health and overall well being. The open spaces they use for these activities are mostly gated and guarded, with strict rules for timing for entry, which act as obvious deterrents for the inhabitants of informal settlements. These become invisible mechanisms for excluding a certain section of the society, which belong to the lower class. The dependence of the inhabitants of formal housing areas, on access to designated open spaces is lower, as the population belonging to the formal housing areas already have open spaces within their gated residential complexes.

This research was carried out during a time when the finalization of Development Plan of Mumbai 2034 was ongoing. Hence the further scope for research could be to consider the finalized DP 2034 of Mumbai and update the results.

**5 Appendix**



**Figure 1: Map showing the location of K West ward in Mumbai.**



**Figure 2: Map showing the councillor wards within the K West ward.**

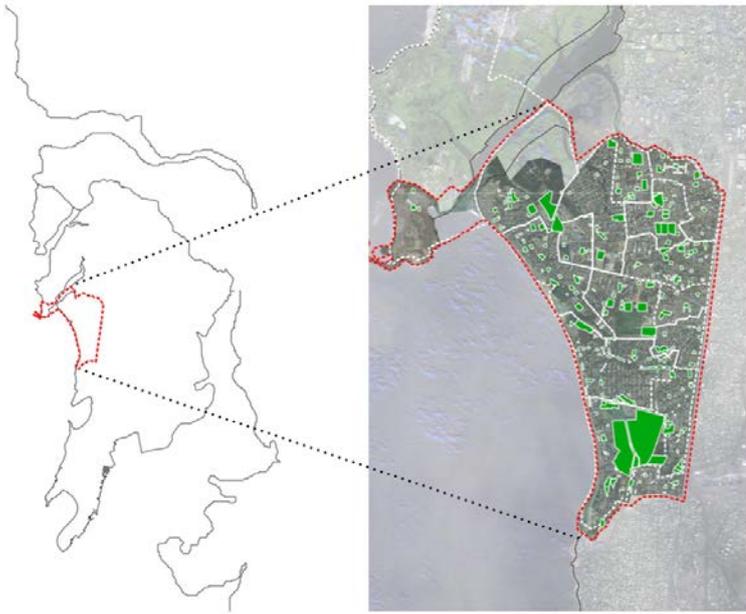


Figure 3: Map showing the location of designated open spaces in the ward.

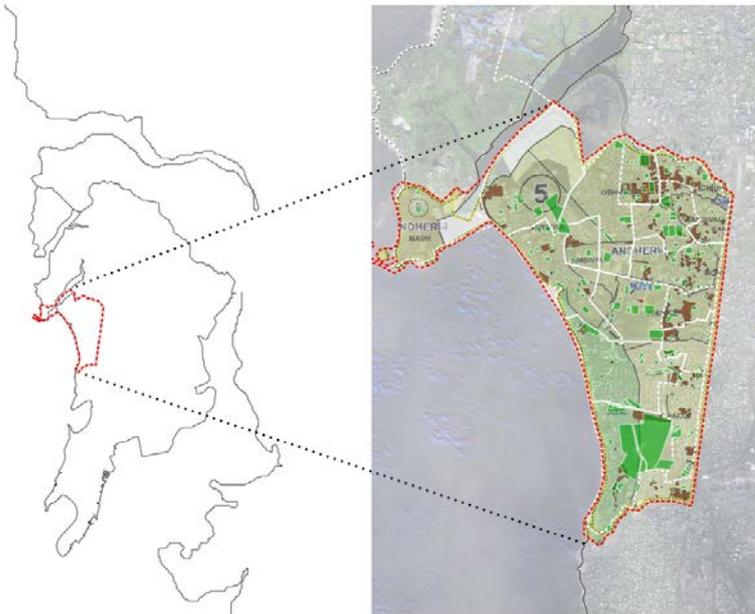
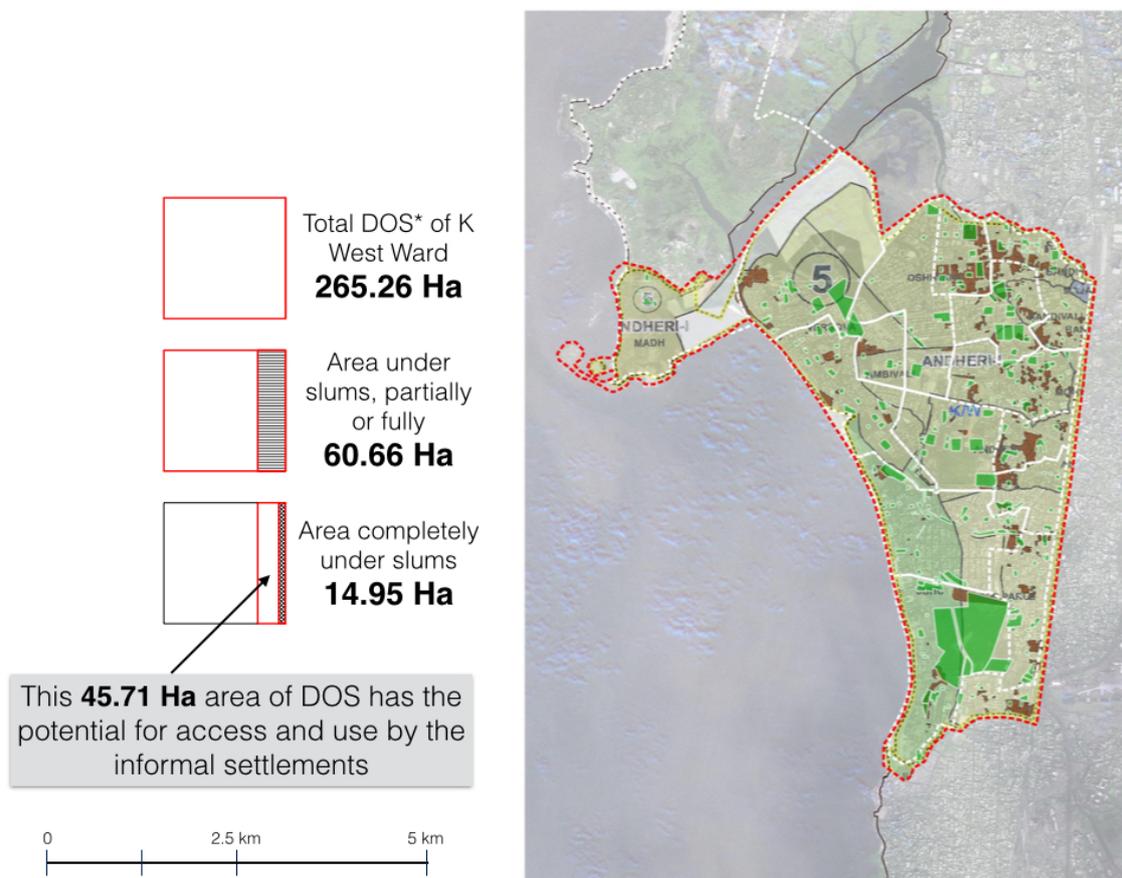


Figure 4: Map showing the designated open spaces which were marked on existing informal settlements or slums.



**Figure 5: Map and diagrams showing the designated open space which has the potential of being accessible to informal settlements.**

**Table 4: Existing data structure of MMREIS data on open spaces carried out by Adarkar Associates and remarks on each with respect to their relevance and design of questionnaire for interviewing informal settlers.**

No.	PARAMETERS	SUB-PARAMETERS	ATTRIBUTES	REMARKS
1	<b>Scale</b>		Small Medium Large	This parameter largely indicates the size of the open space in terms of land area. This parameter can only be useful to understand whether the open space serves a neighborhood or is a large city-level open space, hence not specifically significant for this study.
2	<b>Classification &amp; Status</b>	DP Classification	RG PG G Other	These parameters are only useful if one needs to know the history of their designated use. Since the development plan of Mumbai is under revision, the first two sub-parameters will need a revision. The third sub-parameter can be useful for the present study as the percentage of built area
		DP Condition	Existing Proposed	
		% Built-up	10%, 20%, etc	

		Existing Condition	Open Semi-occupied  Occupied	would indirectly indicate the level of accessibility, though not specifically to informal settlements. This has to be read in conjunction with other relevant parameter.
3	<b>Usage</b>	Stadium Garden Club Playground Parking Hawking Public Utilities Defecation Garbage Slums Land not in use Construction on site	Yes / No Yes / No	This parameter is significant to the present study as it directly contains sub-parameters which are related to informality, such as hawking, defecation, garbage and slums. It has to be noted that a large number of designated open spaces have been marked on informal settlements, and an analysis using GIS would help the present study to quantify the disparity.
4	<b>Occasional Use</b>	Recreational Religious Sports Political	Yes / No Yes / No Yes / No Yes / No	This parameter may not be significant for the present study, however if a sub-parameter of 'livelihood' is added, then it might prove useful to the present study as it will indicate the level of accessibility by the informal settlements.
5	<b>Ownership</b>	Owner         Maintained by	MCGM MHADA Defence MMRDA BPT Private  Owner Current User Any Other None	Ownership is very crucial to this study as a government owned and maintained land has the potential to be released for the informal settlers. This sub-parameter combined with the sub-parameter indicating % built-up will be useful in gauging the accessibility.
6	<b>Maintenance</b>	Extent of Maintenance      Staff Employed	Good Fair Poor None  Security Guard Gardener Both None	This parameter is significant for the present study to know whether there is a mechanism in place to exclude a certain class from accessing the designated open space, in this case the informal settlers.
7	<b>Predominant User</b>	Age Group	Children Youth Adults Senior Citizens	The sub-parameters of socio-economic group would be specifically important for the present study which will indicate the degree of accessibility to the 'poor'. The time of access will also indirectly indicate whether the open space remains shut for

		All	access for a major part of the day, limiting access to informal settlers, as the morning walkers and joggers usually belong to the upper class.	
	No of People Daily	Upto 200 200 to 500 Above 500		
	Socio-economic Group	Poor Middle Class Rich All		
	Gender	Male Female Both		
	Catchment Area	Upto 2 km 2 to 5 km Above 5 km		
	Time of the day used	Morning Afternoon Evening Morning & Evening Whole Day		
8	<b>Infrastructure &amp; Facilities</b>	Water Supply Drainage Lights Toilets Garbage Bins Jogging Track Play Equipment Sitting Area Nursery Caretaker's Room	Good / Fair / Poor / None Good / Fair / Poor / None Yes / No Yes / No Yes / No Yes / No Yes / No	These parameters are not very significant to the present study as there are other indicators included earlier through which this information can be derived.
9	<b>Accessibility</b>	Knowledge about site Visibility Edge Condition Entry to site	Known Not Know Visible from 50m Not visible Defined Not Defined Free Fee charged Restricted Inaccessible	This is an extremely relevant parameters to the present study and all the sub-parameters will be used in the next section for assigning grades and thereby understand the degree of accessibility.
10	<b>Surrounding Land Use</b>	Predominant Land Use	Residential	

		Commercial Industrial Religious Institutional Slums Mixed	The first sub-parameter is useful for the present study in understanding whether an informal settlement is abutting the open space. This will be used as an indicator to indirectly derive the spill over of their livelihood activities.	
	Population Density	Low Fair High	The other sub-parameters are not so significant, however will be included for grading to understand accessibility.	
	Flooding	Yes / No		
	Landslides	Yes / No		
	Defecation	Yes / No		
	Garbage dumping	Yes / No		
	Sewage disposal	Yes / No		
	Debris dumping	Yes / No		
	No of OS in 1km Radius	0 / 1 / 2 / 3.....		
	Predominant OS in vicinity	RG / PG / ...		
11	<b>Threats</b>	Private Appropriation On-going Construction Acquired for Infrastructure  Unwanted Activities	Yes / No Yes / No Yes / No  Yes / No	'Threat' to the open space is largely constructed by the MMR-EIS report from the perspective of a conventional use of public open space by the affluent class. However this will be taken as a parameter for grading accessibility, as a less significant parameter.
12	<b>Environment</b>	Vegetation Type  Low Lying Salt Pans / Mangroves Rocky / Steep Slopes / Hill	Dense Fair Sparse Barren Open Scrub  Yes / No Yes / No Yes / No	This is an extremely relevant parameter and all its sub-parameters will be included for grading in combination with other sub-parameters to understand the level of accessibility.

## 6 Bibliography

- Zhang, X, Lu, H & Holt, JB 2011, 'Modeling spatial accessibility to parks: a national study', *International Journal of Health Geographics*, vol 10, no. 31, pp. 1-14.
- Wilcox, S, Castro, C, King, AC, Housemann, R & Brownson, RC 2000, 'Determinants of leisure time physical activity in rural compared with urban older and ethnically diverse women in the United States', *Epidemiol Community Health*, Columbia.
- Witten, K, Hiscock, R, Pearce, J & Blakely, T 2008, 'Neighbourhood access to open spaces and the physical activity of residents: A national study', *Preventive Medicine*, vol 47, pp. 299-303.
- Adarkar Associates 2012, 'Inventorization of Open Spaces and Water Bodies in Greater Mumbai for MMR-EIS', Mumbai Metropolitan Region Environment Improvement Society, Mumbai.
- Arnstein, SR 1969, 'A ladder of citizen participation', *JAIP*, vol 35, no. 4, pp. 216-224.
- Banerjee, T 2001, 'The Future of Public Space: Beyond Invented Streets and Reinvented Places', *Journal of American Planning Association*, vol 61, no. 1, pp. 9-24.
- Bild, E, Coler, M, Pfeffer, K & Bertolini, L 2016, 'Considering Sound in Planning and Designing Public Spaces: A Review of Theory and Applications and a Proposed Framework for Integrating Research and Practice', *Journal of Planning Literature*, vol 31, no. 4, pp. 419-434.
- Charleux, L 2015, 'A GIS Toolbox for Measuring and Mapping Person-Based Space-Time Accessibility', *Transactions in GIS*, pp. 262-178.
- Day, K 1999, 'Introducing Gender to the Critique of Privatized Public Space', *Journal of Urban Design*, vol 4, no. 2, pp. 155-178.
- Lincoln, YS, Lynham, SA & Guba, EG 2011, 'Paradigmatic Controversies, Contradictions and Emerging Confluences, Revisited', in NK Denzin, YS Loncoln (eds.), *The SAGE Handbook of Qualitative Research*, SAGE Publication, Los Angeles, London, Delhi, Singapore, Washington DC.
- Lim, WSW 2017, *Public Space in Urban Asia*, World Scientific Publishing Co. Pte. Ltd. & EBSCO Publishing, Singapore.
- L, A, Rung, B, Mowen, AJ & Cohen, DA 2005, 'The Significance of Parks to Physical Activity and Public Health: A Conceptual Model', *American Journal of Preventive Medicine*, vol 28, no. 2S2, pp. 159-168.
- Nemeth, J 2006, 'Conflict, Exclusion, Relocation: Skateboarding and Public Space', *Journal of Urban Design*, vol 11, no. 3, pp. 297-318.
- Nemeth, J & Schmidt, S 2007, 'Towards a Methodology for Measuring the Security of Publicly Accessible Spaces', *Americal Planning Association*, vol 73, no. 3, pp. 283-297.
- Nicholls, S 2001, 'Measuring the accessibility and equity of public parks: a case study using GIS', *Managing Leisure*, vol 6, pp. 201-219.
- Macintyre, S, Macdonald, L & Ellaway, A 2008, 'Do poorer people have poorer access to local resources and facilities? The distribution of local resources by area distribution in Glasgow, Scotland. ', *Social Science & Medicine*, vol 67, pp. 900-914.
- Marcuse, P 2002, 'Urban Form and Globalization after September 11th: The View from New York', *International Journal of Urban & Regional Research*, vol 26, no. 3, pp. 596-602.
- McCann, EJ 1999, 'Race, Protest and Public Space: Contextualizing Lefebvre in the US City', *Antipode*, vol 31, no. 2, pp. 163-184.
- Mitchell, R & Popham, F 2007, 'Green space, urbanity & health: Relationships in England', *J Epidemiol Community Health*, vol 61, pp. 681-683.
- Mitchell, D & Staeheli, LA 2005, 'Permitting Protest: Parsing the Fine Geography of Dissent in America', *International Journal of Urban and Regional Research*, vol 29, no. 4, pp. 796-813.

- MoUD, GOI 2014, 'Urban and Regional Development Plans Formulation and Implementation Guidelines', Government of India, New Delhi.
- Pachenkov, O 2013, *Urban Public Space: Facing the Challenges of Mobility and Aestheticization*, EBSCO Publishing, Frankfurt.
- Pain, R 2001, 'Gender, Race, Age and Fear in the City', *Urban Studies*, vol 5, no. 6, pp. 899-913.
- Pan, L 2015, *Aestheticizing Public Space: Street visual politics in east asian cities*, Intellect, Bristol, UK.
- Parks, SE, Housemann, RA & Brownson, RC 2003, 'Differential correlates of physical activity in urban and rural adults of various socioeconomic backgrounds in the United States', *J Epidemiol Community Health*, vol 57, pp. 29-35.
- Pocewicz, A, Nielsen-Pincus, M, Brown, G & Schnitzer, R 2012, 'An Evaluation of Internet Versus Paper-based Methods for Public Participation Geographic Information Systems (PPGIS)', *Transactions in GIS*, vol 16, no. 1, pp. 39-53.
- Richard Mitchell, FP 2007, 'Evidence Based Public Health Policy and Practice - Greenspace Urbanity and Health: relationships in England', University of Edinburgh Medical School, Edinburgh.
- Thompson, CW, Roe, J, Aspinall, P, Mitchell, R, Clow, A & Miller, D 2012, 'More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns', *Landscape and Urban Planning*, vol 105, pp. 221-229.

### **Author Bio**

Abhijit Ekbote graduated as an architect in 1999 from CEPT University, after which he was engaged in private practice in Mumbai (Bombay). His early works were slum redevelopment in developer-driven as well as the NGO-driven modes, affordable housing for a cooperative, a dormitory for nuns, etc. He later worked for a heritage conservation architect and was exposed to the challenges of protecting and conserving the built heritage by working on some of the iconic historic structures of Mumbai. He was part of the conservation team for Chandramauleshwar Temple in Hampi which won the UNESCO Asia Pacific Heritage Conservation Award of Merit, 2012.

After completing his post-graduation in Urban Design, he worked on several projects at an urban scale through the KRVI Design Cell, during his engagement with KRVI as an assistant professor. He developed the Geographical Information Systems (GIS) course at KRVI which was streamlined for architect graduates who were pursuing their post-graduation in Urban Design and Urban Conservation. Later he pursued a research project under the Erasmus Plus funded programme, BINUCOM and built the GIS course around it.

Subsequently, during his association with the Aga Khan Agency for Habitat India (AKAHI), he worked on Hazard Vulnerability Risk Assessment (HVRA) of certain settlements which were at natural and man-made risks, based on the method outlined by the World Risk Report. His other works with AKAHI were multi-generational housing at Nairobi, Kenya and housing need assessment for the displaced communities in Salamieh, Syria.

Abhijit Ekbote is currently teaching as a visiting professor and working as the Secretary of MMR-EIS

and MMR-HCS, which are societies formed by the MMRDA for funding initiatives towards the protection of environment and heritage in MMR.