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A Planning Proposal for Improving Urban Green Space in West Zone of Surat City

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Abstract - *Urban green space is a component of "green infrastructure". It is an important part of public open spaces and common services provided by a city and can serve as a health-promoting setting for all members of the urban community. The basic problem faced by today's urban agglomerates is the lack of green spaces. In the era of urbanization, the word "green open space" is often forgotten. It is therefore necessary to ensure that public green spaces are easily accessible for all population groups and distributed equitably within the city. This study mainly focuses on the assessment of urban green space in west zone of Surat city in Gujarat and giving possible alternatives to meet the demand for green spaces in the study area. A research is carried out to analyze the urban green space with a GIS TOOL and further suggestive planning proposal is given. The result of the study will provide a betterment in people's quality of life and planning urban green space in west zone of Surat city.*

Key Words: **Urban green space, urbanization, surat city, open space.**

1. INTRODUCTION

The most explosive urban growth is expected in some of the Asian region, particularly, in Gujarat where about half of the State population may live in the cities and towns in the next decade. As bulk of human population shifts from rural to urban areas, paucity of the green space is becoming an increasingly urban phenomenon. Urban areas in the developing countries have multi-faceted problems like paucity of safe water, inadequate waste management, pollution, occupation and degradation of sensitive lands, flooding, poor oxygen level, poor tree cover and inadequate green cover. The urbanization has variety of impacts: conversion of agricultural or tree cover lands for urban uses and infrastructure, pollution or reclaiming of wetlands, increasing impervious cover on earth surface, and excavation of sand and loss of trees. To improve health of urban environment, campaign for improving tree cover is unavoidable in the cities and towns. Gujarat has already taken lead in the environmental front and greening urban areas is one of such initiative. Tree plantation in campaign mode has been taken up in several cities like Ahmedabad, Surat and Vadodara but its success has been debated. Thus, it is necessary to take up certain necessary measures like proper planning, plantation of tall seedlings of suitable species, adequate caring and protection measures to achieve higher success rate. Also, there was a need to generate adequate information about the status of trees in the urban areas of Gujarat.

1.1 Problem Definition

The ever-rising rate of Urbanization in Surat City has left behind the Carbon foot-prints with negative impacts like: lack of Green spaces, reduction of forest and agricultural lands, decrease in water bodies, increase in impervious surfaces which further makes the city vulnerable to disasters such as urban floods, pollution, excavating building materials in bulky quantity and deforestation arising a large need of Green Spaces in the city to balance the environment.

1.2 Aim of Study

The basic aim of this study is to provide adequate urban green spaces in the **West zone of surat city** to meet the desired level of sustainability in the lifestyle of the citizens.

1.3 Objectives Of Study

The **objectives** of urban **green space**s are, therefore:

- To safeguard the future of **green spaces in west zone of surat city.**
- To improve the quality of **urban areas** of surat and especially the neighborhoods.
- To make West Zone-Surat more attractive and thereby attract more resources and to enhance the well-being of local people and tourists in surat.

2. Concept of Urban Green Space

Urbanization results in an increasing proportion of the population living in cities. In Europe it is expected that around three quarters of the population will live in urban settings by 2020. Urban living limits access to nature and can increase exposure to certain environmental hazards, such as air and noise pollution. Many urban areas face increasing pressure from expanding populations, limited resources and growing impacts of climate change. These challenges must be addressed in order for cities to provide healthy and sustainable living environments.

Green spaces and other nature-based solutions offer innovative approaches to increase the quality of urban

settings, enhance local resilience and promote sustainable lifestyles, improving both the health and the well-being of urban residents.

3. Study Area Profile

3.1 History and Location

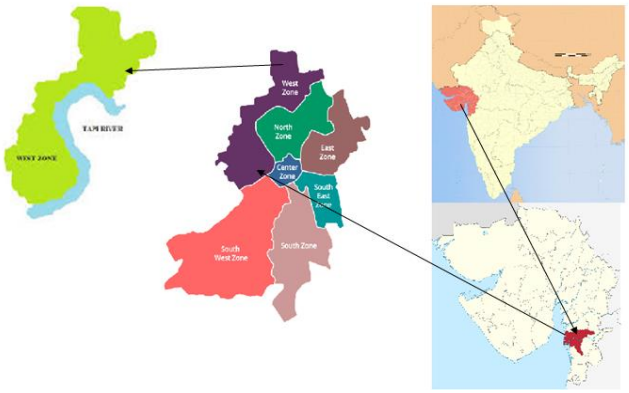
The study area has been the planning region which includes the City of Surat and surroundings. Surat - an important industrial hub and commercial center of the country today boasts of a great historical and cultural heritage. The city of Surat has glorious history that dates back to 300 BC. Surat has a very diverse historical background and because of its textile industries it is known as 'The Silk City'. In recent time Surat has attained the title as one of the cleanest cities presently in India. One of the major factors responsible for rapid growth rates in Surat is immigration from different parts of India, Surat is a port city near Tapi river.

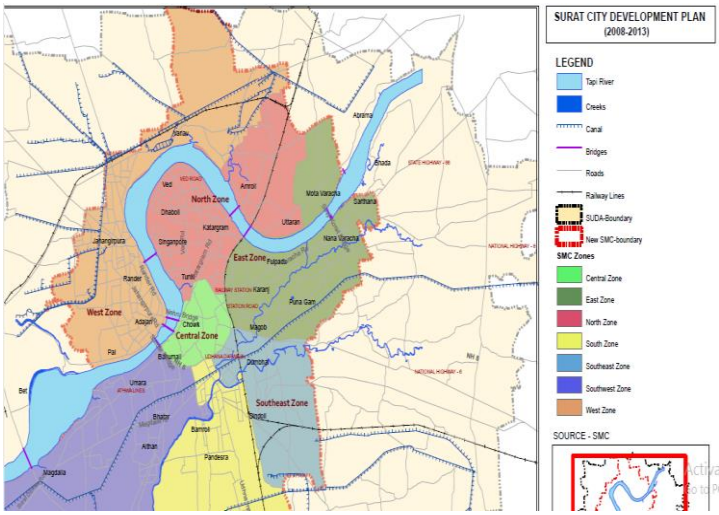
The planning area is located at 21°4'N 72°42'E. There are total five talukas, namely, Olpad, Chorasi, Kamrej, Palsana and SMC area. Presently there are total of 95 villages (17, 44, 17, 17 in Olpad, Chorasi, Kamrej and Palsana respectively) in all five talukas. Atotal of 220 wards are present in Surat. It has an average elevation of 13 meters. Due to location of Surat near to the sea, it experiences high tides mainly in the western parts, and average height of tides ranges from five to six meters. In monsoon season flooding becomes a common phenomenon due to occurrence of flash floods.

West Zone also known as Rander Zone of the Surat city is enclosed by the River Tapti as shown in Fig.5. West Zone of the city is one of the oldest and adjoin to the walled city area. West Zone is found to be low lying area in the City and is very prone to Flood effect. During the Flood in 2006, West Zone is identified as one of the critical area of concern.

Out of total seven zones of the city West zone have a total five wards uptil the year 2006 which includes Rander (14-26), Adajan (27) ,Jahangirabad (63), Jahangirpura (64), Pisad (65). Out of these wards the Rander zone area is successfully implemented by many Town Planning Schemes.

As per the extended area notifications three wards were included in this zone viz. Pal (67), Palanpor (68) Vaiyav (69).





3.2 Demographic Profile

Surat is a tremendous growing city with a speedy growth rate of 50% in one decade. Following Table demonstrates the growth rate of Surat City in past few decades:

Year	Population	Growth Rate (%)
1981	9,99,373	-
1991	16,24,135	62.52
2001	28,68,603	76.62
2011	44,67,797	55.75

West zone is sub –divided into 8 wards which are as follows:

1. Rander
2. Adajan
3. Jahangirabad
4. Jahangirpura
5. Pal
6. Palanpor
7. Variyav
8. Pisad

Future population Forecasting is carried out for each zone for the next 3 decades by adopting Arithmetic Increase method and Incremental Increase method.

Sr. No	Ward	Forecasted Population (Average)		
		2021	2031	2041
1	Rander	1,43,218	1,72,846	2,03,518
2	Adajan	2,41,666	3,63,883	2,63,621
3	Jahangirabad	46,338	71,146	1,02,237
4	Jahangirpura	3,210	4,731	6,728
5	Pal	61,049	95,109	1,37,787
6	Palanpor	35,532	48,667	62,919
7	Variav	25,453	31,287	20,779
8	Pisad	4,863	9,068.5	12,174
Total		5,61,329	7,96,738	8,09,763

3.3 Study Area Justification

West zone is one of the dense zone in the city where lots of infrastructure is seen. According to the demographics discussed earlier in this section, it is clearly understood that there are inadequate green spaces in west zone against the infrastructure provided. Population Forecasting concludes that, as the population will increase in upcoming years, the scarcity of open spaces will be a major issue.

4. Data Collection and Analysis

4.1 Status of tree cover in Municipal Corporation Areas

Tree counting data reveal that Gandhinagar is the greenest city in the terms of tree density as well as the area under tree cover. Over all, Gandhinagar, Bhavnagar and Vadodara may be called as green cities having tree densities higher than the average density in the eight municipal corporations. Other municipal corporations- Surat, Ahmedabad, Rajkot, Junagadh and Jamnagar have tree densities below the average.

Mahanagar Palika	Human population	Geographical area in ha	Number of trees above 10 cm GBH	Tree density per hectare	Tree cover % of geographical area
1. Ahmedabad	5,570,590	46,985	618,048	13.2	4.66
2. Surat	4,462,000	39,549	333,990	8.4	3.00
3. Vadodara	1,666,700	16,264	747,193	45.9	16.29
4. Gandhinagar	208,300	5,700	866,672	152.0	53.9
5. Rajkot	1,287,000	10,400	137,522	13.2	4.69
6. Bhavnagar + Victoria Park	593,770	5,320	475,953	89.46	21.35
7. Junagadh	320,250	5,670	76,694	13.5	4.80
8. Jamnagar	529,310	3,434	45,877	13.4	4.74
Total	14,637,920	133,322	3,301,949	24.8	9.65

4.2 Trees in Surat City

Surat is the second largest city in Gujarat in term of human population and the area. The human population density is very high within city. On other hand, the tree cover is poor. Surat has lowest tree density amongst the eight municipal corporations. Also, number of trees per hundred persons is also lowest. The industrial area of Surat near Hazira support good plantation. The basic facts about Surat city are as follows. Unlike other Mahanagar Palikas, tree composition in Surat is different. Number of Neem trees is very low due to high rains. No specific species of tree has high population in Surat.

Human population: 44.62 lakhs
Area of city: 39,550 ha
Number of trees: 333,970
(above 10 cm GBH)
Tree density 8.4 tees/ha
Tree cover 1,184 ha (3.0% of geographical area)
Trees per 100 person 7.5 trees/100 persons

A total of 83 tree species have been listed during counting of trees and dominant species among them. Surat has good rainfall but city and its peripheral villages have poor tree cover due to the nature of agricultural crops practiced. The tree cover can be improved to some extent in the Surat Municipal Corporation (SMC) area but may not be possible to increase to a desired level due to non- availability of the space. Thus, the gap may be filled up by taking up massive tree plantation and horticulture programmes in the area of Surat Urban Development Authority. SMC and SUDA may join hand to increase the tree population from about 7.99 lakh to about 20.6 lakh. Thus, intensive tree plantation drive and horticulture development programmes should be taken in 94 villages under SUDA. The area around lakes/ ponds in and around SMC should be planted to improve recreational value.

Forest Department successfully raised trees in the campus of National Institute of Technology, Surat over a period. In 2011, Forest Department planted more than 50,000 seedlings at about one and half dozen sites on the occasion of the Republic Day. Major part of this plantation was in SUDA. A block of plantation was also raised in the campus of Surat University. The results of these plantations are very good. A large plantation was also done during the Van Mahotsav in 2010 as a part of green Surat Campaign. In this campaign, over 2.72 lakh seedlings were planted in and around the city and 1.80 seeds were planted in the intertidal zone at the mouth of Tapi River. The industrial areas in Hazira have been planted to raise environmental plantation. As a result, most of the industries have good tree cover, although these areas fall outside the SMC. The coastal forest near Hazira and mangroves at mouth of Tapi River add to ecological value of the city. Within Surat city, there are two very old and large trees of Rukhada which were saved by the local people when authority planned to remove them to widen L. P. Sawani Road. Girth at Breath Height of these trees were 10.4 m and 9.3 m, respectively.

5. Planning Proposal & Recommendations

According to the scope of the work, suitable planning proposal and recommendations for improving green space in West Zone of Surat City is provided.

5.1 Planning Proposal

5.1.1 Green Roofs on Government Buildings

The existing Government buildings located in West Zone of Surat city which are likely to be used for green roofs are listed as below:

Sr. No.	Name of Infrastructure	Quantity
1	Reading Rooms	12
2	Auditorium	2
3	Civic Centre	2
4	Health centre	3
5	Community halls	8

There are two types of green roof systems - extensive and intensive. Extensive green roofs are identified by theirlittle weight, less capital cost and low down maintenance. Intensive green roofs are characterized by their enlarged weight and high capital cost, rigorous planting and more maintenance requirements. Extensive and intensive green roofs are either reachable or unreachable.

For extensive roofs, the growing medium, usually made up of a mineral-based mix of sand, gravel, crushed brick, peat, organic matter and some soil, varies in depth between 5-15 cm - a weight increase of 72.6-169.4 kg per m^2. Due to the inconsequentiality of the soil and the extreme microclimate on many roofs, plants must be low and tough, typically native. Plants should be watered and fertilized only until they are reputable and after the first year, maintenance consists of few visits a year for weedingof insidious tree and shrub species, and safety and inspections.

For Intensive green roofs, the growing medium is soil-based, ranging in depth from 20-60 cm, with a weight increase of 290-967.7 kg per m^2. Due to bigger soil depth the plant selection is more variouswith trees and shrubs, which allow a more intricate ecosystem to widen. Maintenance and watering are more challenging and ongoing than extensive green roof.Structural and landscaping consultations with an experienced installer are required. Depending on substrate depth, about 105-155mm thicksubstrate, has weight around 85-135kg persquare meter. Slopes over 10 degrees extra is required.

Material	Depth	Saturated Weight
Vegetation layer	25mm	25kg/m^2 fully saturated
Extensive green roof substrate	75mm	75kg/m^2 fully saturated
Roofdrain drainage layer	30mm	10kg/m^2 fully saturated
TOTAL	130mm deep	110kg/m^2 loading

5.1.2 Rain Gardens

A rain-garden is plotted landscaping that allow rainwater runoff from impervious urban areas, like roofs,driveways, walkways, parking lots, to get captivated. This reduces rain runoff by allowing storm water to permeate into the ground. They should be designed for specific soilsand climates. The purpose of a rain garden is to improve water quality in nearby bodies of stream. Rain gardens can reduce on the amount of pollution reaching creeks and streams by up to 30%.

Native and adapted plants are recommended for rain gardens because they are more tolerant of one's local climate, soil, and water conditions; have deep and variable root systems for enhanced water infiltration and drought tolerance; habitat value and diversity for local ecological communities; and overall sustainability once established.

The plants — a selection of wetland edge vegetation, suchas wildflowers, sedges, rushes, ferns, shrubs andsmall trees — take up excess water flowing into the rain garden.. The whole roof garden can become a rain garden, and each component of the whole can become a small- scale rain garden in itself.

Rain garden helps in utilizing the biological, physical, and chemical processes found in the plants and soil to naturally remove pollutants from the rainwater so they do not enter the storm drainage system.

5.2 Cost Benefit Analysis

A 500 sq ft terrace garden can be set up with an initial investment of Rs 10,000- 15,000. This includes the cost of fertilizers which can be alternated with homemade compost. Within this space, one can grow a dozen vegetables, about five different flowers and the same number of medicinal plants. (source: www.thebetterindia.com)

Indian standards:

Initial costs: 120% greater than conventional (including upgrade of steel structure)

Soil and plant costs

•SAVINGS: Annual energy savings (Rs.8/sf)

•Annual operations costs: replacement costs (1 time), amortized over 99 years.

Deduct for reduced maintenance costs of HVAC (Heating, Ventilation, and Air Conditioning) systemPost-construction (actual costs): Simple Payback: 5 years

6. CONCLUSION

The world is learning more about climate change every day, which has led to green spaces being featured more prominently in urban planning. While urban greening might have once meant nothing more than parks and tree-lined streets, it now includes a wide variety of beautiful and creative installations. Projects like living walls and green roofs are becoming increasingly popular and are featured in more businesses, public buildings and residential areas. The aims of urban greening are numerous, but effective; they improve the lives of the people and wildlife in the area, as well as making our cities eco-friendlier and pleasing to the eye. Climate change isn't just about rising sea levels; we can see the effects of excessive pollution in urban areas, the smog of Beijing being an extreme example. Cities all around the world are using urban greening to protect and improve their skylines and their health.

The main aim of the proposed work is to provide techniques which can help improve the urban green space in the study area by adopting green roofs on the government infrastructure and rain gardens at appropriate locations. A detailed analysis is done in which suitable green roofs and rain gardens are provided based on geographical conditions. Designs and criteria's are given, through which green roofs and rain gardens can be built. Further, aspects and prospects of both categories are discussed for detailed investigation followed by Cost-Benefit Analysis. The ultimatum of Cost-benefit Analysis is quite effective as it saves annual energy up to 8 Rs. per Sq. Ft. with reduced maintenance costs including 5 years payback period.

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