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Canal Greenway Network as a Sustainable and Conservative Urban Planning Development Strategy for Surat City

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***ABSTRACT**: Open green spaces are a combination of urban systems providing ecological, aesthetic, economic, and recreational benefits. Due to new technologies, rapid increases of population, industrialization, and irregular urbanization, open and green spaces in urban areas are decreasing and existing green spaces are under threat. Open green space play significant roles for city residents, urban climate, and urban ecosystems. Paper suggests that Urban Greenway is a development strategy which can be used as a multifunctional linear landscapes that provide a range of socio-ecological benefits. Paper suggests that greenway can be developed as a Sustainable and conservative development approach. For urban Greenway it can be developed along the Canal route of Surat city. Surat city has the immense opportunity to develop the Greenway along the Canal route. Paper shows the different components to be developed along the canal as a greenway route. The Greenway helps in development of social and physical aspects of the population. Also green plantation helps in ecological aspects of society*. Ultimately, greenways provide a variety of benefits that ultimately affect the sustainability of a region's economic, environmental, and social health.

KEYWORDS: **Canal; Greenway Network; Sustainable; Conservation; Green Infrastructure**

1. Introduction

Urbanization is productive such that concentrated distribution of resources can serve an enormous number of population, however this concentration creates numerous issues. For serving a huge urban population, more land is required for housing, infrastructure and office spaces. Development on those lands, often regularly result at the expense of existing greenery. More population likewise implies more vehicles for transport, therefore more pollution. Reduced greenery implies reduced ability to absorb harmful gases. In this manner, adverse effects of contamination are most certainly not relieved appropriately.

Because of extraordinary urbanization, the gap between city occupants and nature is expanding. The concretization of urban communities and towns has unfavorably affected the natural environment. The space to be used for open green has restricted as the urban areas and towns experience development. Urban greenery is one of the approaches to overcome this issue among individuals and nature. High population density is additionally another purpose behind poor development of urban greenery.

Urban green space is a huge piece of practical turn of events. Improvement of urban green spaces needs to consider interdisciplinary and integrative methodologies, for example, economic, political, social, cultural, management and planning angles to improve existing urban green spaces' facilities and services, and to optimize urban green space approaches. The meaning of urban green spaces which is conceded by ecologists, economists, social scientists and planners is open and private open spaces in urban regions, primarily secured by vegetation, which are which are directly or indirectly accessible for the clients. Open spaces serve a significant need in the relationship of man and the nature. If arranged appropriately, they help in keeping up

ecological balance. Urban Green Space Interventions can be characterized as activities that significantly alter the quality, quantity and accessibility of urban green space. This can be done by establishing new urban green spaces or by changing the characteristics and functions of existing ones.

2. Surat City Scenario of Urban Green Space

Figure 1 here shows the URDPFI Guidelines, 2014 the percentage for Garden & Recreational land use in development area of should be around 14 to 16 % for large and metro cities. As of the Urban Green Space should be around in this range for Surat City.

The Table 1 here shows the Existing and Proposed Land use data for the Surat city. As table shows the Existing Land use for the Surat city is the 2.34 sq. km., which is very less as compared to development need of city.

As the Land use data shown above there is an excessive need of Garden & Recreational area. Greenway can be provided to develop for improving quality of life of people and urban ecology which ultimately increase the Land use of City area.

S.No.	Land use Category*	Percentage of Developed Area			
		Small	Medium	Large Cities	Metropolitan Cities & Megapolis
1	Residential	45-50	43-48	36-39	36-38
2	Commercial	2-3	4-6	5-6	5-6
3	Industrial	8-10	7-9	7-8	7-8
4	Pub. & Semi Public	6-8	6-8	10-12	10-12
5	Recreational	12-14	12-14	14-16	14-16
6	Transport & Communication	10-12	10-12	12-14	12-14
7	Agriculture, Water bodies and Special areas	Balance	Balance	Balance	Balance
8	**Total Developed Area**	**100**	**100**	**100**	**100**

Figure 1 Land use Structure for Developable Area in Urban Centers

Source: URDPFI Guidelines, 2014

Land- Use	Proposed as per DP- 2004		Existing Area (sq.km.) - 2014
	Area (sq.km.)	% of Urbanized Land	
Residential	204	55	102.49
Commercial	7.65	2	4.66
Industrial	43.94	12	38.89
Educational & Public Purpose	64.21	17	13.6
Garden & Recreational	**12.36**	**3**	**2.34**
Road, Transport and Communication	40.73	12	35.31
Urbanized Area	372.89		197.29
Non Urbanized Area	342.11		517.71
Total	715	100	715

Table 1 Proposed Land use in DP-2004 and Existing Land use in 2014

3. Canal Greenway Network for Surat City

Greenways are linear open spaces such as canals and scenic roads that are set along the riversides, hillsides or valleys, converted to a recreational use along the railways (Little, 1995).

A greenway is a network system of areas with linear elements that is intended for various purposes including ecology, recreation, culture, aesthetics, and other purposes. Greenways are road networks planned, designed, and managed for multiple purposes such as ecological, recreational, cultural, aesthetic, and sustainable (Kurdoğlu & Kurt, 2016).

Greenway ordinarily made a piece of the redevelopment and invalidated zone. Greenway is vegetation multipurpose, linear that includes many terms such as Bikeway, footpath, bicycle way, walkways etc. A significant part of accomplishing climate change reduction goals at the urban level is to empower quality, walkable
environments connected by travel. And as discussed above the walkability is an integral element of Greenway.

(a) Canal Network in Surat City

The below figure 2 shows the index map of the Ukai canal flowing from the Surat District. This figure shows the canal flow from the Ukai to Songadh to Surat city. The overall length of the Ukai dam to Canal is around the 73 km long which runs through parts of Surat city.

(b) Components of Canal Greenway Network

The Figure 4 here shows the Cross section for the development of Greenway along the Canal. This all shows the different components to be provide for development. The different component for development consist of the walkway, cycle track, tree plantation, gardening, fish stream and etc.

For tree plantation Neem Tree can be the best option for this. The tree has many advantages for the plantation along the road as it has enormous capacity to absorb the CO2 which ultimately reduce the air pollution.

The below Figure 3 shows the index map of canal of Surat city. The one canal 12.7 km and another one is 25.5 km long. This gives total 38.2 km log route of the canal in the vicinity of Surat City. This is the main canal flowing in the vicinity of Surat city.

There is an immense opportunity to develop this overall length as greenway for sustainable and environmental friendly development. If the greenway is developed all along this canal route it can produce **5,73,00 m²** of the area as a green cover and recreational opportunity.

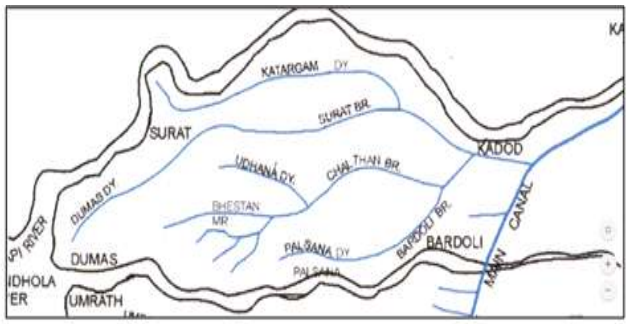

Figure 1 Index Map of Surat Branch Canal

Figure 2 Index Map of Surat Branch Canal

Figure 3 Map of Surat City Canal

The Figure 5 shows different components to be developed along the Greenway for the recreational purpose. This activities and components can attract the population to use the Greenway.

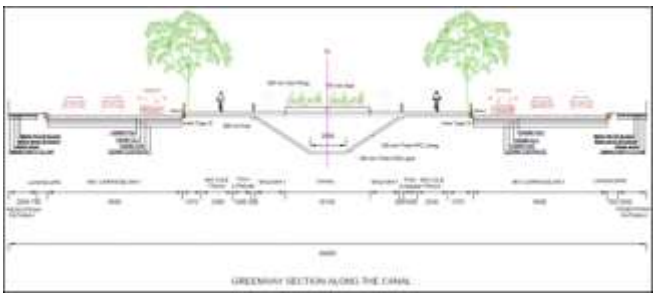

Figure 4 Cross Section of the Greenway

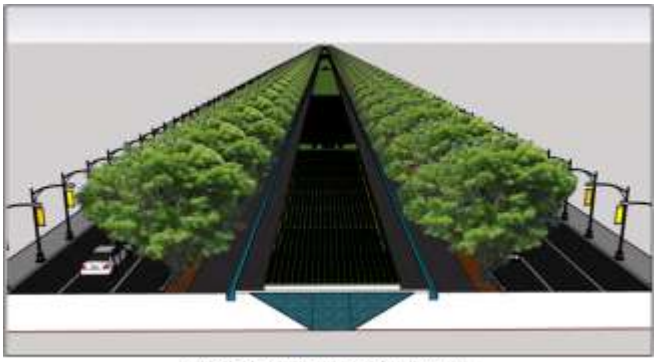

Figure 5 3D Cross Section of the Greenway

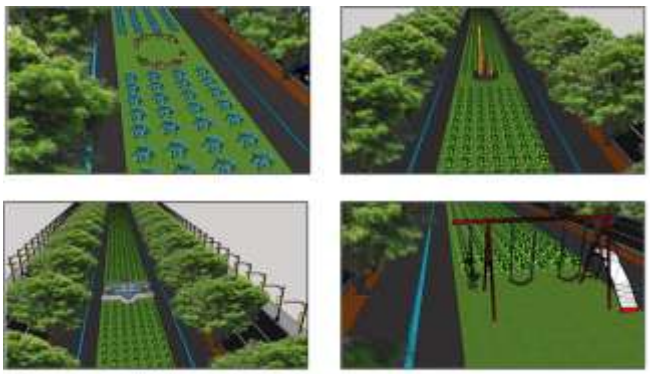

Figure 6 Different Components of Canal Greenway

For this instant different component are Sitting corner for old people, walkway, cycle track, children playing area, sculpture for attraction, fountain and etc. along the Canal for development of greenway.

4. Benefits of the Canal Greenway

There are numerous advantages of greenway planning. These advantages are to minimize the impacts of urbanization and shape the urban structure, and to improve life quality, public accessibility, and connectivity.

(a) Enhance open public places and recreation space

The overall area is developed along the Canal over the top of it. This showed that especially no extra space is required for the creation of the Greenway. This will increase the public space and recreation space in the future.

(b) Increase the overall green coverage of urban area

The tree line is developed along the Canal on the both sides of the road which will provide shades to the user of greenway and overall green coverage of the specified urban area. Also there is provision of flower bed along the canal which also improve the green coverage up to some extent. Approximately it will increase the green coverage of area around 30,000 m^2.

(c) Providing non-conventional recreational spaces

Non-conventional spaces like children play area, senior citizen corner, amphitheater, etc. are the essential need of today's modern era. Old people and children likes to roam around the open public space.

(d) Inclusive development of health related activities

Inclusive development of health related activities include walking tracks, cycling trails, etc. There is a special arrangement of the cycling and walking track for the efficient movement of the user on both the sides.

(e) Improve air quality and Rainfall

Neem trees act as very efficient, natural air filters trapping dust particles, absorbing gaseous pollutants. The planting of Neem trees helps reduce greenhouse

gases through photosynthesis absorbing large quantities of CO2 and producing oxygen.

Annual rainfall of the Surat region is also degrading. And a study shows that the increase in Native plant can improve the prevailing situation. The Neem tree is one of the Native plant of the Surat Region which will ultimately improve the Annual Rainfall.

(f) Create space with favorable areas for birds and other species

The greenway project is developed to improve social interaction, mental and physical health of the user which also provide the extra space for the birds and different species as there is a tree plantation is done along the canal. This will provide home to birds and other species for their living.

(g) Improve accessibility to Public transport

The bicycling and walking track will ultimately increase public transport vehicle accessibility of its user.

Some analysis suggests that physical activity in a natural environment can help remedy mild depression and reduce physiological stress indicators. Greenway should be accessible to as many people as possible people are more likely to visit green space if they do not have to travel far to reach it, and the most frequent visitors report the greatest benefits to their mental well-being.

5. Conclusion

With growing urbanization and population the availability of per capital green space is decreasing in most Indian cities. Rapid growth of urban areas lead to urban sprawl many cities are prioritizing protection of urban green space and the diverse benefits associated with managed natural areas. Urban green spaces are important building blocks for city life. The Greenway development is also a part of urban green space to develop an ecological and sustainable development. Design of different components of Greenway like walkway, cycling track, etc. keeping in mind for improving health of its user. Also for sustainable development the tree plantation and gardening is developed as an essential part of the Greenway which can lead to decrease level of pollution at some extent. The proposed develop site can enhance open public places and recreation space, increase the overall green coverage of urban area, providing non-conventional recreational spaces like children playing area and senior citizen corner, development of health related activities like walking and cycling, improve air quality and rainfall, improve accessibility to public transport.

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