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An Urban Design Approach to a Sustainable Compact City in New Growth Potential Areas

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ABSTRACT

Existence of Cities always depends on the region for the resources-land, food, water, energy or maybe cheap labor. The resource base is vital for the survival of the cities. With increasing urban sprawl there is a great impact on the future of cities and their sustenance. The primary intent of the study is to demonstrate an Urban Design approach towards a sustainable compact urban model in new growth potential areas (case of Cyberabad, Hyderabad, India) as a means to counteract city's faceless sprawl and environmental degradation by generating compact high density, low energy, mixed-use living and integrating it with the existing city fabric reducing the ecological footprint for future generations. As the selected site offers good natural features, ecologically sensitive areas of the site i.e. Steep slope areas, catchment channels and climatically unsuitable areas from the open space system of the development. The sustainable compact city design approach balances the environmental loads and the growth of city saving resources, conserving energy and enhancing the quality of life.

1. Introduction

The primary intent of the paper is to demonstrate an approach towards a sustainable compact urban model towards new growth directions as a means to counteract city's faceless sprawl and environmental degradation.

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"Cities are like organisms sucking in resources and emitting wastes. The larger and more complex they become, the greater their dependence on surrounding areas and the greater their vulnerability to change around them. There are three variables responsible for the collapse of the city- population, environment and resources (Rogers Richard, 1998)."

Due to factors like congestion, high land prices, lack of amenities and lack of space in the primate city-DECENTRALIZATION of the city grew rapidly. While travel time for journeys remained constant, the travel distances increased vastly due to the availability of the new transport systems. Urban sprawl today is above all else the result of the routine use of the motor car. Urban sprawl affects most medium and large cities. It develops both radially around the perimeter of cities as well as in a linear mode along major transport routes. People contributed to urban sprawl by choosing to live in suburbs rather than in built-up city centers with more commuting options. Figure 1 illustrates relation between the natural resource base and the Human interdependence within the city (Mitra, Ranjit 2003).

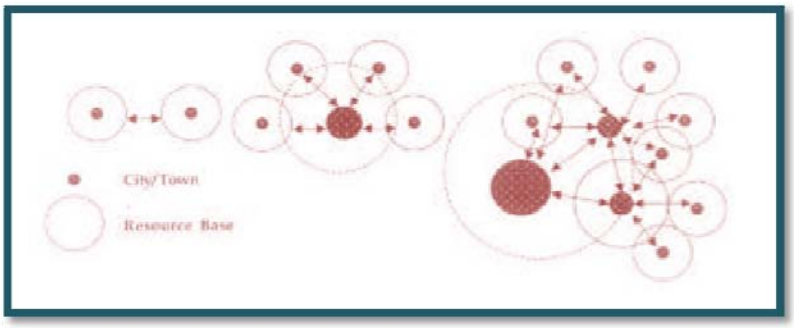

Figure 1: Relation between natural resource base and city (Mitra Ranjit, 2003)

Due to factors like environmental degradation, exploitation of resources, energy consumption, increasing migration and uneven development, the sustenance of our cities and its growth has become the most important issue. Future development of the metropolitan area might take the form of an open hand. Urbanization would be contained within the palm and along the fingers, with space in between the fingers reserved as agricultural and outdoor recreation zones.

"We don't live in a civilization but in a mobilisation of natural resources, people and cities (Girardet Herbert, 2001)". The urgent task is to forge an environmentally responsible modern Urban Design, and make the future city sustainable. This study is a model for such kind of development which can be applied elsewhere also. Cyberabad in Hyderabad is selected as a

case, which has several natural assets and is also the new growth potential area in Hyderabad, India.

"Sustainability is about finding more socially cohesive, economically efficient and ecologically sound ways of producing and distributing existing resources. It is about Securing quality of life by establishing the value of goods held in common – the environment and the community – and about recognizing our mutual dependence on both (Rogers Richard, 1998)."

2. Concept of Sustainable Compact City

"Compact City" is emerging as a new concept to reduce or to control the size of the cities for their efficient functioning.

A city has various functions. Density of various functions in the city is a prime factor for deriving the character of any city. Density of these various functions keeps the city in its equilibrium. This density neither should be excessive nor less. The city should be constituted with respect to its dependence on the surrounding environment for its sustenance and future growth (Dantzig and Saaty, 1973).

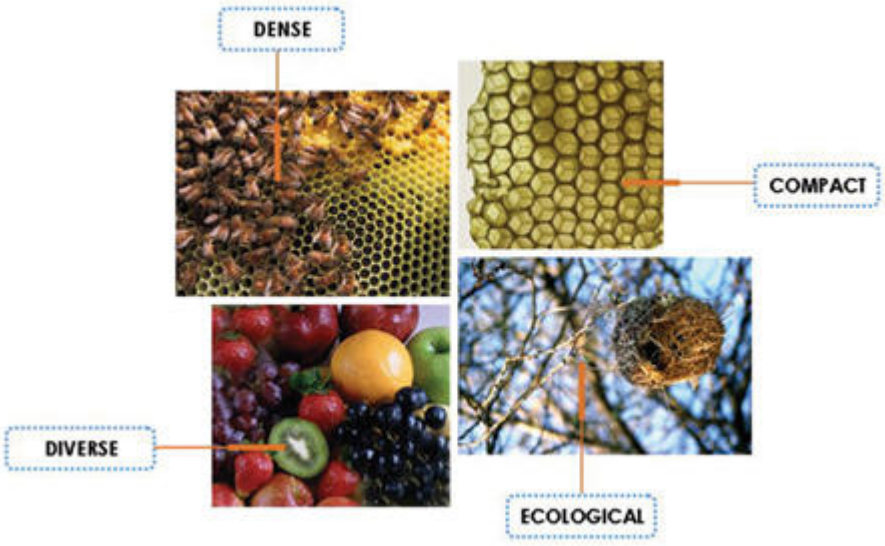

Figure 2: Compact city characteristics

The sustainable compact city concept encourages the aspect of community living. The character of the form evolved is highly dense, compact and poly-centric as shown in Figure 1, with less dependence upon automobiles and has clear defined boundary, conserving

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ecologically sensitive areas for future need. Space derived shall be mixed-use with diverse activities overlapping each other with socially fair functional structure and self-sufficient.

Main purpose of the compact city approach is to save resources, energy (Land, travel distances and wastes) and enhance the quality of life. It encourages creation of neighborhoods within walking distances to reduce the travel times and create livable environments accessible for pedestrians and cyclists.

3. Establishing a case for Urban Design enquiry and intervention - Case of Hyderabad

Hyderabad is the 5th largest city in the country and the fastest growing city developed as Satellite town to Golconda. The last two decades, it has witnessed rapid urbanization and industrial growth. In recent years Hyderabad has witnessed rapid urbanization and industrial growth accounting to changes in land uses, rural-urban migration and environmental degradation. The first and foremost noticeable change observed was mushrooming of concrete jungle in place of urban greenery. In the process of growth control, the master plan proposal of a “Ring town” around the city, as well as “Greenbelt” but they have become causalities in the process of urban sprawl.

3.1 1980-Proposed Masterplan of Hyderabad

To stop or prevent the urban sprawl, Masterplan proposed a ‘Greenbelt’ around the area. It is further proposed to have four ‘Ring Towns’ at a distance of about 25-30kms from urban areas. The proposal is similar to the “Greater London Plan (1944)”. The area between the urban spread and ring towns would be the Greenbelt area which covers 50%.

3.2 Landuse transformations

After notification of Masterplan the growth pattern was towards NW, NE and SE corridors of national highways and railway lines. Urban sprawl led to the depletion of greens as the authorities allowed a change of land use. It was noticed that maximum decrease in agricultural area and maximum increase in built-up area occurred in the NW (63%) as shown in Figure 3 and SW (43.7%) area, while the change was least in SE sector (8.5%).The main proposal of the Masterplan in 1975 was to “Channelise the spatial growth, by imposing Greenbelt policy.” But it is observed that the Greenbelt was encroached upon by 80 Sq km of Residential use and 45.5

Sq km of Institutional use. (HUDA Hyderabad, 2003)

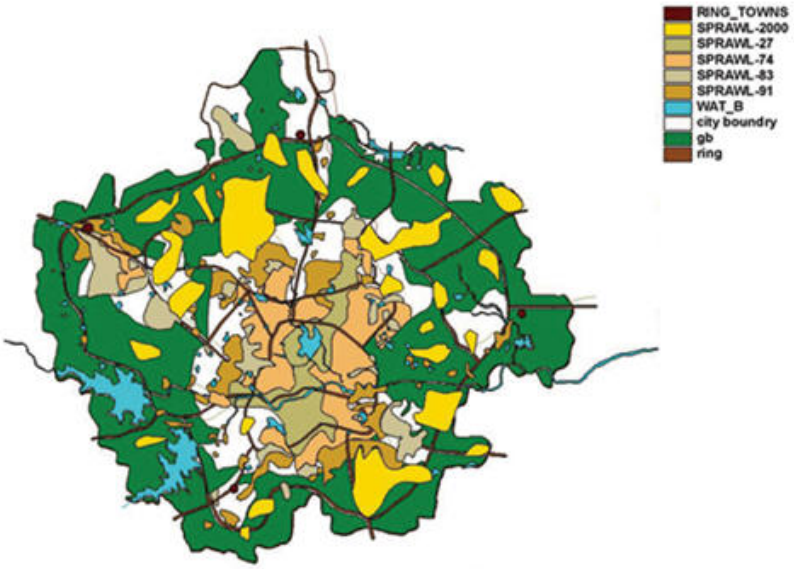

Figure 3: Land use transformations- Hyderabad city. (HUDA Hyderabad, 2003)

Figure 4: Major water bodies Hyderabad city. (HUDA Hyderabad, 2003)

3.3 Ecosystem transformations

Hyderabad city has identified 169 lakes which form a very important component of its physical environment as shown in Figure 4. Till independence lakes were a resource of the local community that took care to conserve them. Through the control of State and private agencies over the years and rapid urban sprawl of the city, many of the water bodies have been totally lost. The flood was witnessed in august 2000 due to a reduction in the carrying capacity of lakes

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and water channels. The state had not bothered to implement the existing laws or pay attention to the suggestions of environmental organizations. Drying up of water bodies has impacted on the recharging of groundwater (C.Ramachandraiah and Sheila Prasad, 2004).

3.4 Uneven density distribution

The main reasons for transformation in the density patterns is due to urban sprawl, availability of open land around the city and the development taking place along major traffic corridors like national highways, state highways and railway lines. The present planning policies are allocating dispersed land uses, densities and dispersed functions, density distribution is shown in Figure 5.

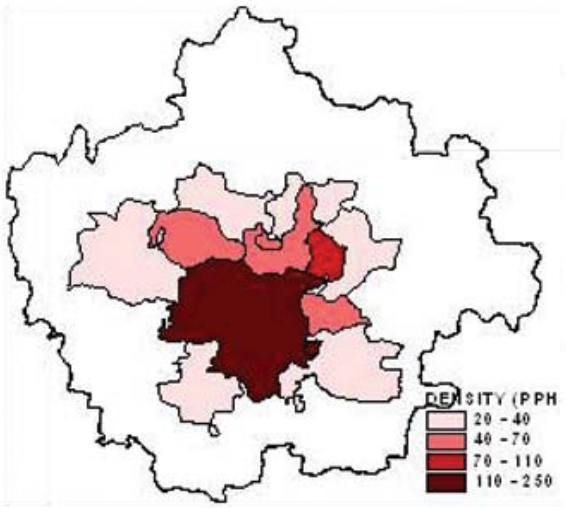

Figure 5: Hyderabad Density distribution.

3.5 2020 Proposed draft Masterplan for Hyderabad

In the name of Sustainable development, fragmented conversion of agricultural lands into urban use is evident in the Masterplan. Non-MCH residential area demands 327 sq km as against current area of 214 sqkm. The Master plan provides a residential zone of more than 500 sq km which is over designed by 53 % (HUDA Hyderabad, 2003). Master plan follows a leap frog method of development. There is no imperative for the urban planning bodies to seriously conserve the natural environment along with optimizing the built environment for achieving a sustainable city.

4. Application of Compact City Principles-Lu Zia Sui, Shanghai proposal by Richard Rogers

Lu Zia Sui is the new Central Business District located on a 168 ha former harbor in the south east of Shanghai that integrates the new Pudong area separated from the existing city. It was designed as a diverse commercial and residential area with parks and public spaces well connected with the public transport (Rogers Richard, 1995).

4.1 Integration with the city

Sir Richard Rogers had demonstrated the principles of Compact city in his proposal for the Lu Zia Sui, Shanghai as a diverse commercial and residential area that provides strong visual and physical connections, connection to city, between the new district and Shanghai. The site is connected with the mass transit system to the city of Shanghai.

The constitution of the business district can be distinguished with major components as the green belt along the river, underground pedestrian network and the set of buildings forming a varying skyline. The central avenue creates the vista for the central open space where there is the main transit terminal. Design provides six large neighborhoods of 80,000 people each focused around main transit interchanges and lies within 10 minutes walking distance from the river, central park and adjacent neighborhoods.

It is designed in such a way that the high rise mixed use zones are located at the intermediate LRT stations. Bicycle routes from the peripheral residential areas are connected to the central green space. The profile of the urban form decreases in height as one goes towards the river side giving a complete view of the same from the buildings.

The design offers a mix of uses such as commercial, residential, hotels and public buildings. On a whole, the design creates livable environment for the pedestrians with various options for transport. All Offices, commercial spaces, shops and cultural institutions are zoned closer to the transit stations and major roads and residential areas, hospitals, schools and other community spaces are zoned near the park and the river (Rogers Richard, 1995). The exclusive demonstration of compact city gives way to future possibilities in similar context for designers to explore.

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5. Site selection criteria

Cyberabad located in Hyderabad (India) has several lakes, natural assets and city level Institutions. It has been earmarked especially for the upcoming IT and ITES based functions. In recent years Cyberabad has been developing as one of the prime growth potential areas of the city. Cyberabad offers good potentials in terms of the natural assets and the new Mass transit system MMTS which connects Cyberabad and the primate city.

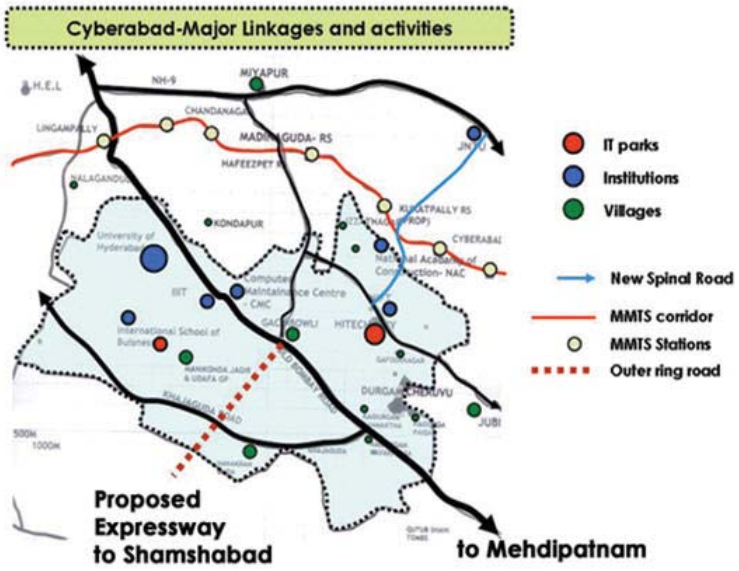
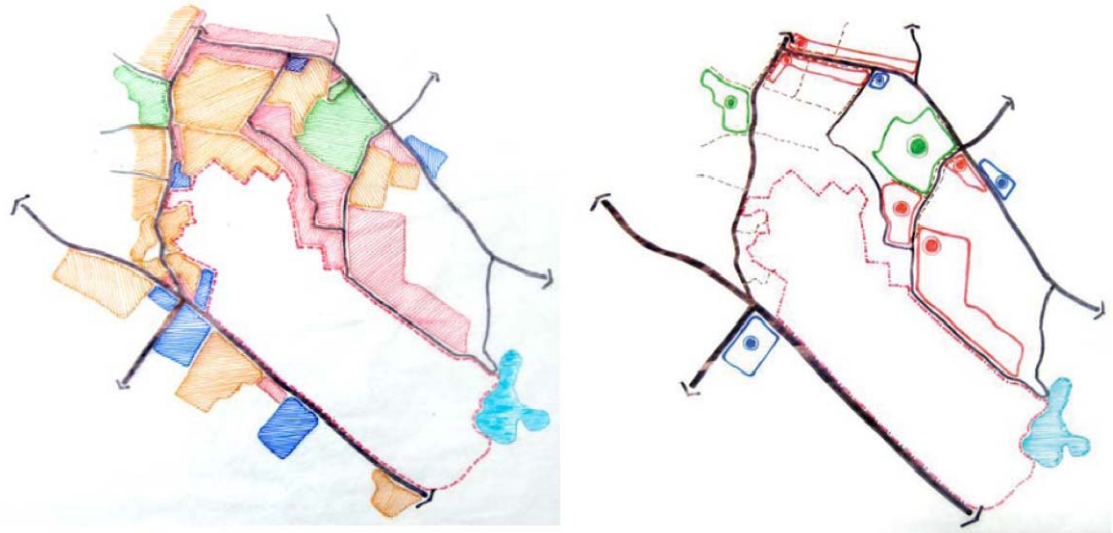


Figure 6: Cyberabad linkages and major activities.

The site is located in the south eastern part of the hi-tech city in Cyberabad admeasuring about 360 hectares. Cyberabad area has a proposed land use of public-semi public uses, residential, commercial and mixed-use zones, refer Figure 6 and Figure 7.

Figure 7: Site and site surroundings.

On the southern side of the site is the Durgam Cheruvulake that serves as a city level recreational area.



Site surrounding landuse

Site surrounding functional structure

Figure 8: Site surrounding structure.

5.1 Site surrounding land use

Site surrounding land use, see Figure 8, is predominantly commercial with large IT Offices which have come up recently. In Cyberabad area no retail and entertainment zones are earmarked and thus it caters to mono-functional use of land and fragmented recreational uses. (Doshi, Balkrishna 2002)

5.2 Site surrounding functional structure

Around the site there are major functions along Madhapur city arterial road. There is no variety of functions along the Old Mumbai road which creates a very poor and non-liveable area, see Figure 6. There are poor linkages within which create unregulated carrying capacities. Functions with high day densities are found along Hi-tech city where the offices of most of the IT giants are located. The plan must provide intermingled opportunities of work, leisure, learning and culture (Doshi, Balkrishna 2002). The form must follow more than just function; it must also respect the natural environment in which it is placed (McHarg, Ian.L. (1969).

6. Site analysis

As the site is a virgin land with rocky areas covering about 168 hectares out of 360 hectares

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and undulating terrain, few parameters to find out the potential land for the development of compact cities were chosen as below-

- Slope character, depending upon the gradient of the slope
- Slope suitability
- Slope orientation
- Ecologically sensitive areas

Overlay of all these parameters would derive areas suitable for development and areas which are vulnerable, out of the192 hectares of developable land.

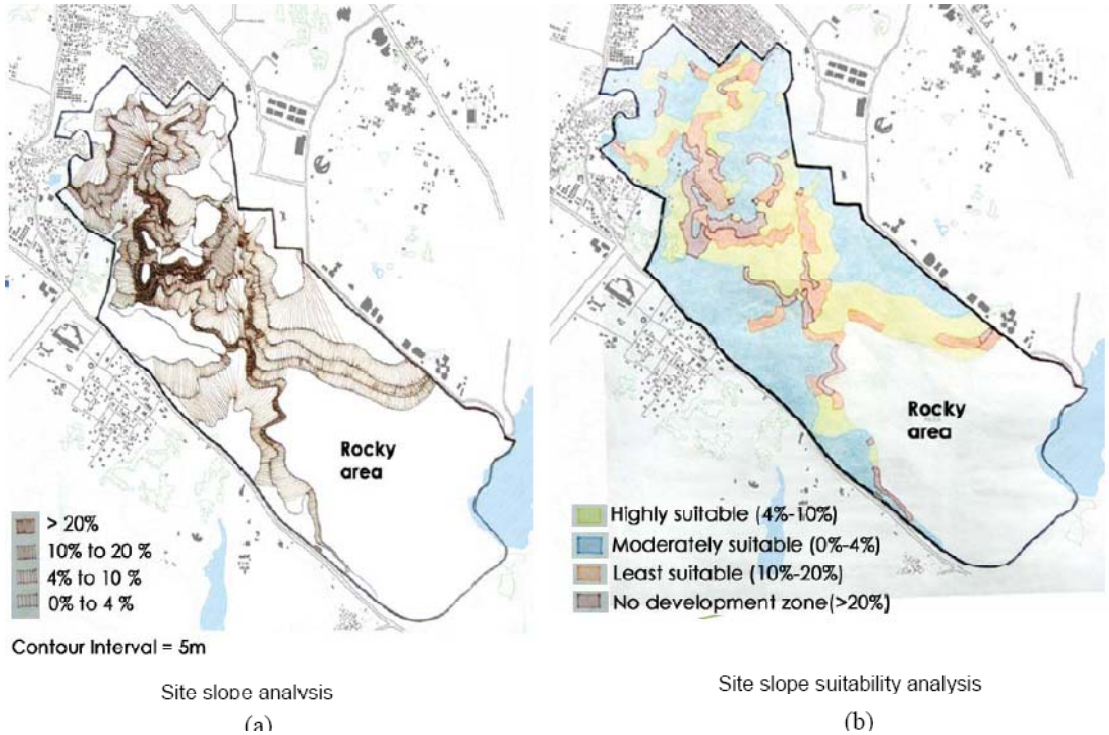

Figure 9: Site slope Analysis.

6.1 Site slope suitability analysis

Detailed analysis of the site terrain was carried out to understand the possibility of potential development following McHarg, Ian.L. (1969) overlay system for land planning. With the help of site contour map with contour interval of 5m, slope percentages were found out in four categories; 0% to 4%, 4% to 10%, 10% to 20% and greater than 20%. This gave rise to the steepest and most vulnerable portions of the site i.e. Greater than 20% slopes where development should not be done. 4% to 10% gradient slopes are the highly suitable land parcels. They offer optimum gradient for development and also for appropriate runoff and

drainage. 0% to 4% gradient slopes are predominant in the site which is relatively flat and they offer potential land for denser developments (Lynch Kevin, 1984). Figure 9, the categorization of land slope as per the above mentioned four categories gives rise to a slope suitability map indicating the possibility of nature of development to be carried out. The light blue portions are predominant in the sites that are relatively flat and moderately suitable land parcels ideal for high density development.

6.2 Site slope orientation analysis

South, Southeast and south-west slopes (Figure 10(a)) are most suitable to harness solar energy. East facing and flatter land parcels are moderately suitable for energy conservation whereas west, northeast and north are less suitable. South Facing slopes do not offer much solar radiation during summers whereas they permit solar radiation in winters i.e. Southeast radiation during the mornings, Southwest incident radiation in evenings and late evening sun in summers. South slopes are best to harness solar energy.

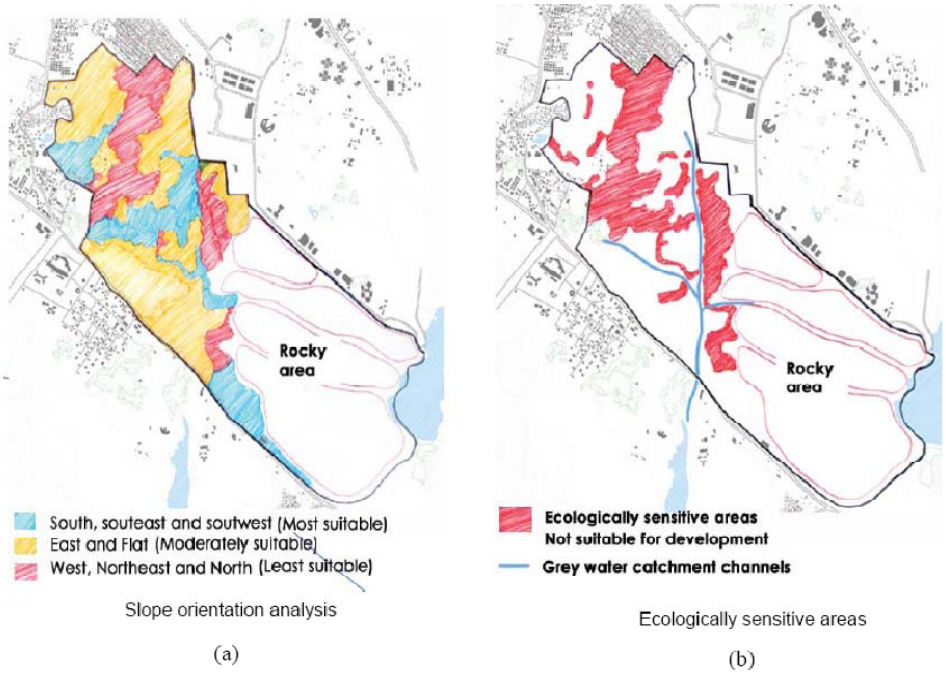

Figure 10: Site slope orientation analysis and ecologically sensitive areas.

Ecologically sensitive areas of the site are the steep slope areas, catchment channels and climatically unsuitable areas. Figure 10 (b) is the final overlay of all vulnerable factors put together following McHarg, Ian.L. (1969) overlay system for land planning. This gives us the

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land parcels which are highly unsuitable or vulnerable in nature.

7. Design Approach

7.1 Site potentials

The site offers good natural features i.e. rocky areas, city level recreational water front and the ridge area and catchment channels, Figure 11 is an approach to land development. Natural features eventually become the structuring elements in designing the compact cities.

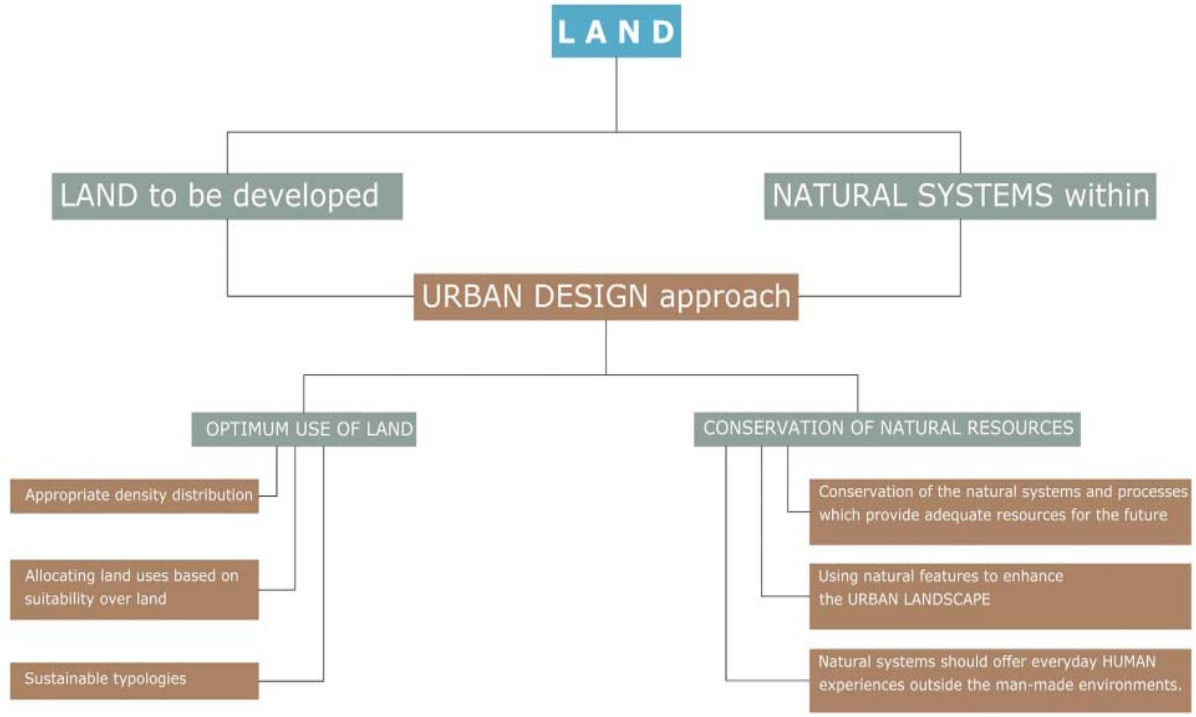

Figure 11: Approach to land development.

The site lies within a distance of 2km from the existing mass transit corridor of Hyderabad. The site provides a connection to the International airport through 90m wide outer ring expressway. It also has the potential to meet the demand of IT and ITES based activities already existing in Cyberabad and can meet the housing demand which is a deficit in the region. (Cyberabad Development Authority, 2001).

7.2 Design Strategies

Development design strategies are detailed in Table 1, by taking various issues into account.

Table 1: Issues and Design strategies.

Issues	City level agenda	Site level agenda	Design actions	Design strategies
Development unintegrated with the natural systems	Developing an approach towards environmentally sustainable future	Conserving the ecologically sensitive areas and processes	Creating low dense passive recreation facilities within ecological areas of the site	Using the natural systems as the structuring elements for the site
Unstructured densities creating uneven pressures	Formation of a dense and compact urban district	Creating dense neighborhoods	Creating compact and dense delineated districts in suitable areas, conserving the natural resource system	Allocating appropriate densities and typologies that conserve land and resources
Unintegrated public transport system with the primate city	Integrating the site with the city through public transport system	Encouraging public transit for daily activities	Encouraging the use of public transport through allocating public functions along the transit system	Linking mass transit systemwith the site through a public transport system
Segregated and dispersed functions	Creating mixed use environments	Creating a mix of IT based functions and the new housing, social facilities and institutions	Allocating variety of functions such as dense housing, Mixed usesspines, recreation facilities in ecological areas within that are important for everyday human experiences	Hierarchical distribution of functions and overlapping those functions
Increased car dependency	Encouraging pedestrian friendly environment	Creating walkable neighborhoods	Allocating public facilities within walking distances 500m (10min walk)	Integrating live, work and play environment with good pedestrian and cycle networks

Hyderabad urban fringe area growth is identified as low density scattered growth over a period of time. Hyderabad Masterplan envisaged density is 228 pph (persons per hectare) Cyberabad existing density is only 95 pph whereas UDPFI guidelines suggests gross residential density of 350-500 pph in urban areas. Hence optimum gross density of 200 to 250 pph is considered in the development of the compact city.

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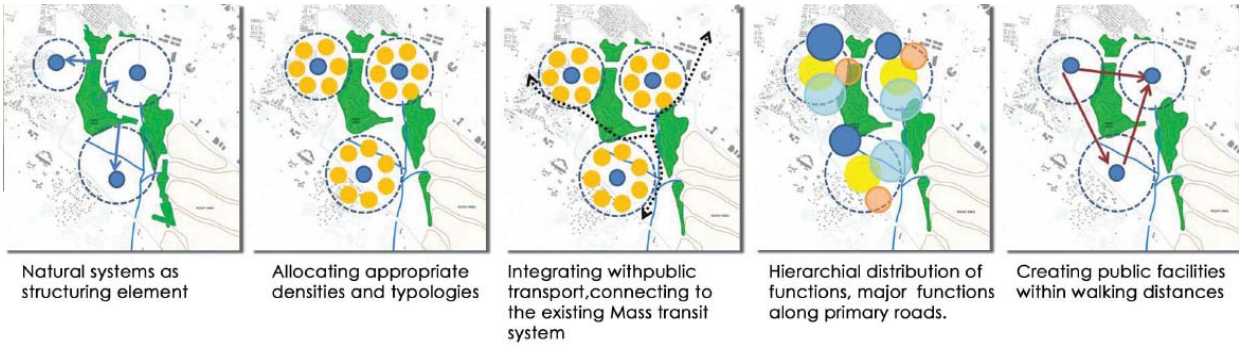

Figure 12: Design Strategies.

Natural systems and environmentally sensitive areas become the structuring component of the design. Three compact nodes are derived as shown in Figure 12 within one kilometer radius to create livable and walkable neighborhoods allocating appropriate densities. The site is connected with a public transport network integrating it with the existing mass transit system of the city for better connection to the inner city. Along the three compact nodes major functions like IT and ITES based offices and retail commercial are allocated along primary roads. Green areas along the catchment channels and development restricted areas become good recreational open spaces, pathways and bikeways connected within walking distances.

8. Conclusion

It is always challenging to address a design in new growth potential areas as these areas are under tremendous pressure of real estate and market forces. This approach optimizes the use of land and resources, conserving the environmentally sensitive areas generating compact high density, low-energy, mixed use living as a **sustainable compact model** and integrating it into the city fabric reducing the ecological footprints for future generations. This approach is a prototypical approach and can be applied elsewhere with respect to the existing site and site surrounding conditions to demonstrate larger urban design principles counteracting city's faceless urban sprawl.

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