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Implication of Sustainable Development in Site Planning in Composite Climate in India

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Abstract - *In today's era, we live in such an intensive built environment with hope for better quality of life. Architecture developed in present time is more or less solely dependent on mechanical controls (i.e. dependencies on electricity for heating, cooling and illumination), resulting in high level of energy consumption. Until the late 19th century, before the dependencies on mechanical control, buildings were naturally more climate responsive. Unrestrained consumption of energy and other natural resources have a consequent negative impact on environment and later on human health.*

Thus, the design and development of new buildings on the concept of sustainability may significantly save energy in many aspects and may lead to comfortable environment for us to live. In this paper, main thrust is given on the implementation of sustainable architecture while evolving site development in composite climate in particular.

Key Words*: *Flow Attenuation, Natural Hazards, Site Assessment, Sustainable Development, Swales, Urban Drainage

1. INTRODUCTION

According to Brundtland Commission (1987), sustainable development has been defined as "Development that means the need of present without compromising the ability". Thus, sustainability can be defined as continuous ability of a society to perform without exhausting key resources and without affecting the environment. Presently, due to modernisation and urbanisation, developments and progresses are required in all the fields. All these developments may have some environmental impact. Sustainable development will surely give the solution for development with low environmental impact by maximising environmental, economic and social gains.

Energy efficiency over the entire life cycle of a building is the most important goal of sustainable architecture. Architects use many different passive and active techniques to reduce the energy needs of buildings and increase their ability to capture or generate their own energy. One of the keys to exploit local environmental resources and influence energy-related factors such as daylight, solar heat gains and ventilation is the use of site analysis.

2. NEED OF SUSTAINABLE DEVELOPMENT

Civilisations are often known by their architectural legacy. We discover in them the accumulated wisdom of thousands of years, based on a deep understanding of sustainable patterns of living. These priceless legacies are vanished under the assault of the technologies and fashions after Industrial Revolution. The rapid growth of the global economy and the rising trends in population and urbanisation has raised concrete jungles over once verdant landscape, threatening flora and fauna.

India, live most major emerging economies, has been witnessing accelerating urbanisation leading to migration of people from rural to urban areas at an alarming rate and thereby increasing the demands of amenities, formulating the concrete jungle as mentioned above. The architecture followed in the urban areas symbolise unrestrained consumption of energy and other natural resources, thus, having consequent negative impact on environment and later on human health. To overcome the problems as mentioned above, efforts should be taken to implement sustainable architecture for better future

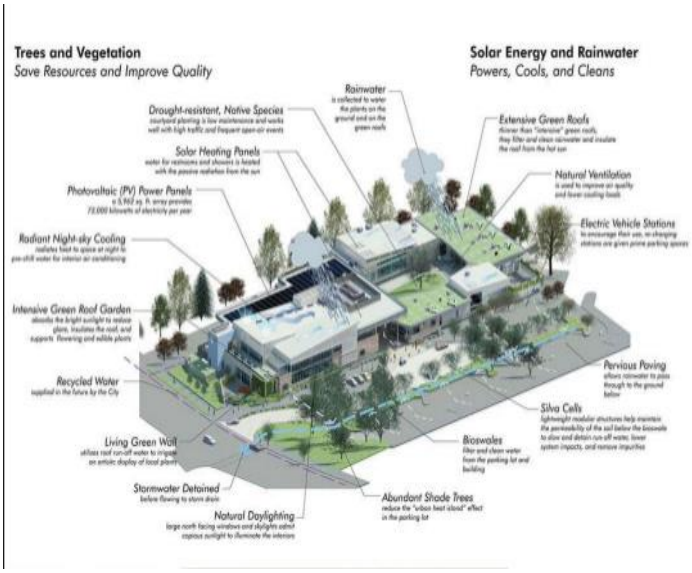

Fig -1: Model showing saving of Natural Resources for improved quality of life

3. GUIDELINES FOR SUSTAINABLE DEVELOPMENTS IN SITE PLANNING

Sustainable site planning begins with the assessment of developing a site. Analysis and assessment of the site characteristics in terms of its capacity to provide natural resources such as light, air and water and the extent to which the existing natural system will be required to support building development

3.1 Site Assessment

Site assessment is a process that helps recognize the potential factors that affect the sustainability of the site. For example, an analysis may identify vegetation type, specific soil types along with their properties, siting and orientation conditions. Broadly, site assessment is done at three levels:

1) Site selection: - This process of site selection for sustainable development identification and weighing the appropriateness of the site with respect to sustainable building design criteria. This often needs to be done long before the project's design phase are commences. The main checklist for the site selection is as under:

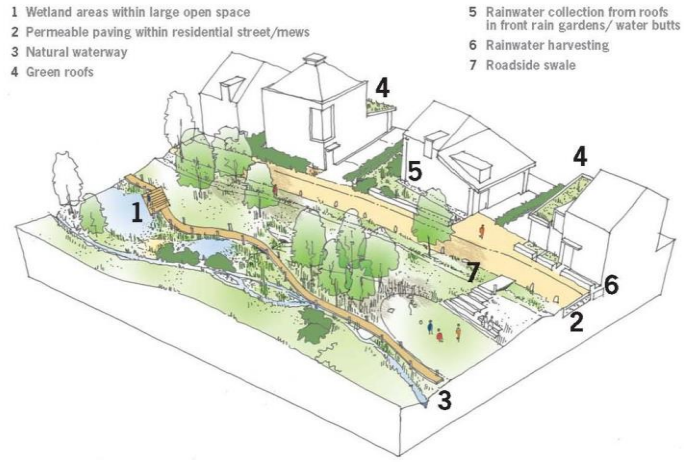

Fig -2: Site plan showing various suds

- Avoid using site having special values like agricultural land, cultural site, wetlands, habitats for endangered species etc.
- Give special consideration for disaster prone areas (Earthquakes, Floods and Tsunami). For example, in a tsunami prone area, the site should be out of safety buffer zone, at an elevated place without the preference of slopes or near other steep slopes to avoid the problems pertaining to landslides.
- Reuse of land that has already been developed or more ambitiously targeted.

2) *Site analysis:* -The site analysis evaluates all the onsite and offsite determinants that affect the development of site and its building programme. The main objective is to allocate and define the use of various parts of the site in a manner that is most appropriate to the specific activities to be carried out on site. An assessment should be made of the sites potential to provide natural resources such as solar energy, light, water etc. and the possible impact of the project on these features. It would result in the modification of the site layout and building design to maximise the use of these natural resources and to protect them from deterioration. It would ensure minimum site disruption, maximum use of bio-climatic features, minimum requirement for intra/inter-site transportation, appropriate erosion and sedimentation control plans along with appropriate landscaping.

The main purpose of site analysis is to determine the site characteristics so that proper drainage system, circulation pattern, landscape design and many other site development features can be considered in relation to building design parameters such as built form, solar orientation, shape, materials implemented, structural and mechanical systems. A site analysis can be done on the basis of following four consideration namely Environmental, Utility/ Infrastructural, Cultural and Historical. The checklist for identifying site characteristic on the basis of above mentioned considerations are as follows:

- Categorise the climate zone according to the geographical attributes of the site. Analyse the climate zone into which falls and investigate the climatically responsive historical architecture and building design practices amenable to that zone.
- Examine historical data for the past trends of natural hazards, such as earthquake and floods, so that proper development may be designed with ability to withstand such eventualities.
- Review the traditional or vernacular architectural style of the region which can be revealed through local cultural characteristics, thus enhancing community values.
- Use of historical energy efficient building techniques that have been evolved and sustained in local climate or cultural characteristics which can be further used or modified to proposed design.

3) Site Development and Layouts: -After the potential factor affecting the sustainable design have been analysed and assessed, site can be selected. Site development can be carried out on the basis of best practice followed in each of the following potential areas:-

- Land use and existing features
- Siting and Orientation
- Appropriate Landscaping
- Utility or Site Infrastructure
- Pavements
- Exterior Lighting
- Construction Management

It has been observed that site infrastructure includes traffic, transportation and planning of their access on site along with their movement. The site infrastructure can be labelled as the first human intervention in the site ecosystem and can also be understood as the interconnecting link between the ecology and building system to be developed on site. Moreover, the concept of sustainability reinforces the idea of maintaining a native habitat, the basic components of which are plant and vegetation as they provide oxygen, shade, regulates the effect of sun, temperature and wind. Landscape promotes diversity and re-establish natural habitats in organic patterns thus reflect the natural system of the site. Landscape with native plants helps to reuse the water use as compared with non-native plants. Moreover, landscape helps in reducing the heat from direct sunlight with plantation of appropriate trees, plants and shrubs as per their needs. Additionally, the shade created by trees and the cooling effect created by grass and shrubs will definitely help in reducing temperature. Thus, sustainable development defragments the landscape, reduce the heat islands and helps to establish a contiguous network with other natural systems, both within the site and beyond its boundaries which is considered as the first step towards sustainable habitat.

3.2 Sustainable Urban Drainage system

It has been observed that the water run-off in cases of Suds are better than that accomplished by traditional drainage system. The main problem with the current drainage techniques is that the building and pavement collect a large amount of rain water and direct it into the sewer, which means that the system has to deal with large flows only occasionally and most of the time has a very little flow. A key principle of suds is attenuating or spreading out the flow over a course of time so that especially during rainfall, the maximum flow is less than it would be for a conventional drainage system. The second principle of the suds is to use natural infiltration and purification techniques to remove contaminated and impurities from water before it is returned to the water cycle.

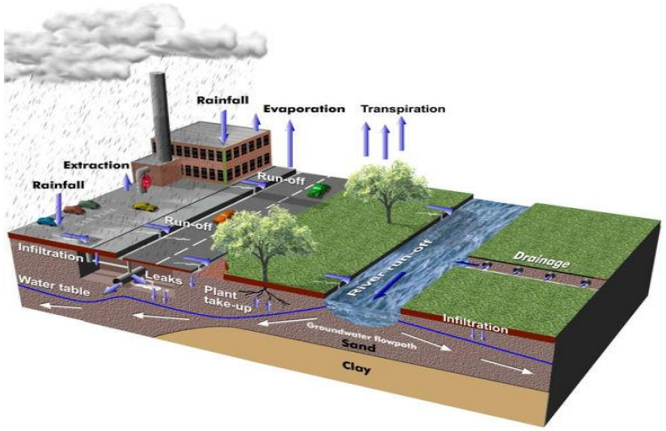

Fig -3: Flow Attenuation within a particular site

1) Flow attenuation: -It constitutes the first half of the suds, deals with the flow of water from larger surface of the buildings, parking areas and other impermeable surfaces during rainfall. Conventional drainage systems involves transporting the water as far as possible to the drainage point which could be water way or sewer hook-up. Second part of the flow attenuation which deals with natural infiltration and purification ponds can also be explained with the help of waste management techniques.

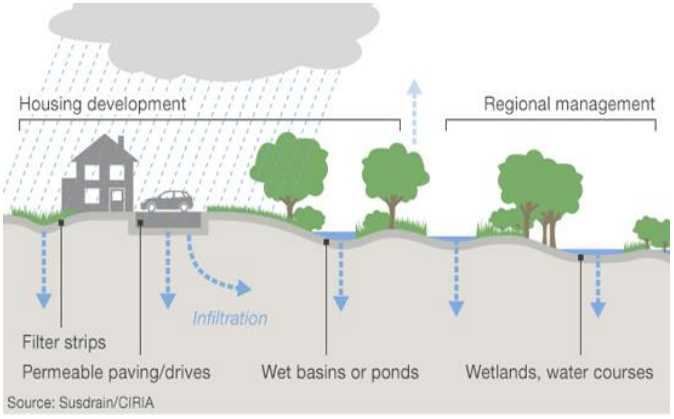

Fig -4: Section showing various methods for Flow Attenuation

2) Swales: -They are considered as the main transportation form of attenuation. They are wide and shallow ditches covered with thick grass and are used to direct and transport drainage water usually to retention or purification pond. Their design slow down the water flow as well as some of it disperses into the ground as well. They are much cheaper to install and maintain than a piping which might be used to transport water. The main drawback is that they usually require more surface land than either conventional ditches or pipes. If land is available, swales prove to be very economical as well as ecological friendly.

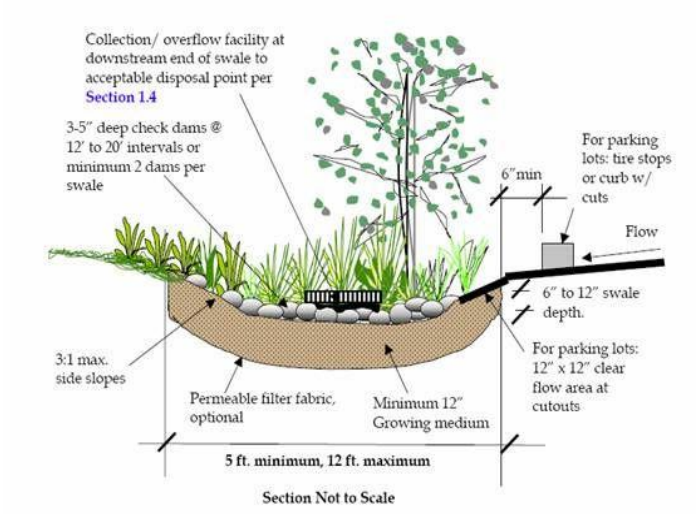

Fig -5: Typical Section of Swale

*3) Soak ways:-*They are another form of sustainable water diversion techniques. They are deep, somewhat narrow cut-outs in the ground that area filled with permeable material usually loose grave. Soak ways are best implemented along the side of impervious surface such as parking areas, where those surfaces are designed to flow into soak ways. Another good position is near the edge of a building, so that the drainage from the roof can flow into the soak way. They are the good alternative to swales when land is not available as most of them are underground.

4) Holding ponds: - These ponds area depressed in the ground designed to hold run off water. They can be designed which are dry or can constantly contain a certain level of water. Holding ponds offer a strong ecological benefits, as they lower the peak flow during rainfall especially when draining into the water course. The main problem with the holding ponds is the amount of area required as they need a sizeable amount of land. Moreover, the maintenance cost of these tanks are generally quiet low as they are nearly self-sufficient.

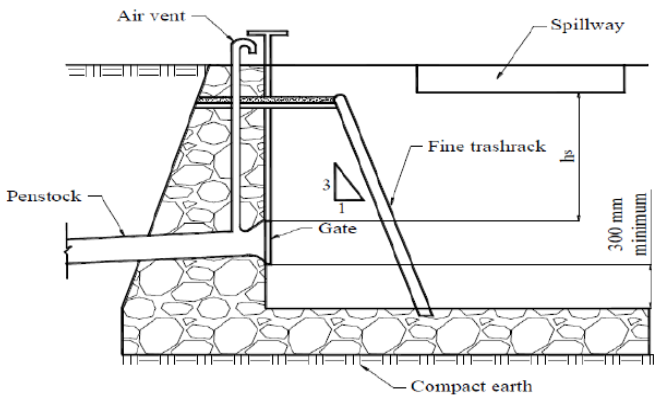

Fig -6: Typical section at Edge of Holding Pond

5) Previous Surface: -Surface such as paving or car parks, which allow rain water to seep through them are called previous surfaces. There are numerous types of previous surfaces that can be broadly divided into two categories:

- Porous surfacing is a surface that infiltrates water across the entire surface.
- Permeable surfacing is formed of material that is itself impervious to water but, by virtue of voids formed through the surface, allows infiltration through the patterns of voids.

Often, a combination of these techniques is used if the rainfall is less that soil can handle the water and then the water is disperse into the ground. If the flow gets too heavy, the grounds are unable to hold it and some of it is directed in other parts of the drainage systems.

6) Pavements: -They act as interconnection between the building blocks and the natural site system. They are used extensively for vehicular as well as pedestrian walkways, parking, outdoor activities or informal zones integrated into the built forms.

The normal practice used while designing a pavement is to exclude water from soil in order to provide a stable surface for human activities. This practice hence increase storm water run-off and soil erosion. Pavement fragments the ecosystem of the site by dividing the entire landscape system. If the choice of the material for paving is incorrect, it can also cause uncomfortable glare and produce harsh environment.

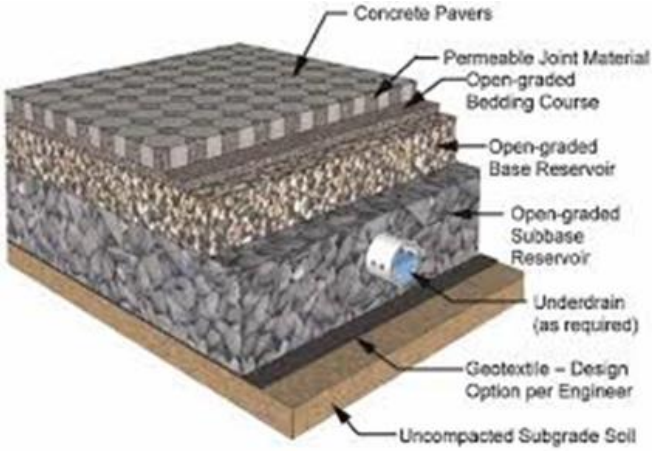

Fig -7: View showing different layers of pavements

4. CONCLUSIONS

It is quite clear from the above study that while developing a site with implication of proper designs helps to preserve existing natural conditions of the site and also to create a microclimate which will ultimately help to reduce the energy usage of built environment, fulfilling a very important aspect of sustainable design. It fulfils the major aspect of water conservation as well. Thus, site planning plays a very important role in sustainable design as it covers the major principles of sustainability. In a nutshell, more thrust may be given on implying sustainable development pertaining to site which will prove comfortable, better and happy society in the coming time.

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REFERENCES

[1] Abdul Halim Babbu & Mohd. Firoz Anwar, 2016 "Bio-climatic Design Strategies for Buildings in Delhi, India," V (IV), page 1-7

[2] Abraham, L.E, Agnello, C.C Burke, (1996), "Sustainable Building Technical Manual: Green Building Design,

Construction and Operations." Public Technology, 292. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Sustainable+building+ Technology Manual.

[3] Alerja, A.O. (n.d), "Passive Solar Architecture".

[4] Consultants, V.S. (2008), "Design of passive cooling system for a building in composite climatic conditions in India". International Journal of sustainable Design, 1 (1), 110-126. https://doi.org/10.1504/IJSDES.2008.017060

[5] Abhimanyu Sharma, Assistant Professor, "Sustainable Campus Design in Cold & Dry Climate: Druk White Lotus School – A Case Study," IJSTE, Volume 3, Issue 05, November 2016

[6] Khan, Z.A (2011) "Sustainable Design," https://doi.org/10.4135/9781412975704.n106

[7] www.googlemaps.com

[8] www.google images.com

[9] Sharma, Abhimanyu, "Vernacular Architecture in Cold & Dry Climate: Ladakh - A Case Study," IJSRD, Volume-3, Issue 12, 2016.

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