

Climate Specific City Planning Guidelines

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ABSTRACT

India is urbanizing, as a result more stress is on demand for resources with limited supply resources. The cities consume enormous energy in order to provide comfortable environment for the residents. Concepts of Green building and sustainable architecture are picking up momentum to negate the energy use. The current practice of achieving thermal comfort within buildings through design is through alteration of micro climate within the plot or site by the architects. There is a need for planning process to contribute to provide thermal comfort by planning cities to achieve meso-level intervention for thermal regulation which can be further effectively regulated at the plot level. Traditional Indian settlements show examples of planning cities with respect to climate to make cities sustainable. The profession of architecture and planning should rediscover the way of practice to attain energy efficiency. The planning guidelines, at present with common approach to whole India should be revised to climate specific guidelines to achieve energy efficiency and sustainability.

Keywords: Micro Climate, Macro Climate, Meso Climate, Thermal Comfort, City Planning

1. INTRODUCTION

Sustenance in harsh climate requires alteration in the micro-climate for existence. Favorable micro climate exemplifies the effect of interaction between the climate, landscape and built habitat. Hence the built habitat and buildings should be altered in design to convert the odd climatic conditions into favorable living conditions. Architecture, as a field of designing buildings professes a theory of designing sustainable or green buildings for comfortable living of the user. India being a tropical country, predominantly strives for attaining comfort level by removing heat from within the building and architectural concepts of passive solar design finds its use appropriate.

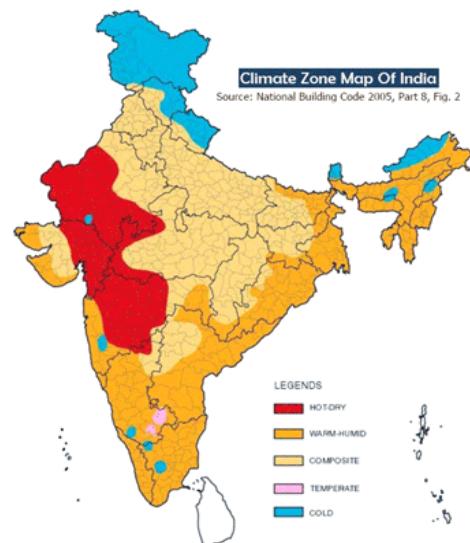


Fig 1 : Map of India showing different climatic zones.

Architects through profession try to alter the micro climate suiting to the need of the habitant's thermal comfort. Thermal comfort is defined by "American Society of Heating, Refrigerating and Air Conditioning Engineers" (ASHRAE) standard 55-2004 as "the condition of mind that expresses satisfaction with the thermal environment". Examples can be seen for the same in much traditional vernacular architecture in India. Even though the development of traditional architecture was based on Vaastu Shaastra Treaties, assessment of thermal performance of traditional buildings through contemporary climatological tools for human comfort through psychometric charts and bio climatic charts proves the comfort levels achieved in the buildings through its design. This makes the understanding of climate and built habitats in Traditional India a unique aspect to be probed.

2. PRACTICE BY ARCHITECTS AND PLANNERS

Current approach in Architectural design is dominated by adherence to the town planning laws and occasionally driven by concept of green buildings identified by various rating systems. The overall aim of preparation of laws, green or sustainable building concepts is to achieve resource conservation to attain sustainable development. The Architect plays an important role in designing building adhering various norms and standards and modify the user climate by altering micro climate. India is a country with diverse climatic conditions due to its location, with cold mountains, hot deserts, rain forests and sea shores. Each place demands different micro climatic conditions for comfort living, correspondingly Architects plan buildings. Use of climatic charts, Energy simulation software has proven to be useful guide for an architect.

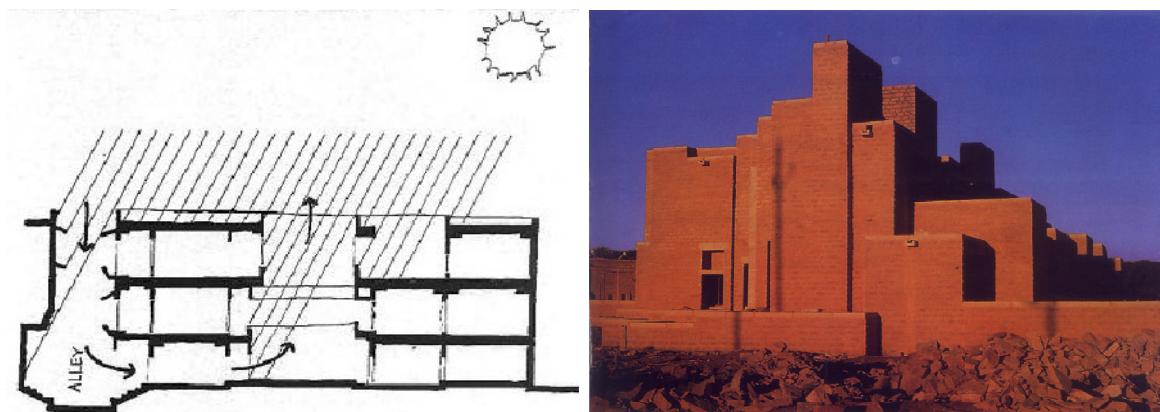


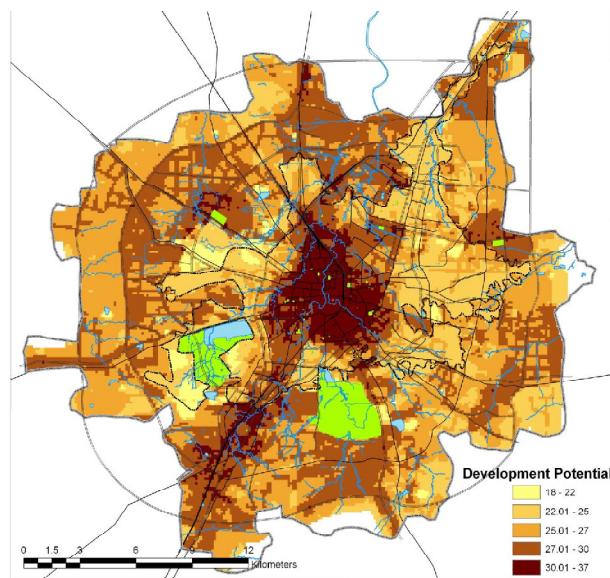
Fig 2: Traditional Residence Design in Jaisalmer for Air Circulation.

Fig 3: Hostel Complex Design by Ar. Vinod Gupta in Jodhpur for Thermal Efficiency.

3. DEVELOPMENT CONTROL NORMS

The current planning guidelines are prepared by concerned authorities. These authorities prepare byelaws for the buildings and plan for city growth often called as development or master plan

based on certain guidelines prepared at national level known as “Urban Development Plan Formulation and Implementation” (UDPFI) guidelines. Therefore the development of built habitat in any Indian city is governed by laws through the concept of land use, Floor Area Ratio (FAR), Building height etc, collectively called as development control norms. Planning profession, based on guidelines is stressed on provision of infrastructure and land development identifying geographical and infrastructural constraints (see Figure 4).

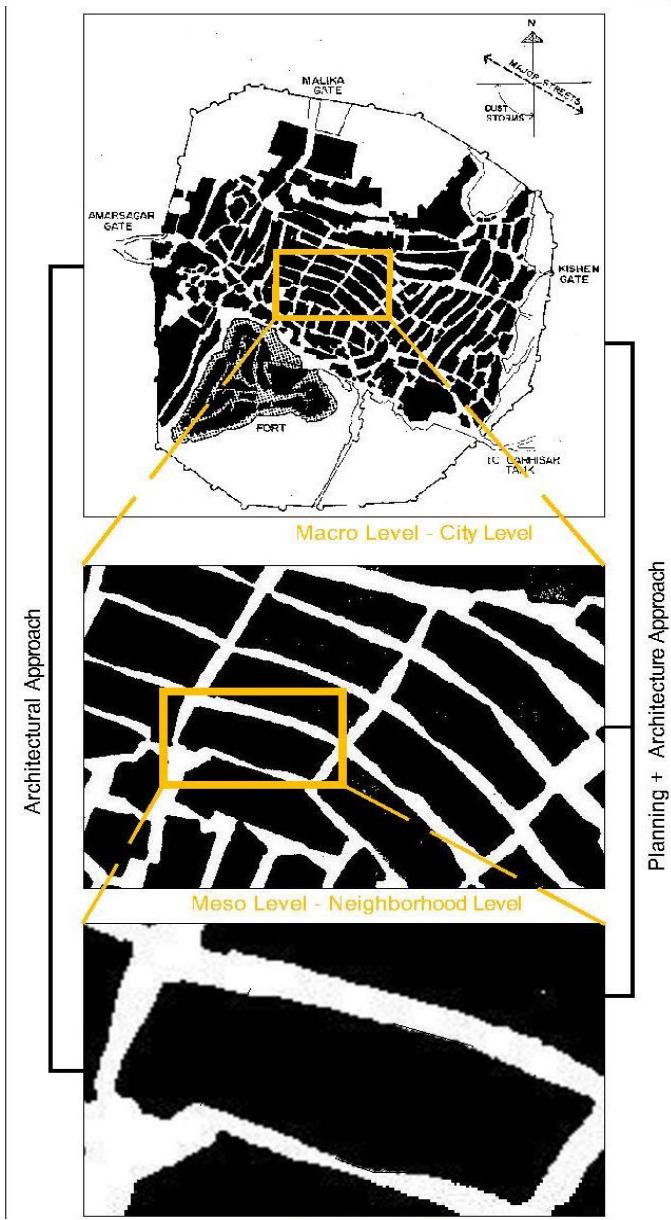


Source: Pragnya Prakash, Population carrying capacity, M.Plan Thesis 2013, SPA Delhi.

4. MICRO CLIMATE- MESO CLIMATE- MICRO CLIMATE

The approach of altering micro climate at plot level provides limited comfort as it cannot deviate drastically in comparison to macro climate. This results for use of mechanically controlled indoor environment and the chain continues with consumption of resources for production of electricity and so on resulting in un-sustainable development. Therefore a stepped approach has to be adopted to attain maximize human comfort at building level without use of mechanical control. Macro Level to Meso Level to Micro level of design alterations to be adopted. The Macro level corresponds to prevailing climate at city level, Meso level corresponds to neighborhood planning and the micro level corresponding to plot level. Architectural interventions can be influenced at plot level beyond which planner's intervention is necessary. Since City planning has many facets of consideration from infrastructure, economy, geography, housing, land provision, little is thought in the guidelines in India about energy efficiency in city planning. Devoid of this, architects directly try to alter micro climate in relation to macro climate skipping meso climate alterations, can be seen in fig:5.

Fig 5: Transition from Macro - Meso - Micro level approach for energy efficiency in Jaisalmer.



Map Source: Natural Cooling of Buildings-A Review (with examples from traditional architecture in India), Vinod Gupta

Since plan preparations for a city itself a painstaking process, a separate guidelines can be prepared for different prevalent climatic zones of India through which the concepts of densities, building heights can be derived for city planning process helping meso climatic interventions. As a result of this, indicators for sustainable development will show positive growth through reduced electricity load, water requirement which are essential for achieving sustainability in city planning and environment conservation.

Traditional settlements were planned in the lines of macro to meso and to micro which varied from cities to cities. Jaisalmer (fig: 5) is planned in order to avoid dust storms by altering orientations of the streets at macro level approach. Meso level alterations were done with the relation of street widths to the buildings and the micro level alterations consisted architectural features cutting the harsh heat resulting thermally comfortable situation. Table-1 shows the meso level intervention where the planning of streets contributing to reduce temperature in the streets. With this, the micro climate can be altered on the baseline of street temperature resulting in higher comfortable situation with respect to macro climate. Fig.6 shows the architectural features helping micro climate.

Table 1: Meso Level Climate Variation: Street Temperature in Jaisalmer

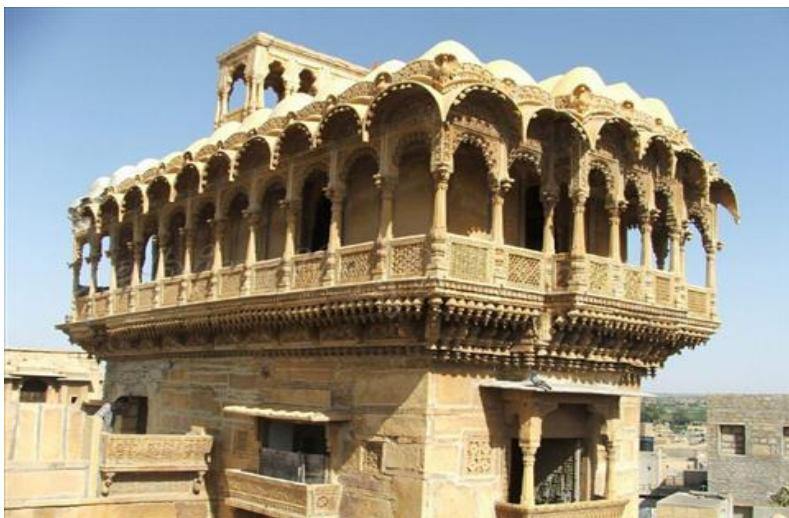
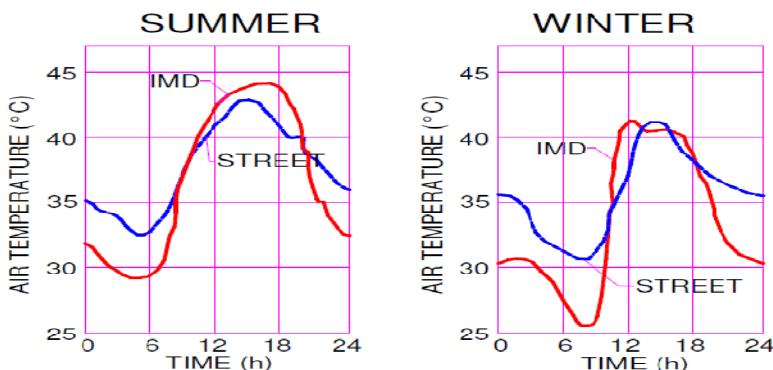


Fig 6: Micro Level Interventions in Building : Double screen, Shadow through Architectural Elements : Haveli in Jaisalmer.

5. CLASSIFICATION OF CITIES IN INDIA

In contemporary world, as a result of globalization and pressure on land, cities have a different economic dynamics and practically it would be difficult to apply all solar passive techniques in architecture and planning due to tremendous pressure and demand in the existing built-up areas. These principles should drive the guidelines for the cities being newly developed, new areas of the existing cities and the cities being projected to grow as mega cities in future for sustainable development. The classification of guidelines based on climatic segregation for Indian cities can be made on the basis of the table mentioned below. The cities listed below form a major growth engines in near future based on projections stating India will be urbanizing at higher rate. Therefore these cities form important to be intervened.

Table 2 : Classification of Indian Cities based on Climatic Conditions

Hot and Arid Zone	Hot and Humid Zone	Warm and Humid Zone	Cold Zone
Agra, Ajmer, Akola, Aligarh, Allahabad, Ambala, Bareilly, Bikaner, Gaya, Jabalpur, Jaipur, Kanpur, Khandwa, Kota, Lucknow, Kota, Ludhiana, Nagpur, Neemuch, Roorkee, Sambalpur, Umaria, Varanasi	Ahmedabad, Asansol, Bhavnagar, Bhuj, Bombay, Calcutta, Calicut, Cuttack, Dohad, Jamnagar, Jamshedpur, Chennai, Madurai, Mangalore, Masulipatnam, Midnapur, Nellore, Patna, Rajkot, Ratnagiri, Salem, Surat, Tiruchirapalli, Vellore, Vishakapatnam	Cochin, Dwarka, Gauhati, Puri, Sibsagar, Silichar, Tezpur, Trivandrum, Veraval	Darjeeling, Drass, Gulmarg, Leh, Mussoorie, Nainital, Ootacamund, Shillong, Shimla, Skardu, Srinagar

Source: Appendix B, IS 3792-1978

6. CONCLUSION

Architecture along with town planning plays major role in developing favorable living habitats. There needs to create a momentum for a synergy between the profession for sustainable development. Traditionally, India has cities planned to take care of climatic conditions. Studies conducted by R. Shantipriya et al prove the traditional constructions provided better thermal experience than contemporary constructions. Though ECBC (Energy Conservation Building codes) are implemented for constructions of buildings having area more than 1000 M² or connected load of minimum 500 KW, many new smaller constructions are still not governed by any laws for energy conservation and not even designed by architects or professionals. Changes in planning laws will propel the energy conservation efforts as no buildings can be sanctioned for construction without adherence to local bye laws. Introduction of efforts at city planning for meso level alteration of the climate itself will create comfortable neighborhoods. Therefore it becomes an obligation towards the society to rediscover the way of practicing architecture and planning profession in the country to learn from our tradition, as the saying goes “Think Global and Act Local”. The stress of globalization should not drive away best practices evolved through tradition.

REFERENCES

- [1] Gupta Vinod , *Natural Cooling of Buildings-A Review (with examples from traditional architecture in India)* Innovative Information's Incorporated – Research Report No: S 1
 - [2] Prakash Pragnya, *Population Carrying Capacity, M. Plan (Urban Planning)* Thesis-2013, SPA New Delhi
 - [3] Gupta Vinod, *Natural Cooling Systems of Jaisalmer, Architectural Science review*
 - [4] R.Shanti Priya, M C Sundarraja, S Radhakrishna, *Comparing the thermal performance of traditional and modern building in coastal region of Nagapattinam, Tamil Nadu*, Indian Journal of Traditional Knowledge, 2012
- Inputs from documents published from *Ministry of New and Renewable Energy, Government of India*.