
“CLIMATE RESPONSIVE ARCHITECTURE WITHOUT ARCHITECTS”- AN URBAN VERNACULAR STUDY

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Abstract: Spontaneous settlements are referred to as an outward spread of built-up areas caused by expansion, with inadequate provision of facilities. The formation of spontaneous settlements is as a result of urbanization, hence are referred here as “urban vernacular architecture”. This study examines the ways in which Spontaneous settlements respond to the extremities of climate. This paper explores some of the connections between sudden extremities of climate and the urban vernacular approach to respond to the problems emerged. The study specifically focuses on settlements near Old Pardi Naka in Nagpur City, Maharashtra State. Data was collected through physical observations and questionnaires. Data was also obtained from published articles and from the Nagpur Municipal Corporation publication. Examination of an interpretation key, plotting of the study area, geo-referencing and editing of maps with ground data were done to have a precise view of the study area. Analysis depicts that, there has been an indigenous and daring use of materials in new ways, textures and colors which are often used to indicate ethnic, religious, regional and other forms of identity, efficient use of resources shows that, the study area is a typical depiction of urban vernacular architecture. In concluding the paper, the solutions found by the dwellers of the spontaneous settlement are nothing but the urban vernacular approach of climate responsive architecture. The paper also makes room for assisted spontaneous settlements to be considered as urban vernacular architecture style which should be looked as having high design potential.

Keywords: Architecture without Architects, Climate Responsive Architecture, Extremities of Climate, Urban Vernacular Architecture

Introduction: Spontaneous settlements are referred to as an outward spread of built-up areas caused by expansion, with inadequate provision of facilities. The formation of spontaneous settlements is as a result of urbanization. The architecture of these spontaneous settlements is what we call as urban vernacular architecture. Creating favorable conditions for comfortable living and providing safety from adverse weather conditions for residents are considered as significant criterion in architectural design. The builders (dwellers) of these spontaneous settlements create the intelligent architecture to provide comfort for residents based on environmental needs of humankind. The study is conducted for Nagpur region which experiences extreme climatic conditions throughout the year.

Urban Vernacular Architecture is a new method of climate responsive architecture and adaptive architecture whose results are not yet studied.



Figure 1: Plan showing Notified and Not-Notified Slums of Nagpur City
(Source: Slum Rehabilitation Authority Nagpur Municipal Corporation 2008)

Selecting A Case for Study: The main purpose of the present study is to investigate about Urban Vernacular Architecture from a different perspective of its architectural design potential which provides solutions for responding to extremities of climate. 'Architecture is intersecting fields of culture, art and technology. Following images show the present condition of slums in Nagpur.



Figure 2: Images of City Level workshop on Rajiv Awas Yojana Municipal Corporation, Nagpur
(Source: Slum Rehabilitation Authority Nagpur Municipal Corporation 2008)

The study can be carried out in different ways i.e. by conducting surveys in various slums of Nagpur and adjacent areas, by selecting a particular slum for study and generalizing conclusions for Nagpur city, by selecting particular season's impact on houses, by actually measuring the inside and outside temperature differences in summer, winter and rainy season due to the use of material, etc. This study is limited to the study of 6 houses of slum at Mini Mata Nagar on the basis of certain identified parameters.

Overview: ²²The slum phenomenon is so widespread that we may speak of a trend in architecture. Slum develops during high urbanization. The influx of labor from the countryside to the city goes far beyond the housing and absorption capacity of the city. In architecture, a distinction is made in style architecture and vernacular architecture. The universal urban slum environment gives its architecture a

globalized nature. ³The urbanized area is the landscape itself. The global theme of the rapid urbanization is the local condition of which slum is the vernacular architecture. This can be found especially where the pace is very high, as in swelling cities. ⁴The specific urban and architectural quality of slums (configurations of their plans and morphology), the author also looks at the use of materials, textures and specific colors, the territory’s effective response to the climate as well as the efficient use of resources and space. Although the information on physical-spatial configurations of the territory of the slums is important to get to understand the vulnerability of a disaster area, one should always put them in touch with the morphological characteristics, soil, geotechnical field, the characteristics of climate localized area where the slum, as well as factors related to the involvement of residents (management practices at the level of cuts and embankments, vegetation, basic infrastructure, etc.) due to their contribution to the vulnerability of the land.

Introduction of Study Area:

Selected City for Study: Nagpur

Selected Slum: Mini Mata Nagar

Location: Near Old Pardi Naka, behind Haldiram’s Factory.

Site Significance: Settlement started growing besides the water body around 30 years back gradually the water body got dry that helped the settlement to expand.

Social Groups: Mixed societies include Maharashtrians and Chhattisghari .

Dominant Occupation: Maximum dwellers are Hawkers Few are having jobs at places like Brick Kiln, MIDC, Steel Factory, etc. Rest few are Self Employed.

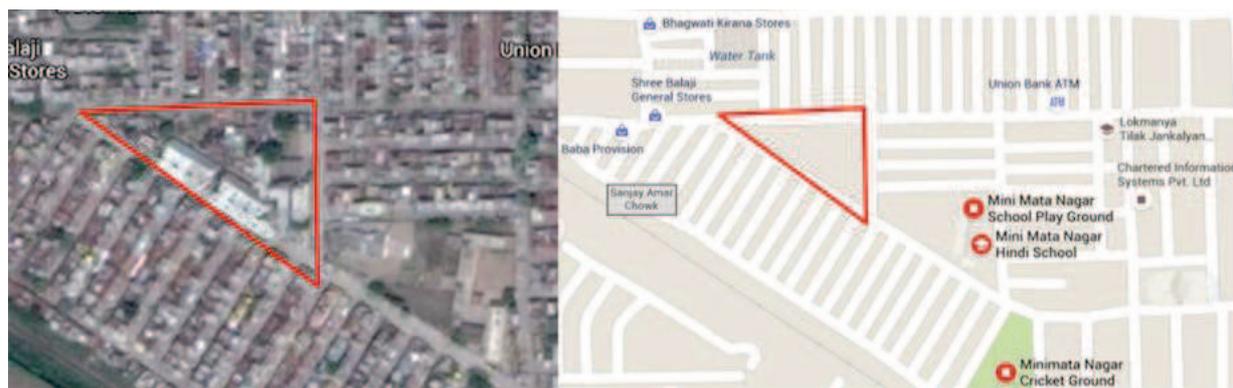


Figure 4: Images Showing Location of Selected Spontaneous Settlement on Nagpur City Map
(Source: Google Maps)

<p>Location and Physiographic Features:</p> <ul style="list-style-type: none"> • Nagpur city is located in Nagpur district in the State of Maharashtra • A mean altitude of 310 meters above sea level and is located at practically the geographical centre of India; in fact, the Zero Milestone of India 	<p>Climate:</p> <ul style="list-style-type: none"> • The climate of Nagpur city is characterized by extremely hot summer and a cold winter. • The city experiences tropical climate and record the rise of temperature up to 48 °C in summer season (March to May). • The cold season is from December to February and the mercury drops down to as low as 6°C to 8 °C. • The southwest monsoon is from June to September • The avg. annual rainfall for the year 2013 is 114.6 mm and • Max. & min temperatures recorded are 47.9 °C & 12.1 °C
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Analytical Study:

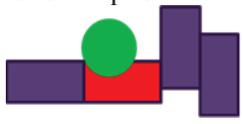
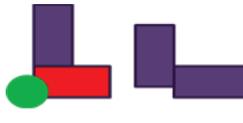
<p>The Urban Fabric High density, narrow streets, small buildings due to: shortage of safe land, mutual protection from sun and wind, security, family growth, construction economy, highly communal spirit of the old societies.</p>	<p>Building Materials Bricks, Wooden battens with mud plaster, G.I. Corrugated Sheets, Cement, Shahabad Stone</p>
<p>Major Building Features Solid volumes, thick walls, small openings, unifying plaster fused into neighborhoods via flexible repetition, simple geometric forms, responding to environmental constraints using local resources, imprinting social evolution, human scale structures (low profile structures), material and space minimalism vital for sustainability, sustainability, products of necessity rather than choice</p>	<p>Observations Sunny place, excessive isolation creates discomfort by reflections, glare, and heat-emitting mass, solar protection is provided by adjacent buildings or free-standing walls, small openings reduce heat losses but at the same time they decrease daylight to the interior</p>

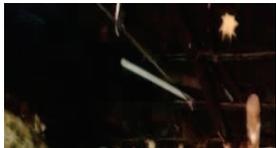
Introduction of the Selected Houses:

Images showing the selected houses for conducting a survey (Source: Author)

<p>House No. 1 Owner: Shivaji Jaggu Gharde Family Size: 5 persons in family Occupation: Business</p>		<p>Figure 5: House No. 1</p>
<p>House No. 2 Owner: Bharti Balkrishna Virulkar Family Size: 4 adults and 2 children in family Occupation: Tailorin</p>		<p>Figure 6: House No. 2</p>
<p>House No. 3 Owner: Manohar Jagne Family Size: 7 persons in family Occupation: Auto Driver</p>		<p>Figure 7: House No. 3</p>
<p>House No. 4 Owner: Kamal Bande Family Size: 3 persons in family Occupation: job at Ara Machine House No. 5 Owner: Ramkali Bante Family Size: 5 persons in family Occupation: job at Ara Machine House No. 6 Owner: Parvati Vikram Bhende Family Size: 5 persons in family Occupation: Labor</p>		<p>Figure 8: House No. 4, 5, 6</p>

Table 1: Analysis (Source: Author)

Parameters	House no.1	House no.2	House no.3
Location of House 	away from 6 meters wide main road with 3 meters frontage, just in front of a tree having large foliage	Just in front of 6 meters wide main road having 1 meter frontage and in between two trees having medium foliage	Just in front of 6 meters wide main road having 1 meter frontage just in front of a tree having large foliage
Clustering of Houses 	Close clustering with a partly shaded open space for semi-public activities 	Close clustering with a partly shaded open space for semi-public activities 	Close clustering with a partly shaded open space for semi-public activities 
Planning of House 	Simple rectangular two rooms with tiny window and separate washing area having sloping roof and having one common wall with the neighbouring house	Simple rectangular two rooms with tiny window and separate washing area having sloping roof and having one common wall with the neighbouring house	Simple rectangular two rooms with tiny window and separate washing area having sloping roof and having one common wall with the neighbouring house
Building Material 	Walls : Brick masonry Roof: Thatch roof Flooring: Cement	Walls: Wooden Battens Roof: G.I. Corrugated Sheets Flooring: Shahabad Stone	Walls: Wooden Battens with Mud Plaster Roof: G.I. Corrugated Sheets Flooring: Cement
Scale of Houses	Low profile (height) house, Human scale	Low profile (height) house, Human scale	Low profile (height) house, Human scale
Maintenance 	The house is in same condition since it's construction, the only maintenance required is of plastic sheets which is used to cover roof during rainy season	Do not prefer to go for maintenance of house, the house is in same condition since it's construction	Do not prefer to go for maintenance of house, the house is in same condition since it's construction
Parameters	House no.4	House no.5	House no.6
Location of House 	Just in front of 6 meters wide main road having 1 meter frontage.	Just in front of 6 meters wide main road having 1 meter frontage.	Just in front of 6 meters wide main road having 1 meter frontage.
Clustering of Houses	Row houses pattern. Same module repeated 3	Row houses pattern. Same module repeated	Row houses pattern. Same module repeated

	times to form a cluster. 	3 times to form a cluster. 	3 times to form a cluster. 
Planning of Houses 	Simple rectangular one room with tiny window having sloping roof and one common wall with the neighbouring house	Simple rectangular one room with tiny window having sloping roof and two common walls with the neighbouring house	Simple rectangular one room with tiny window having sloping roof and one common wall with the neighbouring house
Scale of Houses	Low profile (height) house, Human scale	Low profile (height) house, Human scale	Low profile (height) house, Human scale
Building Material 	Walls : Wooden Battens and mud plaster Roof : Thatch roof Flooring : Cement	Walls : Wooden Battens and mud plaster Roof : Thatch roof Flooring : Cement	Walls : Wooden Battens and mud plaster Roof : Thatch roof Flooring : mud
Maintenance 	Do not prefer to go for maintenance of house, the house is in same condition since it's construction, the only maintenance required is of plastic sheets which is used to cover roof during rainy season	The house is in same condition since it's construction, the only maintenance required is of plastic sheets which is used to cover roof during rainy season	The house is in same condition since it's construction, maintenance of plastic sheet is needed after every 2 years

Conclusion and Future Scope of Study: The architecture we cherish nowadays as 'picturesque' in fact the outcome of a long struggle for survival in an adverse setting by many generations that have squeezed their means out of the available resources in a truly sustainable manner. The locals adapted their comfort and needs to the given conditions, merging the Four Elements into an honest and minimalist architectural idiom: a brilliant example of vernacular environmental sustainability.

In concluding the seminar, the solutions found by the dwellers of the spontaneous settlement are actually the urban vernacular approach of climate responsive architecture. Their way of responding to the extremities of climate through: selection of location for the house, clustering of the houses, scale of the house, planning of the houses, materials used for construction and requirement of maintenance is a great learning experience of climate responsive adaptive architecture. The dwellers themselves came up with these solutions showing high design potential.

Future scope of this study is to actually take readings of the temperature differences of inside and outside of the houses due to the use of different construction materials. The readings and findings can then be compared with the readings obtained from the contemporary houses to find out the best possible solution by the fusion of urban vernacular architecture and contemporary architecture.

Table 2: Inferences- Urban Vernacular Approach of Climate Responsive Architecture
(Source: Author)

Rainy Season	Summer Season	Winter Season
<ul style="list-style-type: none"> • Thatch Roofs are covered with plastic sheets to prevent rainwater to enter into the house. • Due to this solution hardly any maintenance is needed. • No water clogging is observed due to provision of proper water drainage system on roads. • There are very small or no windows to the houses hence only roof needs to be protected during heavy rains. • Absences of windows create swampy ambience inside and increased humidity and restricted air circulation. • Ceiling as well as table fans solve the problem of air circulation. • G.I. Sheets roof protects from rain and requires no maintenance. 	<ul style="list-style-type: none"> • The walls of the houses are made up of: wooden planks, Thatch covered with mud plaster, Brick masonry. These materials help to lower the temperature inside the house. • Thatch roof helps to reduce the heat gain. • G.I. Sheet Roof heats up the inside space but they use coolers and fans to solve the problem. • Houses are closely clustered it helps in giving maximum shaded areas and surfaces which helps to lower the inside temperature. • The houses are low profile/ ground hugging having large foliage trees around this helps to reduce the heat gain. • Absence of windows helps to reduce heat gain and prevents glare. 	<ul style="list-style-type: none"> • Absence of windows helps to trap the heat generated inside the house due to electronic appliances, presence of human beings and house hold activities like cooking. • Absence of windows helps to restrict the flow of cold winds inside the house. • As there are very few months of winter season experienced in Nagpur no special provision is needed.

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