People's Acceptance of Vernacular Houses: The case of Ghantasala, Andhra Pradesh, India.

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Abstract

Houses in rural areas of India are examples of indigenous planning and construction techniques, which had evolved from time to time. Architecture is understood to be a result of informed decisions taken by the people based on beliefs, geography, geology and climate. Thus, residential dwellings of rural areas are a result of time-tested beliefs, climate, locally available building materials and socio-economic aspects of the respective regions. Vernacular architecture of a place is informed by the culture, micro-climate, building materials used and building techniques of the time and place. However, the present trends of globalization and industrialization have led to changes in various aspects like availability of building materials, urge to tide along with modern building styles as well as construction techniques, lack of skilled human resources who can execute old construction methods using old materials, finishes etc. The reasons for transformation may change from place to place and from one case to the other, which show that it's the outcome of need based response(s) to the prevailing means and changing needs of people of a place.

The users may or may not be in favour of transformations but the physical fact is that transformations take place in vernacular houses. In this situation, it is pertinent and rational to assess the acceptance level of people towards vernacular houses. The purpose of this paper is to present the causes of transformations of vernacular houses in a selected village of coastal Andhra Pradesh state of India, understand the acceptance level of people towards vernacular houses and conduct analytical tests to assess the acceptance of vernacular houses by people in an appropriate perspective..There exists an element of applied research as the employed method but the study has more to do with a combination of diagnostic study' and exploratory research methods. The study concludes that people are not happy about the transformations and there is an attachment for the vernacular houses.

Keywords: *attachment, architecture, causes of transformation, level of acceptance, vernacular houses, India.*

Introduction

Vernacular architecture is the common building form of a particular region, produced by people, without Architects. Vernacular architecture of a place is also an outcome of the relation between socio-economic factors, local climate, culture as well as construction techniques employed by people of a given place. Globalization has a major impact on human life, from the beginning of twenty first century. People put a continuous effort to achieve more comfort and convenience in their day to day life, as a result of which different transformation patterns are observed over time in different places.

India is one the oldest civilizations of the world. The building techniques of a given place are not static but in fact continue to transform or evolve over time, by necessary amalgamation of changing needs where the built forms adapt and reflect the same. Oxford Institute for Sustainable Development estimated that over 90% of present buildings throughout the world were designed by the users themselves (Oliver, 2003; Srikonda, 2016). Number of buildings estimated according to this is about 800million (Dili, Naseer and Varghese, 2010). Vernacular architecture can be defined as architecture where design decisions are informed by tradition, culture and local climate. It differs from place to place according to the physiography, available building materials and technical knowledge (Jayasudha, 2014; Srikonda, 2015).

The Issue:

Kotharkar (2012) points out that transformations of settlements is an inevitable phenomenon be it urban, rural or tribal. However, changes occurring in the past were natural and those took place from within. It was a gradual process and it occurred with due respect to climate, community and cultural needs as a process of refinement. With the forces of modernisation, societies have witnessed the change in their patterns of living, which is more intense in the developing countries. To understand the direction of growth, it is imperative to map the patterns of change seeking clues for future trends. The transformations may be quantitatively partial if it is due to the repairable state of an existing vernacular house or it may be full if it's a new additional construction beside the existing vernacular house. The said transformation may be observed with reference to plan, walls, openings, roofing, flooring, columns / beams (Structural Supports), mouldings, exterior open spaces like courtyard, outside seating, or Manduva (the cut-out in the roof of a pitched roof house, surrounded by corridors followed by rooms or just surrounded by rooms) and other visual features. In addition, the transformation in the aforementioned components may be in terms of the material used, ornamentation, colour, finish, etc.

The transformed houses may resemble the vernacular houses despite the use of new materials and construction techniques or they may be a totally different typology. Thus, the reasons for transformation in vernacular houses vary from place to place and from one case to the other, more as a response to available means and actual needs of every place. The users may be or may not be in favour of the transformations but the physical fact is that transformations do tqake place in vernacular houses in rural areas and peri-urban areas. In this situation, it is pertinent and rational to ascertain the level of acceptance of people towards vernacular houses.

With respect to the new houses in a place which are built by individuals or the government, the new houses have very little relevance to the architecture of the place. Consequently, identity is in question. The users get deprived of homestead and belongingness to the new house. Lack of time and lack of willingness among people for building houses in the vernacular style are cited as major constraints and that none are interested any more. It is also loosely stated that people in the rural areas have no attachment to the old houses any longer. In this context, a few pertinent questions emerge as to whether the people no longer have attachment to vernacular components, whether people's patronage of vernacular architecture is reducing, and what may be the reasons for the said problem, if it exists.

Aims:

This paper aims to measure the social acceptance of vernacular houses of a selected rural area through an evidence-based or questionnaire survey. Based on the outcome of this research it intends to sensitize the architects, builders and policy makers on the significance of sustaining local knowledge and vernacular architecture. In this context, vernacular houses in Ghantasala village of Krishna district of Andhra Pradesh state were studied for mapping the transformations.

The research aims at measuring the social acceptance of vernacular houses of the study area through qualitative perception survey and sensitize the architects, builders and policy makers on the significance of sustaining local knowledge and vernacular architecture of the place.

Objectives:

- To identify and map vernacular houses in the study area and select representative sample houses through random sampling technique for further study.
- To derive a list of common vernacular building components across the study area, and map the visual as well as physical transformation of vernacular building components in the identified houses.
- To conduct a socio-economic and perception survey amongst the households of identified houses for measuring the people's acceptance towards vernacular houses.
- To sensitize as well as recommend to the architects, housing providers and decision makers on the significance of sustaining vernacular architecture and local knowledge of the region through documentation, design interventions and policy measures

Literature Survey:

The rich traditions of Andhra Pradesh are reflected in their way of life, song of 'maateluguthalli' (my Telugu mother), dance of Kuchipudi (traditional dance form of Andhra Pradesh), trees of neem, fruit of mango, costume of saree, flower of blue water Lilly, bird of Indian roller, sport of Kabaddi and animal of Blackbuck. Similarly the built form of settlements consists of the following:

- Manduva (courtyard),
- Pantapolam (agricultural field),
- Neetibhavi (a well of water),
- Tulasikota (small podium-like stone or cement construction containing the plant of Tulasi or holy Basil),
- Rangoli (traditional Indian decoration and patterns made with ground rice and other colour powders, particularly during festivals),
- Vuyyaala (cradle or a swing),
- Thiragalu (a traditional grinding stone),
- Pasupugadapa (a wooden door threshold painted or embalmed with turmeric powder or yellow paint),
- Arugu (traditional seating platform in front of houses) etc.

Industrialisation and globalization have led to the development of human settlements in India and the world over, over a period of time and space. One of the facets of the said development in general is the displacement, replacement and inevitably, transformation of human settlements. Transformation of human settlements is considered as a natural phenomenon. However, the nature, causes and extent of transformations may vary from one settlement to the other, be it rural, peri-urban or urban. Rural settlements in India and Andhra Pradesh which are an amalgam of need-based developments, undergo transformation without losing the connection with their core vernacular values which are intrinsically constituted by contextual, spatial and cultural values of the people therein; whereas, urban areas are a reflection of made-up developments which are less organic in nature and hence the transformations therein are less visible or are more as an expected eventuality. Hence, in the wake of transformation of settlements, it can be construed that the most visible transformation can be observed in rural settlements than in urban settlements.

In the context of a comparative study of transformations in traditional house form in one of the regions of india, Kotharkar (2012) reiterated that it was a gradual process and occurred with due respect to climate, community and cultural needs as a process of refinement. This may not mean that the inhabitants have swayed to the effects of urbanization and it may not as well mean that the inhabitants had less regard for the vernacular aspects of the built fabric. In their attempt to understand the changes in culture and architecture of Madhya Pradesh, India from vernacular to modern, Patidatet. al. (2014) claim that provisions should be made to incorporate vernacular architecture and traditional knowledge in the policies in order to protect and conserve the rich cultural and architectural heritage. To achieve the same, the elements of vernacular should be incorporated in the planning and architecture of buildings of today while protecting the existing vernacular houses.

As part of analysing vernacular design principles in India in general and case study of a vernacular dwelling in Godavari coastal region of Andhra Pradesh in particular, Chadalavadaet. al. (2017) says that vernacular architecture is a style of architecture where design decisions are influenced by tradition, cultural significance and climate responsiveness. Kotharkar (2012) while studying the transformations in traditional house form draws attention to the sudden changes that are brought in the patterns of living due to modernization. While accepting or agreeing to the aforementioned need-based or modernity-induced changes, there is a pertinent need to better understand the attachment of the users of vernacular houses to their core house.

Khandekar (2017) says that it is an informal functional architecture of structures, often in rural areas of India, built with local building materials and were designed to address the needs of users. Önder et. al.(2010) mention that Home reflects the view of a person, his or her place as well as social status and collectively provides a different meaning than shelter. Arias (1993) asserts that meaning of home varies, on the basis of user's perception. Also, in the context of memories about a house, Bachelard (1994) expresses that the house we were born in, is physically inscribed in us. It is a group of organic habits. He also asserts that meaning of home varies, on the basis the user's perception. Smith (1994) discusses about necessity of continuation, self-expression, identity which is personal or familial in nature and societal relations for a house to become home. These ideas are pertinent in vernacular architecture too..

Research Methodology

The research focused on a rural area and also a peri-urban area so that the possible influence if any, of an urban area on the transformation of vernacular houses in the nearby rural areas can also be captured. Thus, a village called 'Ghantasala', was chosen as the study area as per the aforementioned rationale and also based on the existence of several houses which are in vernacular style.

A questionnaire survey was administered to understand the transformations. A documentation exercise was then conducted and a few houses were studied in detail in the Ghantasala village. The respondents were chosen based on their direct (owner/successor of the old house) or indirect (tenant) association with the houses in question and were the users of such transformed houses. An initial set of forty components were identified out of which ten key spatial and /or physical components of a house, were considered as parameters to understand the transformations. The selected parameters are given in Table 1.

Table 1: Parameters for studying of transformation in vernacular houses

S.No.	Parameter of Transformation	Interpretation of transformation
1	Plan	Change in original plan or additional built space
2	Openings	Change in the existing ones or provision of new type Doors, Windows
3	Roofing	Change of roofing style / material for existing space or additional space
4	Flooring	Change of floor material in the original space or additional space
5	Columns / Beams (Struc. Supp.)	Change in the existing ones or provision of new type in the additional space
6	Mouldings	Change in the original ones or provision of new type in the additional space
7	Outside seating	Exists as it was or transformed / removed
8	Manduva	Change in the original one by modification with new material
9	Walls	Change in the original ones or provision of new material in additional space
10	Open space	Exists as it was or used for additional built-up space

There are various definitions of Vernacular Architecture. However, for the purpose of this research, houses which are constructed using clay, clay blocks or bricks for wall; timber truss – clay pan tiles for roof; timber rafters coupled with madras terracing for flat roof; timber for doors and windows and for ornamentation; clay plus red oxide or naapa stone tile for floor, is set as definition in the context of the selected rural area.

There were transformations in respect of material, built up area, change of spaces, decoration, colour, structural members etc. A few of the transformations like in roof, floor, openings etc. were easily visible while transformation with respect to location change of functional spaces, addition of a smaller room within a larger room etc. was known only after interaction with the users. The transformation phenomenon was found to be of three types, namely,

a) transformation as a phenomenon which happened within or on the existing vernacular house;

b) transformation as a phenomenon which happened in the form of construction of an additional building detached from the existing vernacular house but on the same plot / site; and

c) transformation within or on the existing vernacular house as well as by way of additional building detached from the vernacular house.

The study was limited to considering all the aforesaid three types, as transformation as a whole without making any specific distinctions between the three types. Users' responses to the questionnaire survey about the attachment to transformed house against attachment to the earlier / original house were scored on a 5-point Likert scale, as given in Table 3.

Case study: Ghantasala, Andhra Pradesh, India:

Ghantasala is a village situated in the Krishna district of Andhra Pradesh state of India. It is one of the 20 rural areas of Ghantasalamandal. It is located at a distance of 21 km west of Machilipatnam, 11 km east of River Krishna and 60 km south east of the city of Vijayawada. Owing to its geographical profile and proximity to transport avenues, it flourished as one of the important places of trade and also religious worship. Limestone Columns belonging to the hypostyle halls of Buddhist monasteries dated 2 BCE were unearthed in and around Ghantasala. Buddhist mounds and ancient Hindu temple places like Jaladheeswaraswamy temple indicate the past glory of this place. However, it can be said that there is no visible influence of Buddhist architecture on the built fabric.

Fig. 1: Ghantasala village in Andhra Pradesh, India
Source:https://www.google.co.in/maps/place/Andhra+Pradesh/@15.8482222,76.2657036,6z/data=!3m1!4b1!4m5!3m4!1s0x3a3546f8ae93d47f:0x33d1bbbe95adcd83!8m2!3d15.9128998!4d79.7399875,

As per the 2011 Census of India, the population of the village of Ghantasala village is 9,200 persons. Out of the total population, nearly 56% are involved in work. Nearly 95% of the said workers are into 'main work' (more than 6 months of earning period of a year) while 5% are into 'marginal work' activity (less than 6 months of earning period of a year). Out of the total main workers, 421 people are agriculturist (farm owners or lessee) while 2,709 are agricultural labourers. Accordingly, economy of Ghantasala is primarily agrarian. A bird's eye-view of Ghantasala is presented in Figure 2.

Fig. 2: Boundary and Birds eye view of Ghantasala village, A.P
Source: https://www.google.co.in/maps/place/Ghantasala, accessed on 14.09.2019

As observed in Figure 2, houses are mostly pitch roofed with Pan tiles; the rich farm belt around the village is where the main workers are engaged for their earning.

Transformation of Vernacular Houses in Ghantasala:

Dwellings in Ghantasala are built using clay, clay blocks or bricks for wall; timber truss and clay pan tiles for roof; timber rafters coupled with madras terracing for flat roof; timber for doors and windows and for ornamentation; clay plus redoxide or naapa stone tile for floor till 1990. Houses which were re-built beyond this period used bricks for walls; wooden rafters – madras terracing or reinforced cement concrete for flat roof; timber for doors and windows and for ornamentation; and naapa stone, cuddapah polished stone, marble orceramic tile for floors.

Quantitative Research:

The need was pertinent to understand the users' attachment to vernacular components of the houses and accordingly ascertain the relations between the socio-economic profiles of users and the attachment to the vernacular houses. In search of a closely relevant example of a testing tool for assessing people's acceptance of vernacular houses, it was found that t-test, Mann-Whitney U test and chi-square test were useful. Önder (2010) demonstrated the use of t-test, Mann-Whitney U test and chi-square test for measuring user participation and degree of satisfaction in the context of after-earthquake houses in Düzce, Turkey. Accordingly, a 'Critical – t' test and 'Chi-Squared' test were conducted respectively.

i. t-test

- The t-test was introduced in the year 1908 by W.S Gosset. A t-test is used as a tool for testing hypothesis by testing of an assumption applicable to a population. A t-test looks at the t-statistic, the values of t-distribution and the degree of freedom to ascertain the probability of difference between two given sets of data.
- The two data-sets are:
  - attachment of the users to the original / untransformed condition of the house
  - attachment of the users / owner to the existing / transformed condition of the house

$$\text{Testing Hypothesis "t"} = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad (1)$$

where, $\bar{x}_1$= Mean of x1 ; $\bar{x}_2$= Mean of x2

$$\text{StandardDeviation "}S_1\text{"} = \sqrt{\frac{\sum(x_1 - \bar{x_1})^2}{(n_1 - 1)}} \quad (2)$$

$$\text{Standard Deviation "}S_2\text{"} = \sqrt{\frac{\sum(x_2 - \bar{x_2})^2}{(n_2 - 1)}} \quad (3)$$

The rationale of the t-test is that if the Absolute value of 't' is more than critical 't', the hypothesis is considered to be proved. In case of this research, it can be construed that the transformed vernacular house is not to the satisfaction of the users. In other words, vernacular house is to the satisfaction of the users.

In addition, the test helps in assessing whether there is a significant difference between the two data-sets. The rationale is, that the 'p' value derived from the two sets of data should be less than the chosen significance factor (say, 0.05, which implies that there is 95% confidence factor on the test result). If so, it can be construed that significant differences exist between the two data-sets.

As a whole, there are 250 data sets considering 25 households studied across 10 parameters each. 't'-test was conducted for each individual house while 'p'-value was checked for each individual house as well as for all the houses cumulatively (considering the cumulative sum of scores of users' response in terms of their attachment to vernacular components of the earlier house and the present or transformed house). The findings are summarized and presented in Table 4, Table 5 and Table 6 for reference.

Vernacular Houses of Ghantasala – Findings and analysis:

Houses having similar character in terms of age (more than fifty years), size of the plot, number of storeys, predominant occupation, structure of family structure etc. have been chosen of the total number of houses. Twenty houses (including two smaller houses within one premises, thereby leading to twenty five respondent households) have been considered for documentation as well as survey through questionnaire interviews with the residents of the selected houses. All the selected houses exhibited transformations but the degree of transformations was different from one house to the other. Important areas of transformations in the houses are:

- Addition of an extended house (attached, semi-detached or detached) using new materials and building techniques.
- Addition of toilet inside the old house, so as to address the needs of the elderly.
- Addition of thermocol – aluminium panel' false ceiling or cement asbestos etc. in bedrooms.
- Diversion of water received from the erstwhile open manduva, through a PVC pipe as whereas the original system was of collecting rain water directly into a floor pit inside the house, within the living area.
- interchanged usage of spaces like Kitchen, granary, worshipping room for reasons of Vastu, a popular belief among people

Details of the houses selected for study are presented in Table 2.

Table 2: Details of selected houses for study

House / Household No.	Plot Area (Sq.Yd)	Built Up Area (Sq.Yd)	Orientation	Year of Construction	Age of House (Years)	User (Owner / Tenant)	Occupation	Education Standard (Std.)	HH Size	Income P.A (INR Lakh)	Income Group	Year of Transformation
1	725	250	West	1943	76	Owner	Farmer	Graduation	5	10-15	HIG	1980
2	1000	300	North	1929	90	Owner	Farmer	Secondary School	1	10-15	HIG	2010
3	345	150	South	1901	118	Owner	Business	X Std.	5	2-5	LIG	2005
4	250	100	South	1918	101	Owner	Farmer	Graduation	3	5-10	MIG	1999
5	500	250	South	1953	66	Owner	Business	X Std.	2	2-5	LIG	1971
6	600	250	North	1918	101	Owner	Landlord	Illiterate	3	2-5	LIG	2010
7	750	420	North	1918	101	Owner	Farmer, Business	Graduation	8	10-15	HIG	1988
8	325	175	North	1961	58	Owner	Farmer, Business	10+2	4	5-10	MIG	1978
9	500	175	East	1965	54	Owner	Farmer, Business	10+2	5	2-5	LIG	1978
10	500	200	East	1944	75	Owner	Business	10+2	2	2-5	LIG	2010
11	2000	500	South	1939	80	Owner	Farmer	Graduation	5	10-15	HIG	1995
12	200	100	East	1920	99	Owner	Farmer	Illiterate	2	1-2	EWS	2000
13	200	100	West	1900	119	Owner	Farmer	Secondary School	4	2-5	LIG	1995
14	200	100	East	1900	119	Owner	Farmer	X Std.	3	2-5	LIG	1995
15	250	150	North	1900	119	Owner	Farmer	Secondary School	3	2-5	LIG	1995
16	600	250	West	1934	85	Owner	Cattle Rearing	Graduation	2	5-10	MIG	1985
17	200	100	North	1959	60	Owner	Farmer	Secondary School	1	2-5	LIG	1985
18	2400	300	North	1945	74	Owner	Business	Graduation	2	5-10	MIG	2000
19	2400	500	North	1945	74	Owner	Farmer	Graduation	4	2-5	LIG	2010
20	600	250	East	1951	68	Owner	Farmer	X Std.	4	2-5	LIG	2005
21	600	250	East	1951	68	Owner	Farmer	Secondary School	4	5-10	MIG	2005
22	600	200	East	1930	89	Owner	Teacher	Post Graduation	2	5-10	MIG	2010
23	800	200	West	1911	108	Owner	Farmer	XII Std.	3	2-5	MIG	2000
24	300	100	East	1969	50	Owner	Farmer, Business	XII Std.	3	2-5	LIG	1995
25	400	200	East	1940	79	Owner	Housewife	XII Std.	1	10-15	HIG	1995

Location of houses given in Table 2 is indicated in Figure 3. Out of all the houses, four houses, namely House number 5, 6, 14 and 20 are selected for detailed explanation for this Paper, based on their plot size, occupation and age of the building.

Key plan, section and transformation scenario of the said four houses are illustrated through Figures 4,5, 6 and 7.

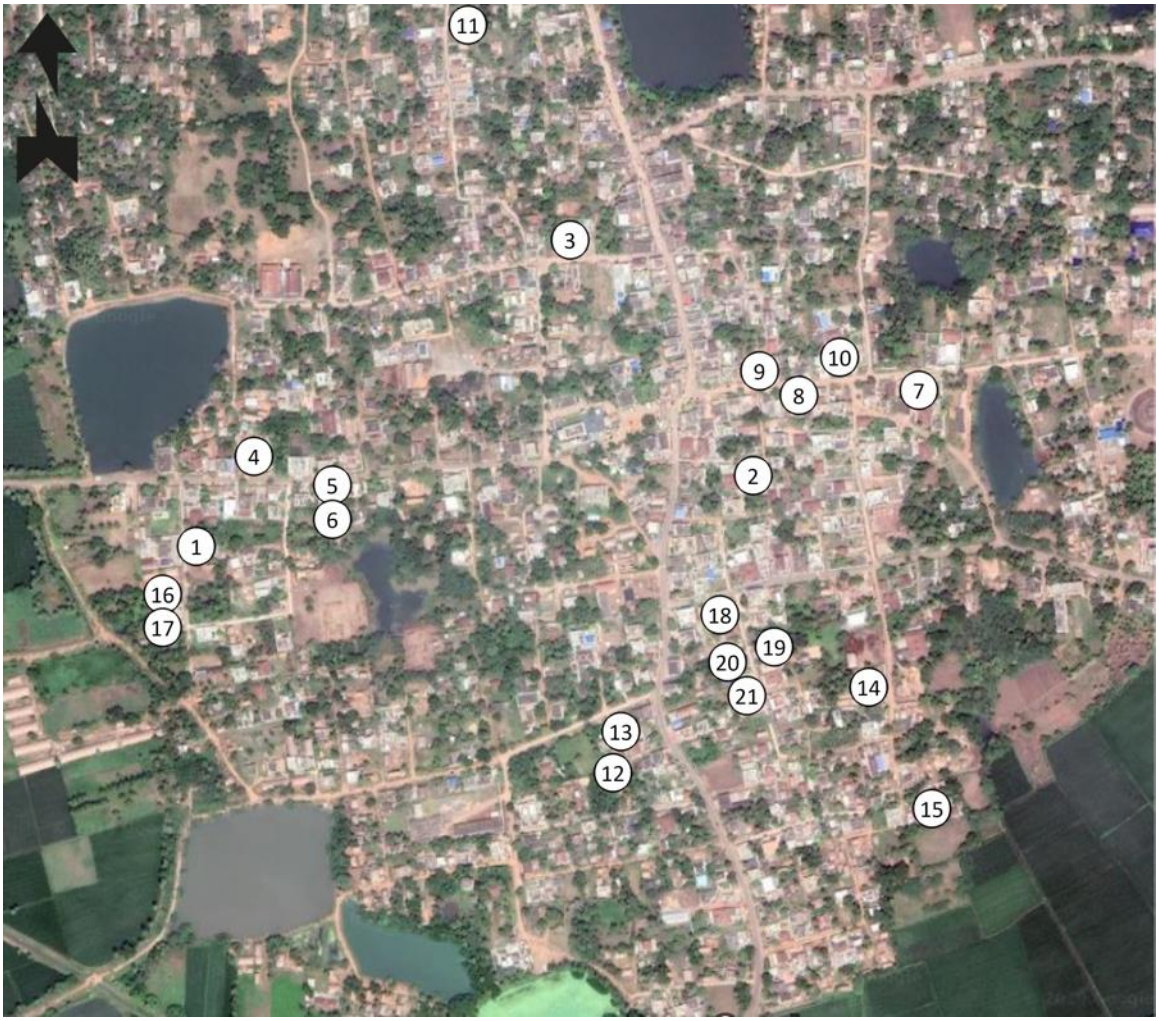

Fig. 3: Location of selected vernacular housesin Ghantasala village, A.P
Source: https://www.google.co.in/maps/place/Ghantasala, accessed on 14.09.2019 and Author

Transformation was mapped with respect to the ten parameters given in Table 2. Scoring of users' responses to the questionnaire survey was done on a 5-point Likert scale, as given in Table 3 below:

Table 3: Scoring of users' responses

S.No.	Users' response about Attachment	Numerical Score for users' response
1	No attachment (user strongly disagrees)	1
2	Attachment is below Average (user's opinion is 'not very satisfactory')	2
3	Average (user's opinion is neutral)	3
4	Fair (user is in agreement)	4
5	Good (user strongly agrees)	5

With the help of the said scores for each respective house, t-test was conducted to ascertain critical 't' value and 'p' value. The values derived are presented in Table 4 and 5.

Table 4: Summary of t-test for each individual house

House No.	Derived critical 't' Value of house	Derived p' Value of house
1	-2.0404408	0.0088142
2	1.8762601	*0.0639232*
3	2.6117145	0.0292016
4	2.1908902	0.0009801
5	2.1611819	0.0022024
6	2.6117145	0.0292016
7	2.1651339	0.0466032
8	2.2497640	0.0183937
9	1.9952172	0.0241759
10	1.9952172	0.0241759
11	2.3463538	0.0032829
12	-2.4440912	0.0434211
13	1.9662480	0.0009617
14	1.9662480	0.0009617
15	1.9245009	0.0047673
16	3.3824071	0.0023233
17	3.3824071	0.0023233
18	*0.1728253*	0.0001711
19	*-1.5554275*	0.0014979
20	2.2247938	0.0001873
21	3.8146448	0.0010027
22	2.1081851	0.0314513
23	2.6097788	0.0069817
24	2.3688968	0.3308902
25	3.1615621	*0.0957015*

Notes:

i. Table value of the critical 't' is **1.833** considering the data-sets and selected 10 parameters. The table value selected is with reference to degree of freedom of 9 (number of parameters 10 minus 1) for 1 tailed test, paired data with 0.05 significance factor (95% confidence factor for the result). Derived value of 't' is to be seen in its absolute value.

ii. 'p' value is 0.05, a significance factor indicating 95% confidence factor for the results.

Table 5: Summary of 'p'-value (part of t-test) on cumulative score of 10 parameters

S.No.	Parameter	Cumulative score of users' response	
		Earlier house	Present house
1	Plan	88	91
2	Openings	66	84
3	Roofing	63	96
4	Flooring	68	87
5	Columns / Beams (Struc. Supp.)	40	95
6	Mouldings	33	95
7	Outside seating	61	96
8	Manduva	43	105
9	Walls	84	94
10	Open space	76	101
	'p'-value	**0.000497974**	

Results

a) As per the t-test, it was observed that ***absolute*** value of the 't' is higher than **1.833**, which isthe table value of critical 't', except the 't' in case of House number 18, 19. However, 'p' value is in order. Thus, it was proved that the transformed vernacular house is not to the satisfaction of the users. In other words, there is users' acceptance for the original vernacular house.

b) As per the t-test, it was also observed that the derived 'p' value is lesser than 0.05 significance factor except the 'p' in case of House number 2, 25. However, the 't' value is in order. Thus it was construed significant difference is there between the two data-sets.

c) In order to further validate the results, 'p'-value was checked for all the houses cumulatively (considering the cumulative sum of scores of users' response in terms of their attachment to vernacular components of the earlier house and the present or transformed house) as in Table 5 above. The result showed that the cumulative 'p' value is less than the 0.05 significance factor.

To sum up, the hypothesis is proved reading the above results together.

ii. Chi-Squared test

A **Chi-squared test** (also termed as x^2 *test*), is a test for a hypothesis where the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. The test is used to ascertainif there is a significant difference between expected frequencies and observed frequencies in one or more categories. In the standard applications of this test, the observations are classified into mutually exclusive classes, and there is some theory, or say null hypothesis, which gives the probability that any observation falls into the corresponding class. The purpose of the test is to ascertain how likely the observations that are made would be, assuming the null hypothesis is true.

$$f_e = \frac{(\text{Row total})(\text{Column Total})}{\text{n(Total number)}} \quad (4)$$

$$D_f = (r-1)(C-1) = 1 \quad (5)$$

In order to ascertain the relation between socio-economic parameters and the attachment to vernacular houses, Chi-squared test was conducted across *six* parameters namely, Education, Occupation, Family structure, Income, Plot area and Type of House (Built up area). The same is presented in Table 6.

Table 6: Summary of Chi-Squared test

S.No.	Parameter	Low Accep.	High Accep.	Expec. Accep.	Total	x2a	x2b	x2a+x2b		Table Value	Signi. level
		fo1	fo2	Fe	fo1+ f1	Sq (fo1- fe)/fe	sq(fo2- fe)/fe	Gross Total	df	TV	LS
A	**Education**										
1	Medium (Up to PUC)	12	18	10.8197	30	0.1288	4.7651	4.8939	1	6.365	0.01
2	High (Degree and above)	10	21	11.1803	31	0.1246	8.6246	8.7492	1	6.365	0.01
		22	39		61	0.2534	13.3897	**13.6431**		**6.365**	**0.01**
B	**Occupation**										
1	Business	4	10	5.4194	14	0.3717	3.8717	4.2435	1	6.365	0.01
2	Agriculture	20	28	18.5806	48	0.1084	4.7751	4.8835	1	6.365	0.01
		24	38		62	0.4802	8.6468	**9.1270**		**6.365**	**0.01**
C	**Family type**										
1	Nuclear	25	46	26.43617	71	0.0780	14.4780	14.5560	1	6.365	0.01
2	Joint	10	13	8.56383	23	0.2408	2.2980	2.5388	1	6.365	0.01
		35	59		94	0.3189	16.7760	**17.0949**		**6.365**	**0.01**
D	**Annual Income (in INR)**										
1	10 Lakh and above	12	16	17.53535	28	1.7473	0.1344	1.8818	3	11.34	0.01
2	5-10 Lakh	7	10	10.64646	17	1.2489	0.0393	1.2882	3	11.34	0.01
3	2-5 Lakh	40	10	31.31313	50	2.4099	14.5067	16.9166	3	11.34	0.01
4	Less than 2 Lakh	3	1	1.494949	4	1.5152	0.1639	1.6791	3	11.34	0.01
		62	37		99	6.9214	14.8442	**21.7656**		**11.34**	**0.01**
E	**Plot Area**										
1	Up to 500 Sq.Yd	37	15	25.73737	52	4.928504	4.479524	9.408028	1	6.365	0.01
2	500 Sq.Yd and above	12	35	23.73737	47	5.803757	5.343757	11.14751	1	6.365	0.01
	Total	49	50		99	10.73226	9.823281	**20.5555**		**6.365**	**0.01**
F	**Built up area**										
1	100-200 Sq.Yd	15	20	13.03191	35	0.2972	3.7258	4.0230	3	11.34	0.01
2	201 to 300 Sq.Yd	17	30	17.5	47	0.0143	8.9286	8.9429	3	11.34	0.01
3	301 to 400Sq.Yd	2	6	2.978723	8	0.3216	3.0644	3.3860	3	11.34	0.01
4	above 400Sq.Yd	1	3	2.510638	4	0.9089	0.0954	1.0043	3	11.34	0.01
		35	59		94	1.5420	15.8142	**17.3562**		**11.34**	**0.01**

Note: 1 Sq. Yd = 0.83 Sq.M

Results

a) In line with the Research hypothesis, there is a relation between the six socio-economic parameters and acceptance of vernacular houses, despite the need-based transformation of vernacular houses. The expected frequencies are compared with the observed ones, and found that greater is the difference between them, the larger is the value of X2 in Chi-Square test.

b) With 1 as degree of freedom and .001 as level of significance the derived values are much larger than the respective table values, based on 2x2, 3x2 or 4x2 table matrices. Hence the null hypothesis is rejected and the research hypothesis is supported that the transformation is evident and people have attachment to vernacular houses as a whole.

On the other hand, there were visible transformations in the chosen houses in spite of the fact that the users had attachment to the original vernacular houses. Thus, an attempt was made to understand the reasons for the transformations of the vernacular houses of Ghantasala village. The reasons as revealed by the questionnaire survey emerged from various concerns which were personal, circumstantial or unavoidable in nature. The general applicable reasons with reference to houses studied, are as follows:

- Inheritance of ancestral property – leading to subdivision and customization by the successors
- Change of family from joint family to nuclear small family system
- High cost of replacement of old components in partial or full
- Employment opportunities in cities and resultant migration of educated Children to urban areas within or out of country
- Marriage of children and resultant migration to urban areas within or out of country
- Living as widow or widower with least interest in materiel things
- Economic constraints to repair, replace or reconstruct in vernacular style Economic constraints to bear repair or replacement cost
- Non-availability of skilled workers to repair, replace or reconstruct houses in vernacular style
- Compliance of Vaastu norms
- Improvement in economic condition and general urge to ape modern building style as a result of peer pressure
- Present generation may not be fully in favour of old house due to many of the problems listed above
- Peer pressure and combination of above factors

However, all the users and general public have a sense of pride associated with the vernacular houses and are happy to be associated with such houses but for the different levels of tolerance to maintenance cost, non-availability of skilled labour etc.

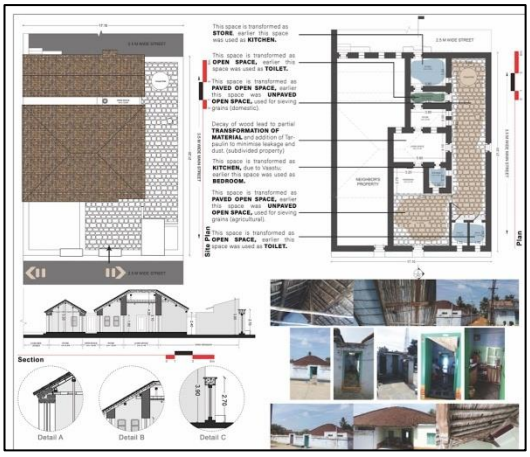

Fig. 4: Plan, Site Plan, Section and transformations of House no. 5;
Source: Author

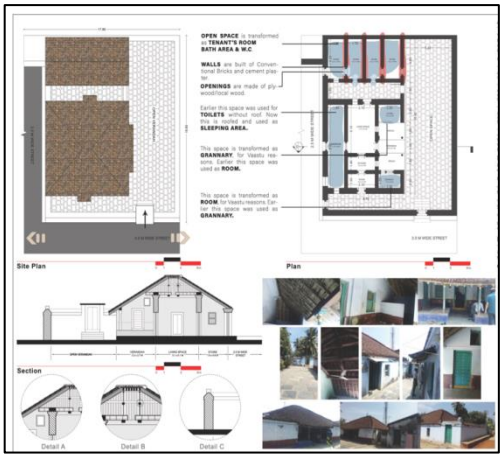

Fig. 5: Plan, Site Plan, Section and transformations of House no. 6:
Source: Author

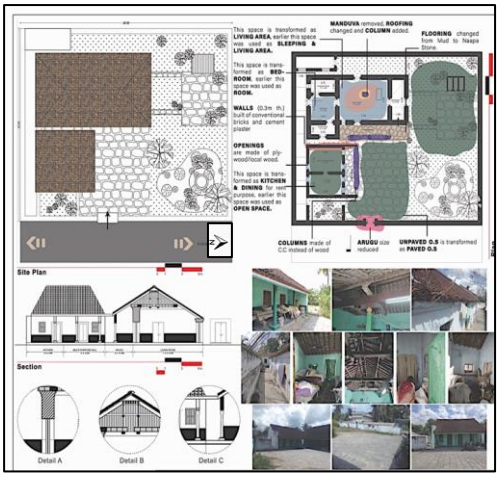

Fig. 6. Plan, Site Plan, Section and transformations of House no. 14; Source: Author

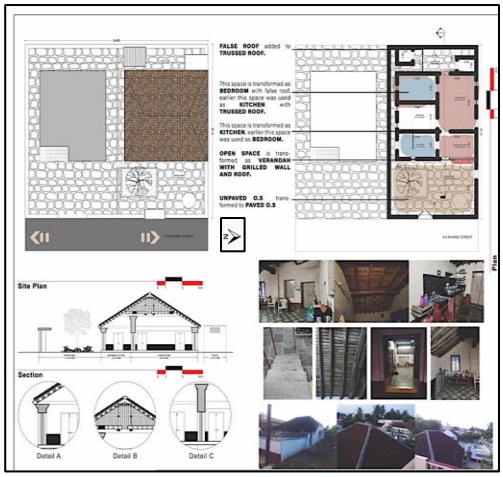

Fig. 7. Plan, Site Plan, Section and transformation of House no. 20, Source: Author

Conclusions:

As narrated in the earlier section of this paper, Absolute value of 't' is more than the table value of critical 't' of 1.833. Similarly, the absolute value of 't' is more than critical 't', irrespective of their plot size and built up area, user's occupation and orientation of the house. Thus, it can be understood that the transformed vernacular house is not to the satisfaction of the users. It can be inferred that there is people's acceptance and attachment for vernacular houses.

It is important to consider phenomena like the degree of people's acceptance of housing types, schemes and transformations so as to make any housing scheme meaningful, relevant and successful. To achieve the same, it may be necessary to document the existing rural houses so as to view the regional variations in rural houses and select essential building components viz., spatial, material, visual, physical and aesthetic aspects of housing settlements in general. This can become be a credible repository with the government.

Further, as part of suitable skill development programmes of the state, the government can train building skilled and semi-skilled workers of the construction industry with the 'hands-on' experience of working with vernacular construction techniques and the relevant building materials. If this can be accomplished, one of the quoted reasons for the transformations which is "non-availability of skilled labourers" can be addressed to a certain extent. If deemed fit, the government can subsidize the cost of building materials to be used for repair and / or restoration of repairable vernacular houses. As a result, life and durability of the existing housing stock of vernacular category can be extended, leading to the preservation of the local knowledge of construction and vernacular architecture of the regions.

The Way Forward:

As and when any new housing scheme is envisaged for a rural area, the outcome of this documentation may be considered to inspire the design of an envisaged new housing scheme. Accordingly, the housing provider can attempt to ensure that the beneficiaries of the proposed housing schemes are in a position to accept and adapt to the proposed housing scheme, due to its close relevance to the vernacular houses of the given area with due consideration to the people's acceptance level. In a nutshell, a housing scheme which can balance the need for provision of

new housing duly considering the vernacular elements and components of the place can result in meaningful implementation of the proposed housing schemes.

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