OCCUPATION AND BUILT FORM: A CASE OF WEAVER'S HOUSING IN THE STATE OF ANDHRA PRADESH, INDIA

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Abstract - This paper aims to envisage the provision of occupationally (weaving) driven housing for better living for households in the state of Andhra Pradesh, India. The objective is to analyze the built form of weaver's housing and assess the occupation impact surface and surface distribution of built up areas at plot and unit levels in different manner and in different percentage through space syntax method. The study is conducted in Mangalagiri which is located in the state of Andhra Pradesh, India. The occupational activities involving the work spaces in the house or within or outside the plot has been clearly understood for analyzing the spatial pattern and occupational influence. Space syntax method is adopted to quantify, represent and interpret spatial configuration of buildings in relation to the occupational spaces.

Keywords - Occupation, Built Form, Weaver's, Housing, household, spatial activities

I. INTRODUCTION

Occupation is considered as a set of economic activities while involving self-employment by making use of human or materials endowments resulting in wages for the livelihood. Occupations have been perceived by individuals as an integral aspect of his or her individual identity and could be segregated as productivity, self-care or leisure (Creek, 2006). Every individual is known to engage in a distinct constellation of occupation on a day-to-day basis and throughout their span of life (Christiansen, 1999). Occupations can occur in physical as well as spatial environments and the performance of individuals is shaped by these. Spaces required for occupation could either be outdoors or indoors, up a mountain, in water, at a home, in an office or a workshop for that matter. The spatial understanding of these houses which are also occupationally driven or influenced is an interesting study and plays a major role in developing housing standards. The researcher has adopted the following research methods to identify the occupation and built form relation in selected case area.

a) Descriptive, Exploratory and Explanatory
b) Space Syntax

The study was conducted in the selected village with five houses in detail and the same was analysed through the two research methods as mentioned above. Direct observation, sketches and photographs and structured interviews were conducted to collect the data required for analysis.

II. CASE AREA: MANGALAGIRI , HOUSIE NO.1

Mangalagiri Village

Village Profile

Mangalagiri is a village in Guntur district situated between the twin cities of Vijayawada and Guntur, Andhra Pradesh, India. Mangalagiri translates to the auspicious hill in the local language before the sarees came into existence, Mangalagiri was always known for its pilgrimage importance. The main occupation practiced is Handloom weaving. Nearly 50% of the population is dependent on this cottage industry. The occupation of weaving in Mangalagiri is as old as 500 years old as per the inscriptions found in this region. It is said that as per the ancient traditions, the pilgrims had to purchase a sari from the local weavers after offering obeisance to the lord, which was another way of giving a livelihood to the local weavers. Thus, grew the popularity of the Mangalagiri saree. The settlement pattern observed is planned and grid iron as shown in figure 1.

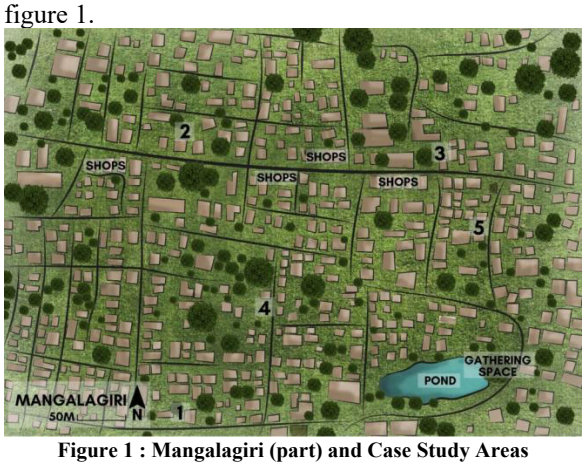


Figure 1 : Mangalagiri (part) and Case Study Areas
Google Earth image (accessed 2018)

House and household character

The house (H1) corresponds to case study of first house in Mangalagiri as shown in figure 2. The house is around 250 years old with 7 members (4 male and 3 female) in the household situated in 450 Sq Mts plot, with a built-up area of 180 Sq Mts. Five members of the family are involved in the occupation of weaving which is a home business.

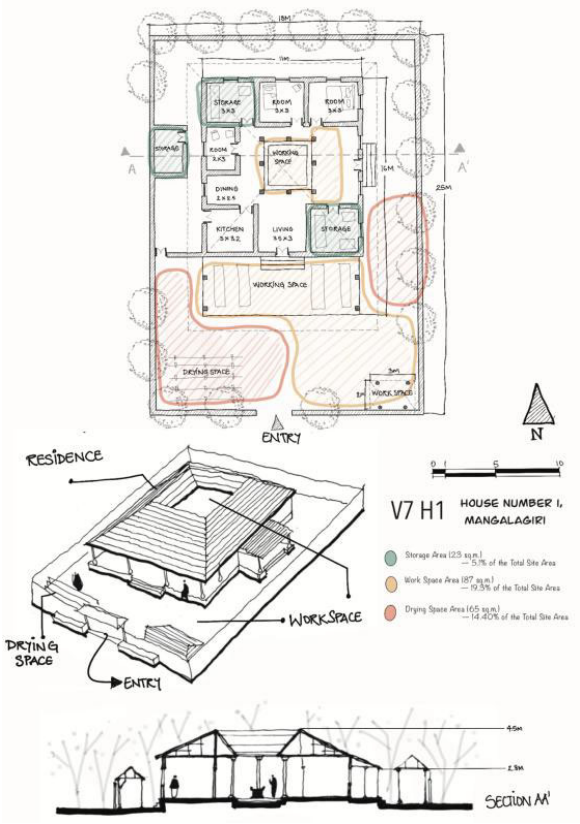


Figure 2: Plan, View, Section, Household and Occupational activity spaces (House No.1)

House no.1

The house is made of Mangalore roofing, walls are random rubble stone masonry, and local stone is used for flooring. The house is known as Mandava house which were once most found here are almost in an extinct or a demolition stage. The rooms are distributed around the centrally located Manadava or courtyard, with a verandah at the main entry.

Activity space

Household Activity Space (HHAS)

The bed rooms, kitchen, dining and store rooms are distributed around the courtyard. The spaces are exclusively earmarked for household activities.

Occupational Activity Space (OAS)

The occupational activity related spaces are the front verandah space, courtyard and storage spaces. The distribution and division of spaces for working is planned without any hindrance to the household activities. Based on the Vastu Purusha Mandala rules and according to the need of the space the weavers had provisioned and planned the spaces of their houses. The yard for dying and starching was in the south and southwest part of the house. The house consists of a Verandah with 3-4 pit looms for the weaving equipment. This is also used as informal gathering space. The main house has a hall for seating leading to the central courtyard with a Tulsi plant. The remaining space is used as a weaving area, as a dining area and for rituals and is seamlessly coalesced by the play of peristyles and gallery spaces which are surrounded by the courtyard. It was the spatial, social, and environment control center for the home. As per the survey it shows that occupational influence at the site level is 38.8% and is 18.75% of influence at the individual unit level.

Mangalagiri houses are marked by linear units enclosing a large courtyard space. These courtyards, frequently used for social activities, are primarily used by the women of the household for various pre-loom activities. These activities cannot be carried out indoors since most of the indoor space is allotted to the loom set-up. In modern structures, these open spaces are hard to achieve, and this creates a space constraint for the weaving process.

III. SPATIAL ANALYSIS

Space syntax method is adopted to quantify, represent and interpret spatial configuration of buildings in relation to the occupational spaces. Space Syntax method is a set of techniques for representation, quantification, and interpretation of spatial configuration in buildings and settlements. (Hillier,1986). The spatial arrangement is depicted through use of justified graphs that are derived from spatial layouts

For example, if Space A is directly accessible from Space B, the depth between them is 1. If Space A is accessible from Space B only after crossing Space C, the depth between Space A and Space B is 2. The depth between Space A and Space B is therefore, the number of intervening spaces between them plus one.

Integration value ranges from 0 to 1. It denotes how integrated or segregated a given space is with respect to all other spaces in a particular configuration. The integration value 0, indicates maximum integration (No depth), and the integration value 1, is indicative of maximum segregation (Maximum possible depth).

Integration Value of a space is equal to - $\frac{2(\bar{d}-1)}{k-2}$ where:

$\bar{d}$ = mean depth of the space from all other spaces in the layout, and

k = Total number of spaces in the configuration.

If numerical differences of integration values in functions across a sample are in a consistent order, then we can say that there is a cultural pattern. This is called inequality genotype. With the help of Shannon's entropy formula, this can be given a numerical value called as difference factor. This is used to measure differences in integration values of spaces in a layout. If difference factor is closer to 1, it

signifies a weak inequality genotype, and if it is closer to 0 it indicates strong inequality genotype. In this study, difference factor is calculated by considering integration value of most integrated space, least integrated space and average integration value.

Difference factor is given by the formula, $H = -\sum\left[\frac{a}{t}\ln\frac{a}{t}\right] + \left[\frac{b}{t}\ln\frac{b}{t}\right] + \left[\frac{c}{t}\ln\frac{c}{t}\right]$, where a, b and c are minimum, maximum and mean integration values and t is the sum of a, b and c.

This value is further relativized across samples, by using the formula for Relative difference factor:

$$H^* = \frac{H - \ln 2}{\ln 3 - \ln 2}$$

The analysis shown below includes:
Inference of justified graph from layouts
Calculation of depths between spaces
Calculation of integration values of all spaces
Identifying least integrated and most integrated spaces
Calculating Difference factor and identifying the existence of a strong or weak cultural pattern across different houses across villages.

Spaces	Mean Depth (d-)	Number of Spaces(k)	Integration value	Difference Factor	Relative Difference Factor
Work space	2.54	14	0.26	0.92	0.55
Drying space1	2.69	14	0.28		
Drying space2	2.69	14	0.28		
Kitchen	1.92	14	0.15		
Living	2.00	14	0.17		
Storage1	2.23	14	0.21		
Work space2	1.31	14	0.05		
Dining	2.23	14	0.21		
Room1	2.23	14	0.21		
Storage2	2.23	14	0.21		
Room1	2.23	14	0.21		
Room3	2.23	14	0.21		
Lobby	2.00	14	0.17		
Storage3	2.85	14	0.31		

Table 1: Difference Factor (House No.1)

Figure 2 shows the layout of House 1 and Figure 3 its justified graph. According to the graph one has to pass through occupational spaces to reach the domestic space. Workspace 2 connects to all the domestic spaces and occupation related spaces exist across all depths of the graph (including storage spaces) workspace 2 happens to be the most integrating space with integration value of 0.05 according to Table 1. The relative difference factor of mean, minimum and maximum integration values is 0.55 which is strong.

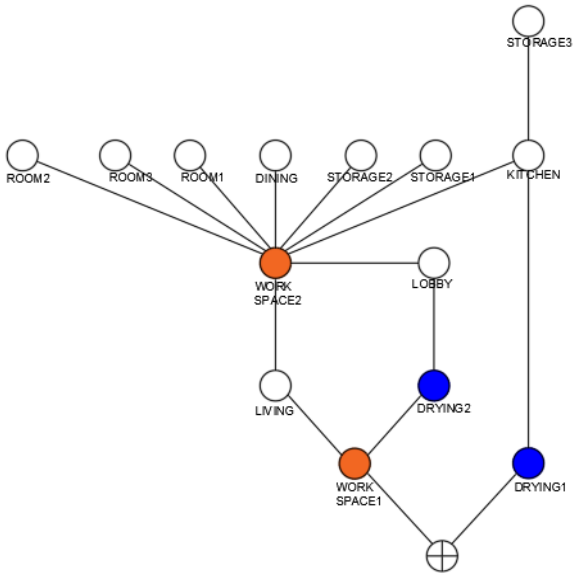


Figure 3: Justified Graph (House No.1)

House no.2

According to the justified graph (Figure 6.79) derived from the floor plan (Figure 6.78), the drying and workspaces are interconnected and also connect the entry point to the multipurpose. The multipurpose space then leads to the storage and the kitchen. According to Table 2, the multipurpose is the most integrating space and the relative difference factor of mean, minimum and maximum integration values is 0.95.

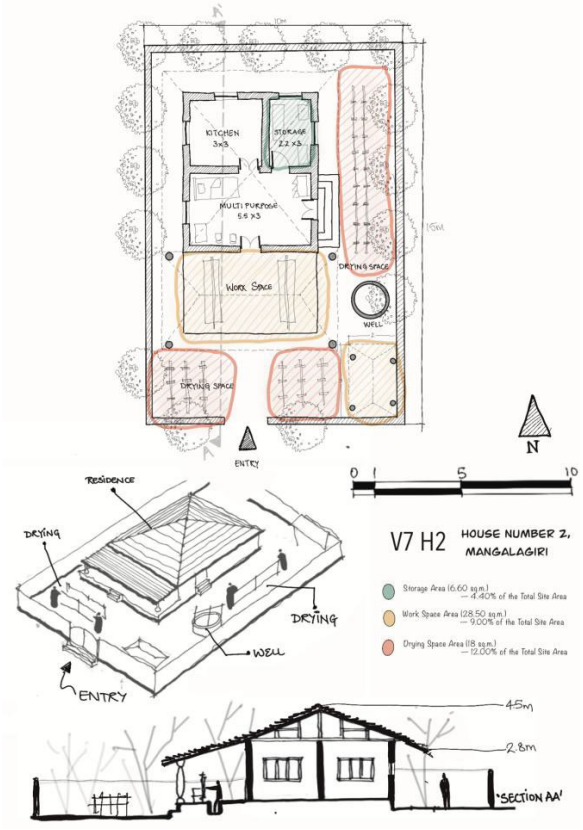


Figure 4: Plan, View, Section, Household and Occupational activity spaces (House No.2)

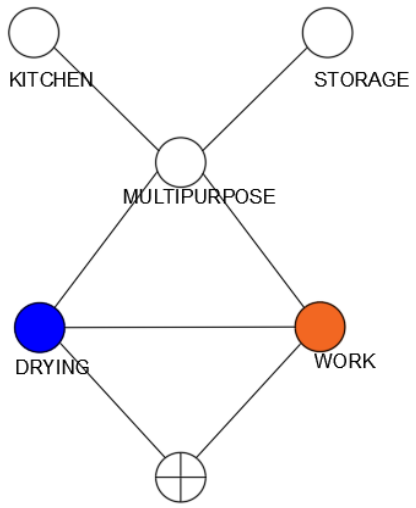


Figure 5: Justified Graph (House No. 2)

Spaces	Mean Depth (d-)	Number of Spaces(k)	Integration value	Difference Factor	Relative Difference Factor
Drying space	1.5	5	0.33	1.08	0.95
Work space	1.5	5	0.33		
Multipurpose	1	5	0.00		
Storage	1.75	5	0.50		
Kitchen	1.75	5	0.50		

Table 2: Difference Factor (House No. 2)

House no.3

Figure 6 shows the layout of house 1 and Figure 7 shows its justified graph. According to the figures, one has to cross workspaces to reach the domestic spaces. The drying space however can only be reached after passing through the inner workspace, dining and work and kitchen consecutively. As per Table 3 the passage is the most integrating space and the relative difference factor of the integration values is 0.71.

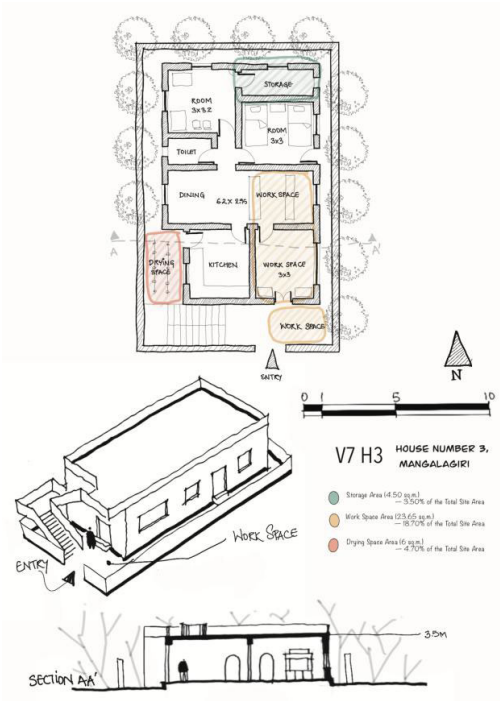


Figure 6: Plan, View, Section, Household and Occupational activity spaces (House No.3)

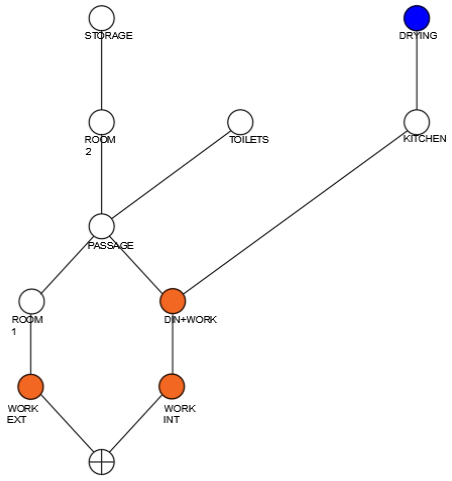


Figure 7: Justified Graph (House No.3

Spaces	Mean Depth (d-)	Number of Spaces(k)	Integration value	Difference Factor	Relative Difference Factor
Drying space	3.44	10	0.61	0.98	0.71
Work space out	3.00	10	0.50		
Work+Dining	1.89	10	0.22		
Kitchen	2.56	10	0.39		
Room1	2.33	10	0.33		
Toilets	2.56	10	0.39		
Storage	3.22	10	0.56		
Work space in	2.56	10	0.39		
Passage	1.67	10	0.17		
Room2	2.33	10	0.33		

Table 3: Difference Factor (House No.3)

House no.4

As observed in Figure 8 and Figure 9, one has to pass through the workspace through the other spaces in the house. To reach the toilet, one has to pass through the workspace and drying area. According to Table 4, the integration value of the workspace- 0.07 is the strongest and the relative difference factor of the mean, minimum and maximum integration values is 0.37 which is the strongest in the village.

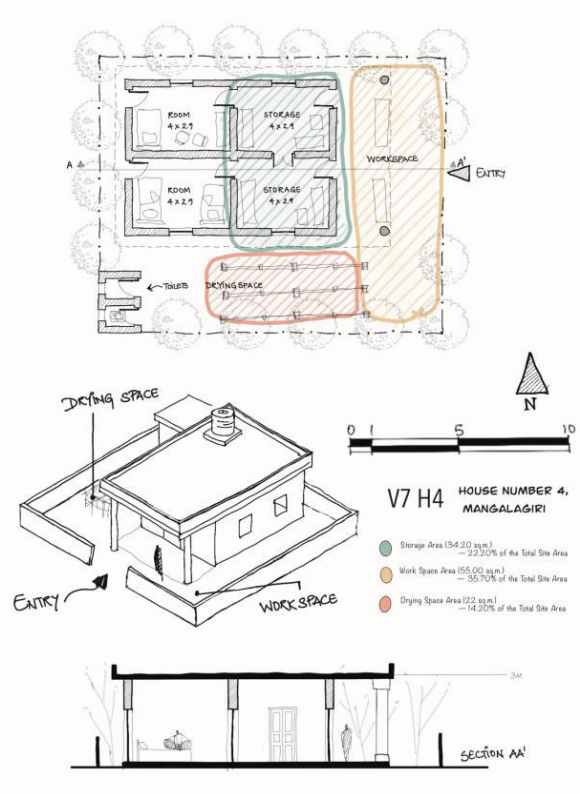


Figure 8: Plan, View, Section, Household and Occupational activity spaces (House No.4)

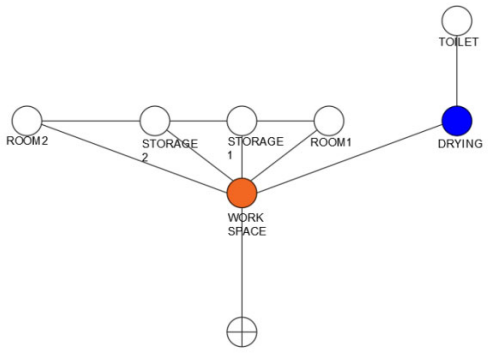


Figure 9: Justified Graph (House No.4)

Spaces	Mean Depth (d-)	Number of Spaces(k)	Integration value	Difference Factor	Relative Difference Factor
Work space	1.17	7	0.07	0.85	0.37
Drying space	1.67	7	0.27		
Storage 1	1.67	7	0.27		
Storage 2	1.67	7	0.27		
Room 1	1.83	7	0.33		
Room 2	1.83	7	0.33		
Toilets	2.50	7	0.60		

Table 4: Difference Factor (House No. 4)

House no.5

The floor plan of House 5 Is shown in Figure 10 and Figure 11 shows its justified graph which indicates that one has to pass through the workspace in order to reach the toilets and multipurpose area. The multipurpose area is used as a workspace. The workspace is the most integrating space with integration value of 0.17 and the drying space is the most segregating space with an integration value of 1 according to Table 5. The relative difference factor of the mean, minimum and maximum integration values is 0.54 which is strong.

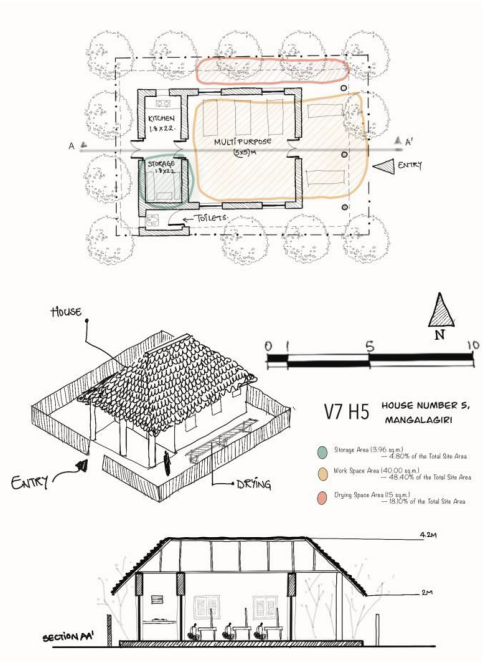


Figure 10: Plan, View, Section, Household and Occupational activity spaces (House No.5)

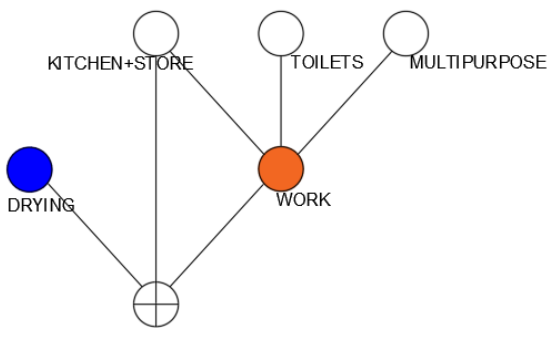


Figure 11: Justified Graph (House No.5)

Spaces	Mean Depth (d-)	Number of Spaces(k)	Integration value	Difference Factor	Relative Difference Factor
Drying space	2.5	5	1.00	0.91	0.54
Work space	1.25	5	0.17		
Multipurpose	2	5	0.67		
Kitchen+Storage	1.75	5	0.50		
Toilets	2	5	0.67		

Table 5: Difference Factor (House No. 4)

IV. GENERIC TYPOLOGY OF THE HOUSES AND DEVIATIONS OR VARIATIONS OF HOUSE DESIGNS

H1 as shown in figure 2 shows one of the oldest houses in the settlement, with central courtyard and occupational spaces spread within the courtyard and spaces around. H2 is another typology, which is traditional and built around 180 years ago, as shown in the figure 4 with Mangalore tiled roof and the weaving activities spread in the semi open and open spaces of the house. H4 and H5 as shown in the figure 8 and 10 are pucca houses constructed as part of the rural housing schemes. H5 is a kutcha house made of thatched roofing, mud walls, mud flooring and local wood for doors and windows. The house consists of only two rooms and an attached verandah. There is only one major room 5m x 5m used as multipurpose with a single loom and the space is used for multifunctional activities related to house hold and also occupational activity spaces. The thatched roof extended in the front side becomes a space for interaction, sleeping, eating and also work-related activities. The house survives with a single loom, but the head of the family and the main weaver says he is comfortable and happy with the weaving jobs undertaken by the family.

There is a sequence of transformation of houses from traditional to modern from tiled roofed courtyard house, followed by the tiled roof house, thatched houses and to the modern RCC house as shown in figure 2,4,6,8 &10. The spatial requirement as observed in these houses seems to be well defined and organized in the traditional and vernacular houses, when compared to the recent houses, where predominantly the house as an independent unit is given more prominence than the activities and needs of the user.

V. DESIGN DISCUSSION AND CONCLUSION

As per the Syntax spatial analysis for the houses with weaving as the main occupation, work spaces, storage spaces and drying spaces are the three occupational spaces. Drying spaces are very close to the origin point (entry point) in majority of the houses. In most cases, Workspaces are either directly accessible from entry point or have a maximum of one intervening space which is the drying space.

The occupational spaces are the most integrating spaces, revealing its cultural patterns Storage spaces are kept closest to workspaces, with maximum depth of 2 between them in most houses.

The common occupational spaces in Households with weaving as primary occupation in order of usage are: Drying space (For sun drying the yarn), Workspace (with weaving looms), and Storage space. Apart from this, pre-loom activities such as boiling the cotton yarn are also part of the process. Locating occupational spaces in the order of usage would facilitate an efficient work environment.

Segregating and providing separate entrances to spaces related to household and occupation related activities (indoor: weaving and storage) through a common verandah, porch or courtyard could ensure privacy to both functions.

For the most part during the day, work is carried out with weaving looms. This workspace, in most houses studied, was either semi open or completely indoors. Whatever the setting of the workplace, it is essential to provide ample daylight, while avoiding glare to increase work efficiency. Cross ventilating the workspace would also aid in improving comfort conditions which in turn will enhance working conditions.

The drying space requires maximum exposure to the sun and is therefore mostly situated outdoor. If provided in the open space, it must be ensured this space is not shaded by the building during the day.
In some case studies it was observed that dedicated drying spaces were not provided, owing to restricted plot area. In such cases it is advisable to have flat/terraced roofs to provide for pre-loom activities such as boiling, drying and stretching yarn.

To minimise disturbance from occupant movement in the drying space it is advised to locate it either in the backyard or in a space that is least accessed.

VI. DESIGN CONSIDERATION

Arrange occupational spaces in the order of usage to facilitate easier movement and efficient workflow.

Segregate occupational and household related spaces from each other with the help of separate entrances from courtyard, verandah or porch to ensure privacy to both functions.

Provide adequate daylighting and ventilation in workspaces where weaving is carried out in order to provide comfortable working conditions and improve efficiency of work carried out.

Ensure that the space provided for drying is not shaded by adjacent building or other structures during the day. Provide flat terraces for facilitating pre-loom functions (boiling, drying or stretching the yarn), specifically in sites with lower open plot area.

Ensure drying space is situated in an area which is least accessed in order to avoid unwanted disturbance due to occupant movement.

Adopt construction techniques that could facilitate future vertical expansion.

Through case studies it has been observed that the occupational influence is greater in the unit level than at the plot level in most of the weaving-based households.

The average percentage of occupational influence at plot level is 28%, and at unit level is 43%.

By nature of its function, drying spaces require to be located in an outdoor or semi-outdoor area. It is observed that the workspaces in this occupation type is not confined to one type of space and is distributed across semi-outdoor, outdoor and indoor spaces, depending on the plot size and availability of space. It is also noticeable that most occupants prefer to have storage accommodated indoors.

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