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DWELLING STRUCTURES IN THE CYCLONE PRONE COASTAL AREA: A CASE STUDY OF BURIRCHAR, BARGUNA

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Abstract: Bangladesh faces severe cyclone almost on a regular basis and thus subject to devastation. The long coastline is covered by the Sundarban, which gives some degree of protection in the western coast, but the looming threat is so pervasive in the south-central belt that cyclone storm surges have devastating effect. With such a back drop, certain indigenous treatise may be of great use to combat large scale devastation. It is being observed that the dwelling structure and layout characteristics can abate cyclonic storm to a great extent. The study considered Burirchar Union of Barguna District as the study area. The study observed the homestead characteristics and homestead layout influenced given the local people's economic status. It has been found that houses in study areas are constructed giving importance the local geographical characteristics including natural disturbances.

Keywords: Dwelling Homesteads, Cyclones, Jhupri, Chala, Floating Pillar, Barguna

INTRODUCTION

Cyclone is one of the most common natural hazards in coastal Bangladesh. In fact, the Bay of Bengal is so phenomenal that it is the perfect breeding ground of tropical cyclones, causing severe demage on a regular basis (Hoque and Islam, 2008). The very location of Bangladesh is within the cyclone tracts. In addition, the flat landscape and low elevation of the country give way to cyclone and tidal surges. These two matters accentuate the vulnerability of the region (Khan, 2008). Because of the funnel shape, cyclones occurring in the Bay of Bengal cause severe damage to the eastern part of the sub continent. Occurring cyclones with storm surges in the coastal regions of Khulna, Barguna, Patuakhali, Barisal, Noakhali, Chittagong and the off-shore islands are affected on a regular basis (Chowdhury, 1998).

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Bangladesh with 87,316 villages (Statistical Pocket Book of Bangladesh 2008, 2009) is often labelled as an agrarian village at a large ignoring its hugh urban population. There is a huge rural homestead scenario all over the Bangladesh but it is ture that there is no creditable study related to homestead management in the southern part of Bangladesh (Rahman et al. 2009). It is also to be recalled that the coastal region comprises of about 28 percent (around 50 million people) of the total population.

AIM AND OBJECTIVES

The central theme of the present study is to demonstrate the components of building elements and their alignment with the blowing wind during cyclones. More specifically the study attempted to illustrate the following aspects;

a) Fragility of the dwelling structures

b) Dwelling layout and storm fallout directions

PROFILING THE COASTLINE

The study villages are situated in the coastal areas where cyclone and storm surges are regular phenomena. The coastal line has a length of about 654 km. (Mahbub, 2005). Of the total 64 districts, 19 coastal districts (147 upazilas) have direct exposure to sea coasts. The coastal areas of Bangladesh can be subdivided into 3 parts; South-east, south-west and the central or south-mid of coastal area (Figure 1).

Figure 1: Sattelite Image of Coastline of Bangladesh

i. The SOUTH-EASTERN BELT is narrow, unbroken, straight shoreline, less dynamics, includes sandy beach, sand dunes, and mud flats. The south-east part, which has 2 districts; Chittagong and Cox's Bazar.

ii. The CENTRAL BELT is highly broken, irregular, very dynamic, includes many islands and mud flats topography. This central or south-mid part, which covers Barguna, Patuakhali, Barisal, Jhalokathi, Bhola, Noakhlai, Lakshmipur, Feni district area. Erosion is highly active in this region which makes the area more vulnerable than two other parts.

iii. The SOUTH-WESTERN BELT is broken, shows network of tidal rivers, stable, includes tidal flats, mangrove swamps and, dunes. The south-west part, which has 3 districts; Shatkhira, Khula, Bahgerhat. Sundarban the greatest mangrove forest is situated in this area.

DATA SOURCES AND METHODOLOGY

Both primary and secondary data have been used in the current study. Secondary data have been collected from the different reports, census, and books. Primary data were collected from the field through questionnaire survey, Focus Group Discussion, interviews and as well as observation.

Considering the fragility, the sample site was selected from Barguna Sadar Upazila. Burirchar Union from the Barguna Sadar Upazila was selected for field works. The location of Burirchar and Char Charakgachhia is shown in Figure 2.

Barguna district was selected from the mid-southern coastal part of Bangladesh for further sample study and site identification. Barguna was affected by most of the cyclones and storm surges in the past years. The area is low and flat. The soil of this area is characterized by non-calcareous floodplain and calcareous grey floodplain. Higher population density, exposed to Bay of Bengal, flood plain characteristics make this district one of the vulnerable zones to cyclone and storm surges.

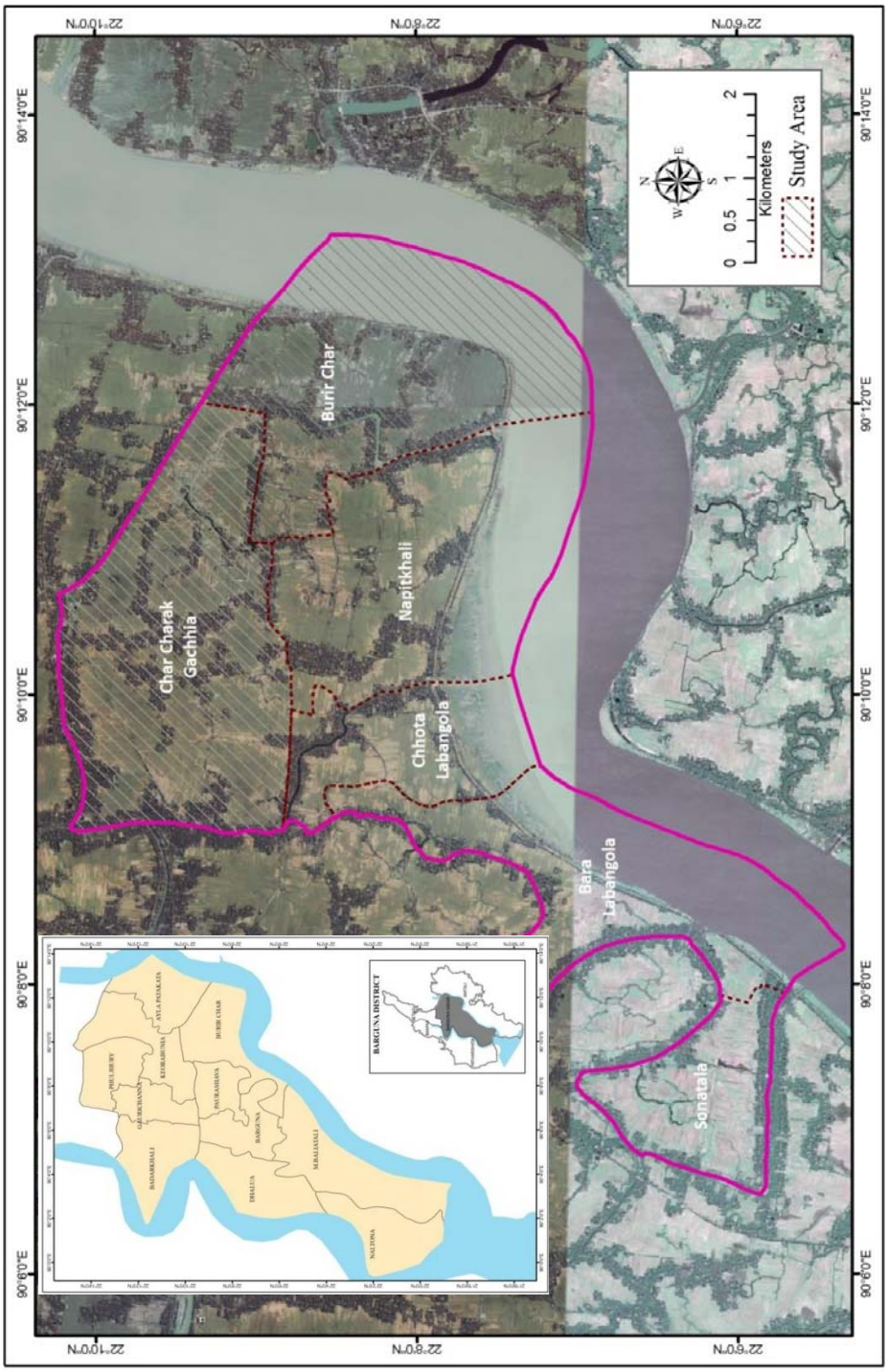

Figure 2: Sattelite Image of Burichar Union, Barguna Sadar (Modifield after Azim, 2014)

SAMPLE SIZE AND SELECTION PROCEDURE

According to Bangladesh Population Census 2011, there are 3217 households in Burirchar and Char Charakgachhia Mauza (BBS, 2012). The sample size was determined at 99% confidence level and at a confidence interval of 12. The sample size was 112 according to the determination criteria.

Number of households in the study area	:	3217
Sample size	:	112
Confidence level	:	99%
Confidence Interval	:	12

RESULTS AND DISCUSSION

Settlement Characteristics of the Study Area

As mentioned earlier, the coastal area is densely populated. Five thousand people are living in per square km. (Baqee, 2005). The current study has also observed high density of population in the study area. It has been observed from the study that the settlements are very densely located. The southern part area's settlement is built up too close than to inside area's settlement.

The study area's settlement pattern is curvilinear. The settlement has been established beside canal and embankment at Burirchar village (Figure 2). This embankment is also used as a road. Road is always important for settlement. Accessibility gives a benefit to settle down in a place. Plain land has an advantage in this regard. Although the area is in the south end of the union as well as the river bank side but this embankment cum road is an important factor for settlement. This road gives the area's accessibility. Beside that Char Charkagachhia village has a bazaar in the centre location. The bazaar might be one of the strongest influential factors.

Water source is another important factor for dwelling. River bank and both sides of the canal attract people to live in the study areas. Burirchar village situated at the side of Burishwar River and Char Charakgachhia is connected with a canal. People need this water for their livelihood and agricultural purpose.

Fragility of the Dwelling Structures

The current research observed the study area's housing characteristics. The study observed the structural variety and building materials of the study site.

Structural Variety

The house structure of the study area is not almost same. Housing composition of study area of the dwelling households is found mainly *jhupri*[1], *kutcha*[2], semi-*pucca*[3] and *pucca*[4]. In two different places we observed the same scenario with some common characteristics.

In the study area 2.7% *jhupri* house observed and rest of the houses, 92.9% were *kutcha*, a very few houses are semi-*pucka* and *pucka*. The research observed that the *jhupri* and some of the *kutcha* has less strength to combat against cyclone or storm surges. Almost 73.2% of *kutcha* houses destroyed partially and completely due to cyclone. In opposite side the semi-*pucca* and *pucca* houses are strong enough to survive the cyclone wind. Though that number is very few and those people are not such economic solvent to attain this.

Table 1: Composition of the Houses of the Study Area

Types of House	Number of Houses	% of the Houses
Jhupri	3	2.7
Kutcha	104	92.8
Semi-*pucca*	3	2.7
Pucca	2	1.8
Total	112	100.0

Source: Updated after Field Survey, 2011

Vertical Rise of the Dwelling Units

The study areas illustrate that one story structure is very prevalent in the study area (Table 2). Such structures are mostly *kutcha* (Table 1), only two houses appeared to be two storied which were *pucca*. It seems to be more expensive compared to the other village dwellers. Though the two storied house suffers more than one story house but post period of the flooded situation creates its demand and two storied house has extra benefit. After the storm surges people take refuge in the first floor. Two storied houses are comparatively advantageous, but on the other hand, those structures are subject to cyclonic havoc. People also keep money, necessary documents and life saving materials in the first floor.

Table 2: Number of the Stories of the Houses of the Study Area

Number of the Stories	Number of Houses	% of the Houses
1 story	81	72.3
2 storied	31	27.7
Total	112	100.0

Source: Updated after Field Survey, 2011

Building Materials

Uses of timber, branch of tree is the most common phenomena, Mud is the next common materials that are under use of making houses in the coastal areas (Baqee, 2005). Although building materials depends on some other characteristics like weather situation, economic conditions and availability of resources.

In the study area the walls are mostly erected by CI Sheets by the relatively solvent family and the poor uses Jute sticks and bamboo fences. Roof materials and pillar material of the houses were considered. The important thing is most of the house is being built by their own homestead vegetation. 61% house is fully and partially built and by their own trees. Rain tree, *gab*, mango, and jackfruit are the major trees to build their house structure, doors, window and etc.

Wall Materials

Tin (CI Sheet) is the common and main wall materials of the houses of the sites. Tin is the dominant material as wall material in both of the Burirchar and Char Charakgachhia village. 83.9% houses' wall is tin. Other material like straw and bamboo is seen 4.5%, bamboo and tin 7.1%.

Table 3: Wall Material of the Houses of the Study Area

Wall Material	Number of Houses	% of the Houses
Tin (CI Sheet)	94	83.9
Straw and bamboo	5	4.5
Bamboo and Tin	8	7.1
Cement and brick	5	4.5
Total	112	100.0

Source: Updated after Field Survey, 2011

Roof Materials

Field Data indicate that three were three different types of roof material in the study area. Uses of CI Sheet (Tin) are the dominant of the roof materials. It is about 95 percent of houses which CI Sheet roofs.

Table 4: Roof Material of the Houses of the Study Area

Roof Material	Number of Houses	% of the Houses
Tin (CI Sheet)	106	94.6
Straw / bamboo	4	3.6
Concrete	2	1.8
Total	112	100.0

Source: Updated after Field Survey, 2011

Roof Types

There are five types of roof like 1 *chala*[1], 2 *chala*, 4 *chala* and 8 *chala* houses and simple flatted concrete roofs have been observed. There is relation between roof types with house characteristics. The two storied house and large space houses' roof is mainly seen 8 *chala*. *Jhupri* is mainly 1 *chala* house and this type of house is very poor quality. The study area's 4.5% houses are 1 *chala* house. 4 *chala* house is highest 50.9% and 20.5% houses are 8 *chala*. Actually the 8 *chala* houses represent the two storied house. And two houses found *pucca* with flatted concrete roof.

It should be mentioned that the house material tin is very much vulnerable and causes for major injury during the cyclone and storm surges. It has been found that 20.6% injury occurred but this phenomenon.

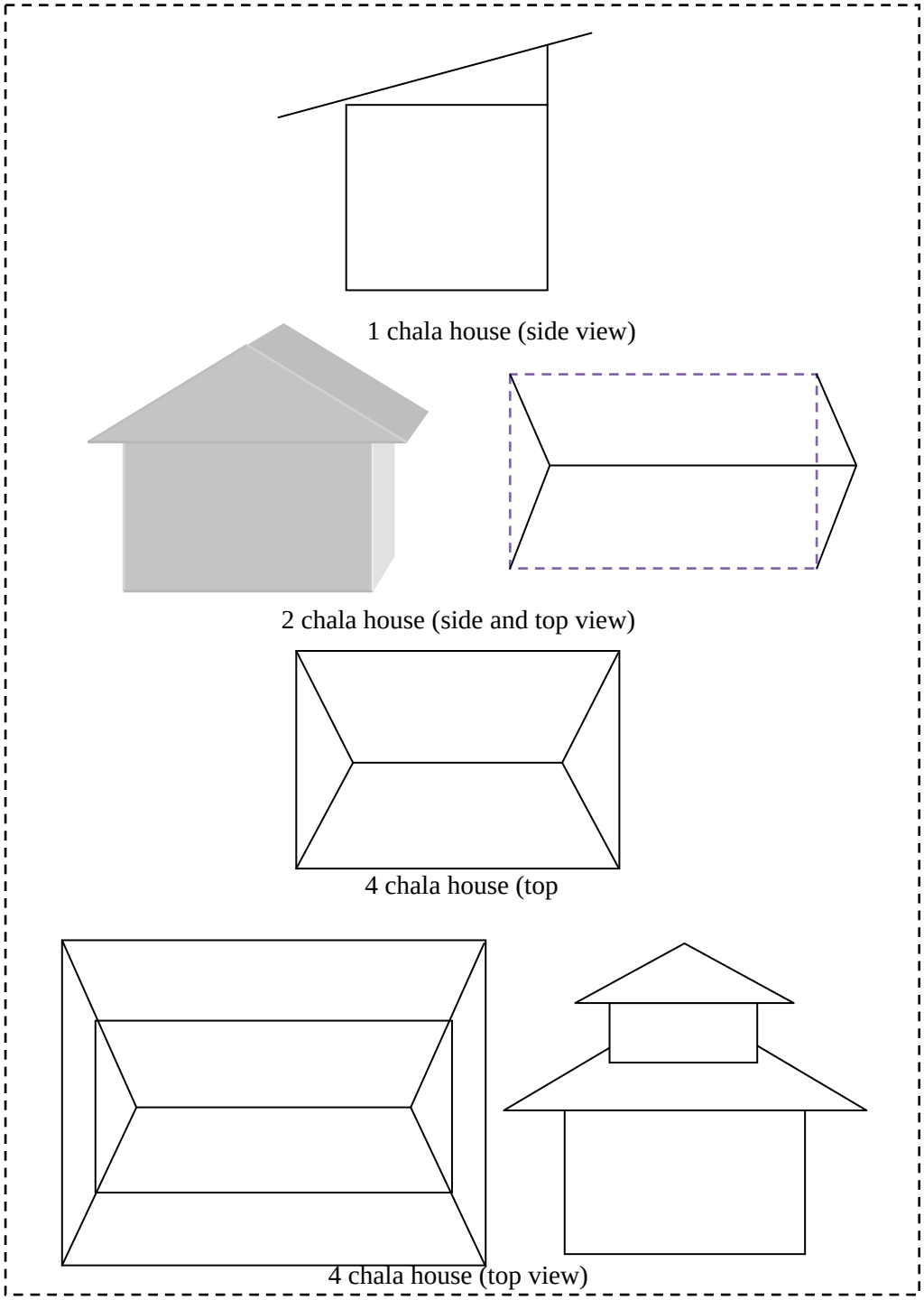

Figure 3: Different Types of Roof

Table 5: Roof Types of the Houses of the Study Area

Roof Types	Number of Houses	% of the Houses
1 *chala*	5	4.5
2 *chala*	25	22.3
4 *chala*	57	50.9
8 *chala*	23	20.5
Flat (Concrete)	2	1.8
Total	112	100.0

Source: Updated after Field Survey, 2011

Pillar Materials

Pillar material has no difference. Almost every house's pillar is wooden. But the fact is there are some relief houses (constructed by the government after a devastating cyclone) at Burirchar while the pillar is of concrete. The houses are *kutcha*, single storied and 4 *chala* but the pillar/pole is made of concrete. Government distributed these types of houses to the cyclone affected poor people which cost around 20,000 Taka. The concrete pillar is strong enough to withstand against cyclone and storm. Almost every concrete pillar made house could survive with less damage than any other type.

Table 6: Pillar Material of the Houses of the Study Area

Pillar Material	Number of Houses	% of the Houses
Bamboo	3	2.7
Concrete	13	11.6
Wood	96	85.7
Total	112	100.0

Source: Updated after Field Survey, 2011

Here one thing is very important that rest of the houses' pillar is floating. They float their pillar on the block (cement) on the floor. The respondents replied that if they dig the pillar (wooden pillar) then it would be decay in very soon. They float the pillars on a piece of cement block on the floor.

Photo 1: Floating pillar of a House

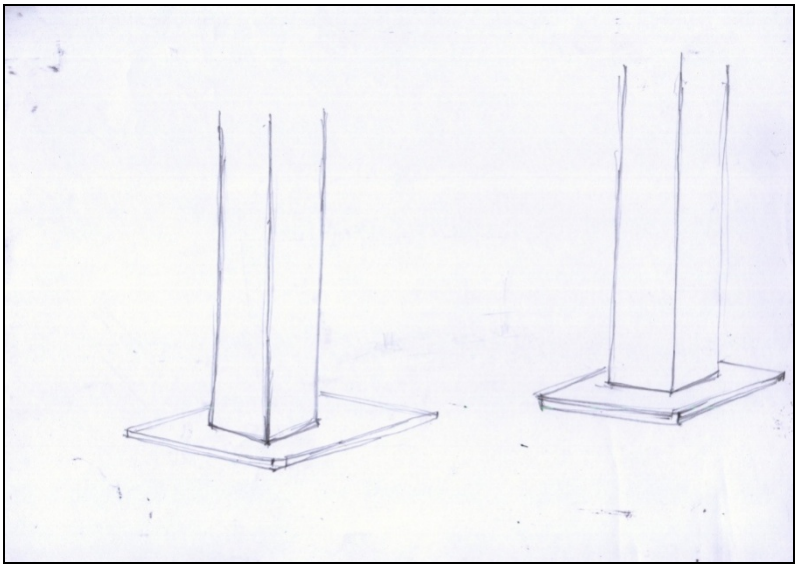

Figure 4: Sketch of the floating pillar

Floor and Vita

Soil is the main material of the floor and *vita*[6] of these two study sites. And average height of vita is 3 feet in both study area. But the southern part of the area's houses' vita is little higher due to closeness of the Burishwar River. There is a relation between vita height and the cyclone water level or flood level. Usually the homestead land is made uplifted than agricultural low land due to flood level that may reach the

house. And the vita is made more higher (normally 3 feet) than the homestead land for extra care. The level is also considering the extensive flood case and also cyclone surges water level.

Photo 2: *Vita* of a House (2 storied) in Study Area

House Space

The average house space of the study area is 2.5 decimal. House space indicates the socio-economic condition. The study observed that 3 decimal houses are faced less damage than the 2 decimal and 4 decimal houses. And 50% of the houses have 2 decimal space and those damaging and collapse ration is higher than others (33.2%).

Table 7: House Space of the Study Area

House Space in decimal (1 decimal=40.5 m^2)	Number of the House	% of the Houses
1.5	8	7.1
2	56	50.0
3	29	25.9
4	17	15.2
5	2	1.8
Total	112	100.0

Source: Updated after Field Survey, 2011

Age of the Dwellings

The research found the settlements are old. It was not found any migration within the study that occurred very soon in due to cyclone cause. Though they faced several severe cyclone and storm surges but their economic condition do not permit to shift on to another places. The settlements are almost old but they need to reconstruct house after the disaster. People are here living too close to seashore but it seems that people are accepted and reluctant by the nature calamity.

Table 8: Age of Dwellings of the Study Area

Dwelling Year	Number of Houses	% of the Houses
0-25	22	19.6
26-50	25	22.3
51-100	36	32.1
100+	29	26.0
Total	112	100.0

Source: Updated after Field Survey, 2011

Dwelling Layout Analysis

Homestead Size

The rural homestead area, position, size are depend on the owner economic condition, social status, cultural norms and beliefs. In the same time building materials will be depended and influenced by some other factors. The factors are availability of resources, peoples' economic condition, physiographic, weather etc. Environmental determinism is more reflected in the rural houses rather than urban areas (Baqee, 2005).

The study area's average homestead area is 17.1 decimal that means 692.6 m^2 or 0.17 acre. The study found 85.7% homestead area below 30 decimal which is equal to 0.30 acre. The average household income of the study area is around Tk. 15000. Average household size is 4.3. It represents the poor socio-economic condition of the study area. But where the large homestead area was found (though it's a few in number) has the benefit of planning the homestead dynamics and also gives the opportunity to making a planned vegetation coverage which can combat the cyclone. The study observed that small homestead are has more damage and injuries rather than the large homestead area.

Table 9 : Homestead Size of the Study Area

Area in decimal (1 decimal =40.5 m^2)	Number of Homestead	% the Homestead
1-5	12	10.7
6-10	36	32.1
11-20	27	24.1
21-30	21	18.8
31-40	7	6.2
41-50	4	3.6
51-60	2	1.8
61-70	1	0.9
71-80	2	1.8
Total	112	100.0

Source: Updated after Field Survey, 2011

Facing Dynamics

Most of the houses of the study area are situated facing south of their homestead. Rural people are almost engaged in agricultural activities. So they need the open space in front of south that they can use it. The farmer families are mainly practicing such structure that can help their livelihood. South facing houses are widely practiced in the country while the residents experience comfortable living conditions with fresh air.

Table 11: Facing of the Houses in the Study Area

House Position	Number of Houses	% of the Houses
South Facing	75	67.0
North Facing	16	14.3
East Facing	11	9.8
West Facing	10	8.9
Total	112	67.0

Source: Updated after Field Survey, 2011

The study observed that the most of the houses' sites were not only detemined by this factors but also the canal, road and their econmic solvency. The study found that south facing house are affected more than other facing houses. The cyclone and sotrm surges blow from south and those suffered more.

Kitchen Location

Most of the kitchens are very small in size. These have a weak structure and people do not bother on this. The traditional stove system can easily build any time. Usually they locate their kitchen at north side so that the smoke does not enter their house.

Pond Location

The most of the ponds are situated in east and west side of the homestead of the study area. Almost each homestead got one pond. Pond are useful to their daily life and as well as livelihood. Sometimes they use their pond to keep their heavy goods to ensure safety.

CONCLUSION

The housing characteristics and the homestead layout are very important for combating the cyclone and storm surges in the study areas. In addition, positing of the house is very important to grab the opportunity and planning. A planned homestead layout gives the benefit to optimum use of the homestead area considering plantation of the tree and other uses so that they can make their house safer and can survive against such disasters. Sometimes people are ignorant and bound with their economic status and construct unplanned homestead which pushes them into a venerable condition. However, both the study areas accommodate houses that are generally constructed keeping in mind the local geographical contexts.

Notes

1. Made of jute sticks, tree leaves and jute sacks etc.
2. Made of mud brick, bamboo, sun-grass, wood and occasionally corrugated iron sheets as roofs.
3. Where walls are made partially of bricks, floors are cemented and roofs of corrugated iron sheets.
4. Where walls are made of bricks and roofs of concrete (Islam, 1997).
5. *Chala* means the edge of the roof (see Figure 3).
6. Uplifted floor in rural area.

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REFERENCES

Azim, S. A. (2104). Homestead Vegetation in Coastal Areas: The Case of Burirchar, Borguna District. *Journal of Earth and Environmental Sciences, 3*(1), 61.

Baqee, A. (2005). *Grameen Bashati* (Third ed.). Dhaka: Sujeneshu Prokashani.

BSB (2009). *Statistical Pocket Book of Bangladesh*, Dhaka: Bangladesh Bureau of Statistics Planning Division, Ministry of Planning.

Chowdhury, A. M. (1998). Detection of a Cyclone. *International Decade or Natural Disaster Reduction (IDNDR) and Natural Disaster Preparedness Days (NDPD).* Dhaka: Ministry of Disaster Management and Relief Disaster Management Bureau.

Hoque, A. and Islam, M. S. (2008). Local Wisdom in Disaster Management: Case Studies of Chakoria and Moheshkhali. In S. M. Amin (Ed.), *Studies on Coastal Environmnets in Bangladesh* (First ed.). Dhaka: A H Development Publishing House.

Islam, N. (1997). *Human Settlements and Urban Development in Bangladesh.* Dhaka: University of Dhaka.

Khan, A. A. A. (2008). Perception of Cyclone Hazard and Community Response in the Chittagong Coastal Area. In S. M. Amin (Ed.), *Studies on Coastal Environments in Bangladesh* (First ed.). Dhaka: A H Development Publishing House.

Mahbub, A. Q. (2005). Durjogbarta. (J. Khan, ed.) *Upokulio Ghurnijhor-durjog Proshomon o Bebosthapona Shohayika*.

Rahman, M. M., Atikulla, M. and Miah, M. G. (2009). Retrieved September 17, 2010, from National Food Policy Capacity Strengthening Programme: http://www.nfpcsp.org/CF_13_of_07_Final_Technical_Report-_Approved.pdf