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Rehabilitation of Housing for Disaster Affected People: A Case Study of Landslide at Chittagong, Bangladesh

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Abstract

Housing provides shelter and living environment to human beings. Population growth rate, urban migration and natural disasters are making it more complicated and strenuous and also reducing the housing stock of a country. Landslide is one of the natural disasters which directly and indirectly impacts on housing every year. Chittagong the second largest city and industrial and commercial hub with the largest seaport of Bangladesh has undergone steady and rapid unplanned urbanization since independence. Chittagong urban area is facing landslide disaster in rainy season. On the other hand, the City is facing housing shortage and the shortage in the number of housing units is increasing. In this paper, it is an attempt to find out the way with a proposal of selecting a site for rehabilitation of housing scheme which is economically viable for that affected people in Chittagong City.

Introduction

Natural disasters are the complex dynamics of unfavorable events that occur completely beyond the human's control and human interventions often indirectly make it worse. Some hazards are known to be more prevalent such as windstorms, floods, earthquakes, volcano, droughts and extreme temperature; however, landslides are the 7th largest destroyer among all natural disasters (Herath & Wang, 2009). Landslide is a natural disaster which has been causing a large number of deaths, injuries and damages to human settlements or housing and infrastructure in an urban area. Statistics show that landslides are responsible for at least 17% of all fatalities from natural hazards worldwide (CRED).

Petley reported on the occurrence of landslide fatalities in the year 2007 by nation, the most seriously affected country was China with 695 landslides induced death followed by Indonesia (465), India (352), Nepal (168), Bangladesh (150) and Vietnam (130). Regarding trigger, 89.6% worldwide fatalities were a result of landslides caused by intense and prolonged precipitation (Kyoji Sassa, 2009). On the other hand, SAARC[1] reported that there are various types of landslide hazards that happened in almost all the countries of South Asia (SAARC, 2010). According to Geographical Survey of Austria, 2012, landslide is a mass movement of rock, soil or debris materials forming slope towards to the lower and external part of the slope, along with sliding surface. When a part of a natural slope is not able to sustain its weight, a landslide hazard occurs causing the destruction of property, shelter, infrastructure and death of people and livestock. (SL-GDC, 2008).

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[1] South Asian Association for Regional Cooperation (SAARC). (Member Countries are: Afghanistan, Pakistan, India, Nepal, Bhutan, Bangladesh, Maldives and Sri Lanka.

The importance of housing is universally accepted from the dawn of history. Since past few decades the poverty of urban dwellers has been increasing, mostly in low- and middle-income nations and for that the housing of those countries is of poor quality, overcrowded and has lack of provision for the basic infrastructure and services which should protect them from environmental health hazards and prevent disasters (IFRCCS, 2010). Sub-standard housing is more vulnerable to disasters and during landslides these sub-standard houses are easily damaged aggravating the problem of housing in those areas. For a safe life, it is necessary to provide a safe house for landslide affected areas.

Bangladesh is an overpopulated developing country, where housing is an important factor in its development, and still the country is facing housing shortage due to different reasons (Khaled, et al., 2012). People are not getting proper shelter, and most of the poor and economically disadvantaged people have to face this housing problem severely (Ahmad, 2014). The country is vulnerable to various disaster and environmental hazards because of its physiography, morphology and other natural condition. Natural and human-induced hazards, such as floods, cyclones, droughts, tidal surges, tornadoes, earthquakes, river erosion, fire, infrastructure collapse, high arsenic contents of ground water, water logging, water and soil salinity, epidemic, and various forms of pollution are frequent occurrences (NPDM, 2010). In Bangladesh, almost 70000 people are living in vulnerable housing in landslide disaster porn area (IRIN, 2015). Landslide is an incurable problem for southeastern part of Bangladesh, and Chittagong city is particularly highly vulnerable to this hazard with an increasing trend of frequency and demand. Since Chittagong is the Port City and the Commercial Capital, people from the surrounding regions are migrating into the city areas for better income opportunities as well as attractive urban facilities (Hashemi, 2006). The hilly area of Chittagong Metropolitan Area (CMA) is highly vulnerable to landslide hazard with the increasing trend of frequency and damage (Bayas & Yiasen, 2013). The landslide of 11 June 2007 in Chittagong is the most devastation case of landfall in the history of a landslide in Bangladesh (IRIN, 2015). The direct loss due to that disaster of Chittagong estimated as US$ 13.2 million (SDMC, 2007). The Daily Observer reported that almost 10000 people live in the hilly area of Chittagong city who are most vulnerable due to landslide disaster (Amin, 2015). The Daily Star (Local News Paper) editorial report stated that 127 people died due to a landslide in Chittagong in June 2007. According to a committee who worked on a landslide in Chittagong city identified the most 30 vulnerable area and 666 families are living in this area (Amin, 2015).

The landslide happened in Chittagong city every rainy season, and recently three people died due to this disaster in at Baijed Bostami and Lalkhan Bazaar area (DMIC, 2015). On the other hand, NIRAPAD reported that mainly self-employed, garments workers, day laborers live in 1,814 slums in Chittagong city where half of them are at hill slope and at foothills and these are very risky due to landslide disaster (NIRAPAD, 2010). The main cause of landslide in Chittagong is soil condition, the slope of the hill, hill cutting and deforestation (Sultana, 2013). The hills of Chittagong are sandy and for irresponsible hill cutting the hill slopes are unstable, and landslides happen (Murshed, 2013). The increasing annual rainfall has aggravated the occurrence of landslides in Chittagong city (Mia, et al., 2015).

Landslide disasters affect directly on informal settlement (30 % of total settlement) in Chittagong city and from 1997 due to Landslide disaster, people lost their life and property and also become shelter less. For that Government and other organizations now try to solve housing problem for long term basis in various ways. Safe and proper housing are one of the main factors to save people from a disaster like a landslide. Proper rehabilitation is important for all people for a healthy city life. As the growth rate of development in Chittagong is very high, proper planning is essential for its development. So it is a burning issue for the Government to rehabilitate the landslide disaster affected vulnerable people properly. With this end in view, this research aims to find out the housing solution for landslide affected people who are economically weak and not able to buy a house in present housing market at the same time to make a proposal for the government in policy level in Bangladesh.

Methodology

The research work is done in two phases. In the first phase, secondary data and information are collected from literature, publications by the government and non-government organizations and articles on landslides. The second phase identifies stakeholders, landslide affected settlement areas in Chittagong city and prepares a framework for the study. Socio-economic and demographic profile is prepared with collected data by primary survey in the second phase.

Data collection: In research, secondary data and information are important and an integral part. Various governmental and non-governmental organizations, such as Chittagong Development Authority (CDA), Chittagong City Corporation (CCC), and Study report of the student of Department of Architecture of Chittagong University of Engineering and Technology (CUET), Chittagong Division, Bangladesh Bureau of Statistics (BBS) were contacted. On-line paper and information on contemporary urban landslide issues were also used to enrich the literature review and analysis sections.

Selection of Study Area: There are many settlements in Hill area in Chittagong City. Two major areas with respect to landslide and population are studied. GIS map and other maps of the site have been collected from Planning Department of CDA.

Site Analysis and Feasibility Study: For proposed housing Scheme, the Site analysis and feasibility study was conducted for the site selected by the CDA. Financing of the project is explored with existing data of land value and cost benefit analysis.

City Profile of Chittagong

Chittagong is the second largest metropolis in Bangladesh. Situated in the Bay of Bengal, Chittagong has historically been an important center of commerce due to its geo-strategic location and is regarded as the commercial capital of the country. The city is well known for its scenic beauty and the unique combination of hills to the north, flat land bounded by the Karnaphuli River to the southeast, the Halda River Valley to the northeast and the Bay of Bengal to the west. Within the city, there are a number of tidal canals that serve as the main drainage channels. Its diverse ecosystems with low-lying coastal area, beaches, estuaries, lakes and hills create opportunities for different economic activities and social and cultural diversity.

The Chittagong Statistical Metropolitan Area (SMA) covers an area of 1,152 square kilometers and consists of six metropolitan *thanas*, 68 wards and 236 *mohallas* (localities) with a population of 3.38 million. Chittagong City Corporation covers an area of 155 square kilometers with a population of 4,009,423 in 2011, which had grown on average by 3.6% per annum between 1991 and 2001(BBS) The population growth is much higher compared with national growth of about 1.6 percent. The garment industry has increased the number of females migrating into the city. 35 percent of the city's populations are slum dwellers (IDS, 2007).

Chittagong has been contributing the national economy since the independence of the country in 1971. The major economic establishments/resources are 1) Chittagong port, 2) lots of garments industries, 3) huge numbers of medium and heavy industries (Industrial belt at Fouzdarhat, Baizid Bostami, Kalurghat Industrial, and Patenga industrial area) and 4) natural beauties such as the Patenga Sea Beach, Batali Hill, Foy's Lake, Karnaphuly river bank, court building, Circuit House, etc. These facilities in the city are playing a significant role in the development of Tourism Industry in Chittagong region (Hashemi, 2006)

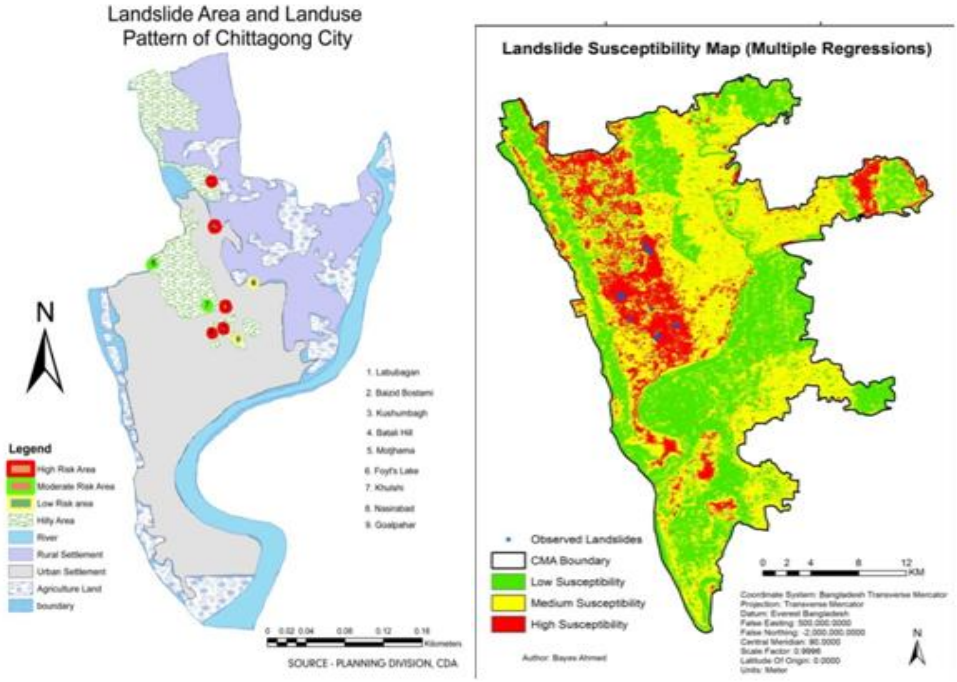
Cities are being inundated with people looking for a job and a decent income. The Chittagong City is not an exception to it. Like many developing country cities, it is experiencing a rapid growth of population mainly because of rural-urban migration (BBS, 1981, 1991 & 2001). As the new population is added, the demand for the different type of infrastructure facilities and services are increased continuously. As different urban authorities of Chittagong are providing inadequately municipal services, the citizens are frequently unsatisfied with the quality of services and facilities. Like many urban centers, most of these services of Chittagong city are confined only to administrative hubs and residential enclaves of the rich and the middle-class people. Chittagong has pucca, semi-pucca and kutcha houses where the private and informal sectors supply most of the housing in Chittagong. Housing and residential processes are in unplanned and irregular approach due to lack of institutional control and monitoring.

Landslide in Chittagong City

City since 1997, 15 landslides have killed nearly 400 people in the city and adjacent small urban centers. For example, the landslide disaster in June 2007 that was triggered by intense rainfall killed 128 people and affected 2,072 families in five informal settlements (Khan, 2008). After the massive landslide of 2007, a technical committee has been created of government agencies, Chittagong City Corporation (CCC), Chittagong Development Authority (CDA), researchers, engineers and NGO workers for identifying priorities for action, land use vulnerability assessment and zoning. That committee divided the city into 3 zones considering risk issues of the landslide.

Source: The Daily Star, local newspaper.

Figure 1: View of landslides in Chittagong



Source: (Bayas & Yiasen, 2013)

Figure 1: Landslide area in Chittagong City

The whole Chittagong city is divided into three different zones depending on vulnerability of landslides which are High Risk Areas (Lebubagan Area, Baizid Bostami Area, Kushumbag Residential Area, Batali Hill Area,Motijharna Area), Moderate Risk Area(Foy's Lake Area, Khulshi Area) and Low Vulnerable Areas (Nasirabad Area, Goalpara Slum area) (Mahmood & Khan, 2010). According to CDA, the following Map shows the landslide area of Chittagong city and on the other hand Bayes and Ahmed shows the area which are risk due to the landslide in Chittagong City and the susceptibility of the landslide is divided into three categories where red color is high risk, yellow is medium and green is low-risk area. Figures 1 and 2 present landslide condition. and areas in map respectively.

The different government, autonomous and private organizations like Bangladesh Railway, Chittagong City Corporation (CCC), Chittagong Development Authority (CDA), Chittagong Water and Sewage Authority (WASA), and Bangladesh Army are owners of the hills of Chittagong city, and some large private companies (AK Khan Group, Ispahani Group, James Finley, etc.) and some elite individuals have also owned a portion of the hilly lands of Chittagong (Murshed, 2013). But among them, Bangladesh Railway owned the maximum hill area of Chittagong. People migrating from the village area started to living in open vacant are due to lack of housing. Mainly poor people have to select the area for low housing cost, near to job place. Though they are not getting the services and facilities there, they live there to get a place for shelter in the vacant land which is mainly owned by the Government agencies. That hill area is also a risk to landslide disaster but people still living there which are mainly from the informal sector.

Causes of landslide in Chittagong City

Soil Condition: Formation of hill soil is an important factor to trigger landslide. According to geological time scale, hilly area of Chittagong developed in Tertiary age and is composed of unconsolidated sedimentary rocks such as sandstone, siltstone, shale, and conglomerate. The hilly region is underlain by Tertiary and quaternary sediments that have been folded, faulted and uplifted, then deeply dissected by rivers and streams (Brammer, 1996). Sandstones, shale, and siltstone, are the main components of these hill area and acid properties of hilly soil are easily saturated with water. For this in rainy season Landslide take place in that area.

Hill Cutting: Presently indiscriminate hill cutting is one of the major causes of landslides in Chittagong city (Rahman, 2010). Hill cutting has been identified as one of the major causes of landslide in the study area because all settlement has been developed by hill cutting. Beside this, unplanned hill cutting takes place for sand collection, road construction, and informal settlements.

Survey of Landslide Area in Chittagong

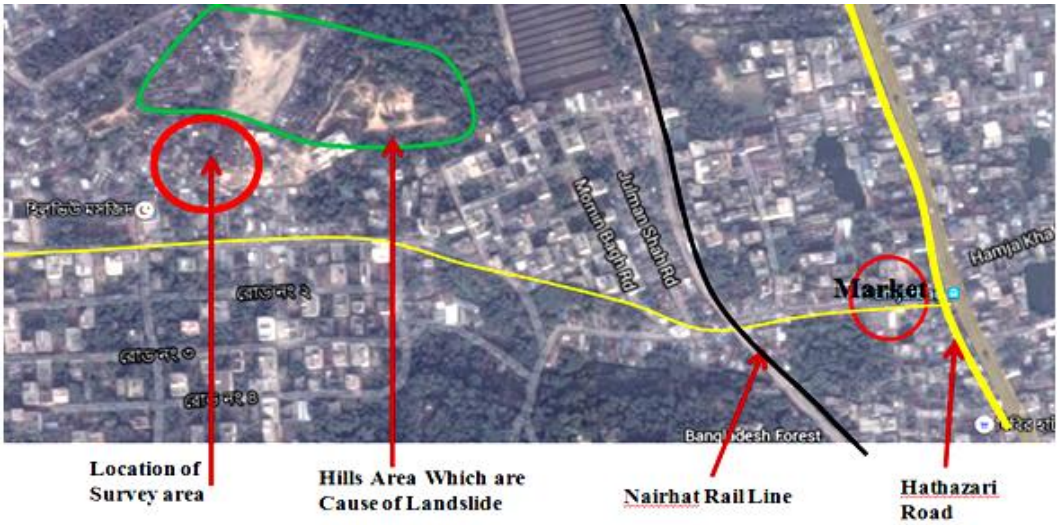
For the survey, two landslide affected sites have been selected, which are Mothijorna Slum area and Biozeed Bostami Informal settlements area. The summary of the socio-economic condition of the survey areas is described in this section.

Landslide in Survey Area 1

Figures 3 and 4 present condition and location of Survey Area 1 respectively. Various information related to this Survey Area are provided in this section.

Figure 3: View of the survey area 1

Source: GIS map, planning department, CDA.



Source: Map from Google Earth.

Figure 4: Location of the survey area 1: Santinagar Slum

Social Profile

- Average Household Size - 5
- Percentage of household living in tenants 90%
- Percentage population having - Primary Education 11% Secondary Education 6%

Environmental Profile

- Percentage of Buildup area - 75 % (approximate)
- Percentage of green area 5-8 %
- Percentage of open space 20 %
- Number of landslide disaster last ten year: 4
- Number of affected person by landslide 100 (approximate)

- Number house destroyed by landslide 18 (approximate)
- Percentage of house vulnerable for Landslide: Low 20%, Medium 50 %, High 25 %

Services and Amenities

- Approach Road – No formal approach road
- Water supply – Water available from the common source.
- Sanitation – Common Toilet
- Surface drainage- Open Katcha surface drain
- Distance of local shopping area – 1 km
- Distance of Medical Facilities - 5 km
- Distance of Bus stop /Railway station 2 km

Building Condition

- Average Area of the housing unit - 13 sqm
- Floor area per person – 2.6 sqm
- Number of room - 01
- Material of the house: Wall – Bamboo -80%, Brick Wall 20%, Roof- CI Sheet 90%
- Floor- Cement concrete, Door- Bamboo/ Wood, Window- Wood/ CI Sheet
- Average Height of the roof: 2.75 sqm
- Natural Lighting and ventilation of the house. Not proper

Priorities and Aspiration

- Percentage of Household desire to shift- 85%
- Percentage of Household to pay for rent house - 70%
- Demand of Size of house – 20 sqm (0.59 Katha)
- Prior Space/Facilities – Safe Bedroom- Kitchen and Toilet

Landslide in Survey Area 2

Figures 5 and 6 present the conditions and location of landslides in Survey Area 2 respectively. Various related information are provided here.

General Information

- Name of the landside area: MotijhornaSlum (Part 1), nLalkhabazar, Chittagong
- Location in town
- Nearest Main Road: CDA Avenue Road
- Nearest Landmark: Wasa Water Tank
- Nearest Node point: Ispahani Junction (LalkhanBazar Moor)
- Number of house 1800
- Total population 9820
- Number of dwelling unit survey 40
- Total area 5 acres (approximate)

Economic Profile

- Average income of the family per month –9500 taka (Min 6000 Taka Max 11000 taka),
- Formal Workers (Factory and Garments): Male 25 % Female 35%

- Percentage of casual workers: Male 65% Female 45%
- Percentage of unemployment: Male 10% Female 20 %
- Average distance for workplace: 3 to 4km
- Percentage of income spent for maintaining housing: 35%
- Percentage of household in debt 10-15 %

Social Profile

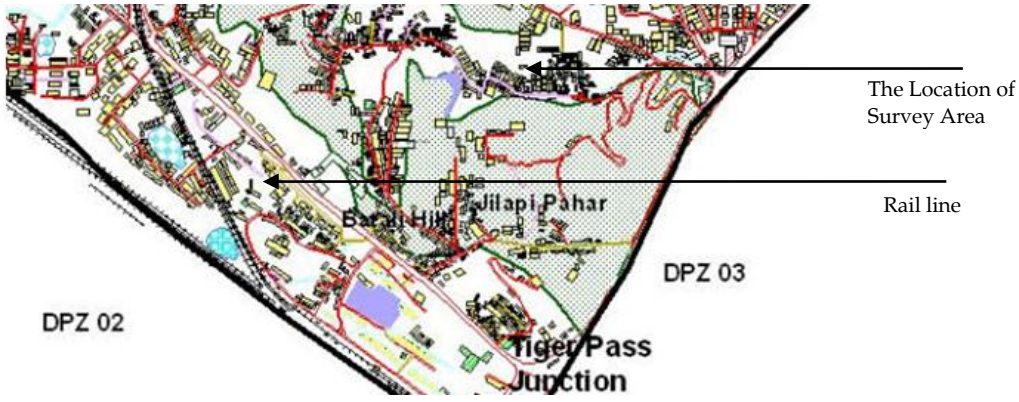
- Average Household Size – 5.5
- Percentage of household living in tenants 85%
- Percentage population having- Primary Education 15%, Secondary Education 5%

Environmental Profile

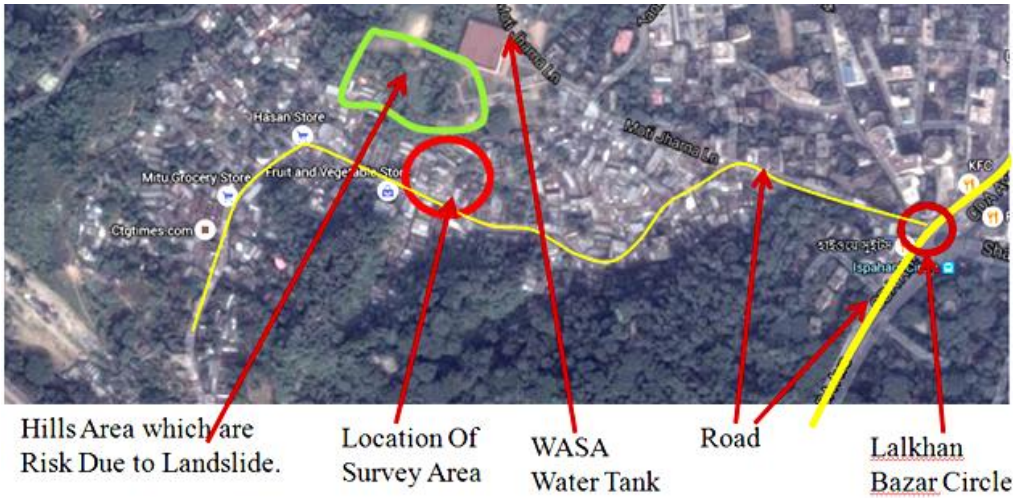
- Percentage of Buildup area - Assume 85 % (approximately)
- Percentage of green area 5-8 %
- Percentage of open space 10 %
- Number of landslide disaster last ten year: 5
- Number of affected people by landslide 500
- Number house destroyed by landslide 45
- Percentage of house vulnerable for Landslide: Low 20%, Medium 45 %, High 35 %

Source: Field survey

Figure 5: View of survey area 2



Source: GIS map, planning department, CDA



Note: Map from Google Earth

Figure 6: Location of the survey area 2: Motijorna part 1

Services and Amenities

- Approach Road – No formal approach road
- Water supply – water available from the common source.
- Sanitation – Common Toilet
- Surface drainage- Open Katcha surface drain
- Distance of local shopping area – 1 km
- Distance of Medical Facilities - 5 km
- Distance of Bus stop /Railway station 3 km

Building Condition

- Area of the housing unit - 12 sqm (0.18 Katha)
- Floor area per person – 2.6 sqm
- Number of room 01
- Material of the house: Wall – Bamboo -90%, Brick Wall 10% , Roof- CI Sheet
- Floor- Cement concrete, Door- Bamboo. Wood Window- Wood,/ CI Sheet
- Average Height of the roof: 2.75 sqm
- Natural Lighting and ventilation of the house. Not proper

Priorities and Aspiration

- Percentage of Household desire to shift- 85%
- Percentage of Households to pay for rent house - 70%
- Demand of Size of house – 20 sqm (0.59 Katha)
- Prior Space/Facilities – Safe Bedroom- Kitchen/toilet

Housing Condition of Landslide Area of Chittagong

Like most other informal settlements in Chittagong, Biojeed Bostami, Motijahrna informal settlement has been built on vacant government land vulnerable to natural disasters - a landslide. A lot of houses are built on the edge of the steep slope, hill top and foot of the hill. This practice makes them extremely vulnerable to landslides. According to the survey report of the students of CUET, the building of Motijorna settlement is in four types – Katcha, Semi pucca, Pucca and Multistoried.

Kutcha House: Katcha house mainly are built with cheapest and temporary materials, The Foundation is made earthen plinth with bamboo (sometimes timber) posts. When the wall with organic materials - jute stick, catkin grass, straw, bamboo mats, etc. and split bamboo framing. Here the roof is of CI sheet.

Semi-Pucca House: In this house the foundation or plinth is made of brick perimeter wall with earth infill (sometimes the plant is brick or cement concrete layer) and walls of bamboo mats; CI sheet; Timber (sometimes split bamboo) framing. The roof is also made by CI sheet.

Pucca House and Multistoried Building: Here the foundation is built with brick or concrete framing, wall is made by of brick, and the roof is reinforced Cement Concrete (RCC).

Layout Pattern: There is irregular pattern in the housing of that study area.

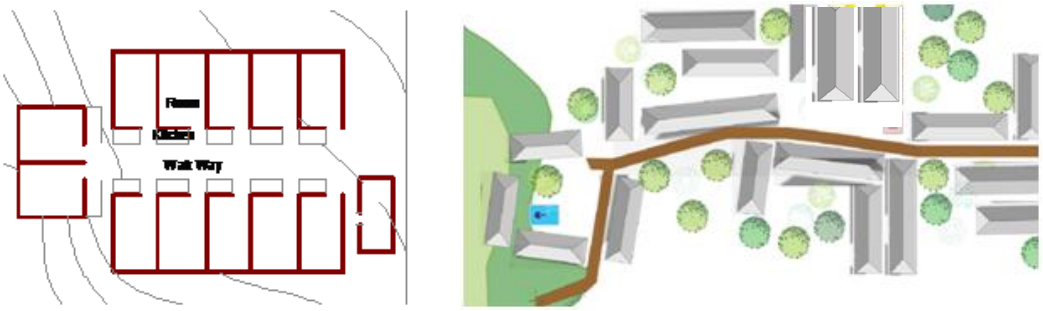
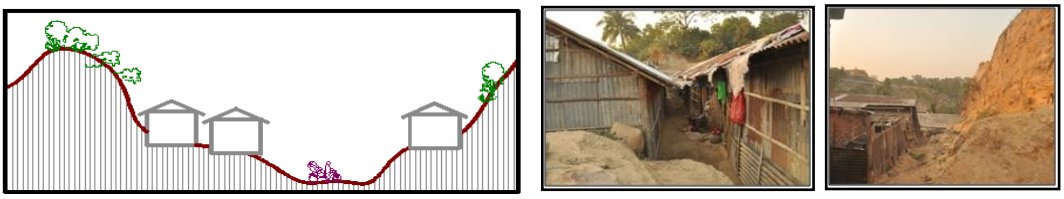


Figure 7: Conceptual Layout Plan



Source: Field survey

Figure 8: Conceptual Cross Section of the settlements, view of the site, narrow walkway and hill cutting

There are different layout plans of the houses in the study area. The most common and vulnerable shelters are in group sharing with common toilet and kitchen facilities. There houses connected with a narrow corridor and some of them are very near to hill.

Common water supply and electricity facility are there. The drainage system is not properly made in consideration of rainwater drainage. The layout plan and cross section are shown in Figure 7 and 8.

People living in the landslide prone area are mostly illiterate, day laborers and garments based occupation, low income, migrated from outside of city mainly for the job, weak housing infrastructure, not access to the basic urban services (water supply, sanitation, electricity, etc.) and facing disaster in nature.

Example of Rehabilitation Project in Bangladesh

In 1998, the Government of Bangladesh (GoB) had taken up Bhashantek Rehabilitation Project to provide housing for the Slum Dwellers (SD) and Low Income Group (LIG). The project is expected to provide shelter to more than 80,000 urban poor. This project is the first joint venture rehabilitation project by the Government and the private organization (Mohit, 2012).

Summary of Project: On a total land area of 20 hectors, 15024 units of apartments were to be constructed. Residential land coverage is about 58% of the total land. The government is providing the total land costs of about US$ 50 million. The selling price of apartment unit is US$ 160 per sqm with prices for SDs flat being US$ 3000 and LIG Flat US$ 4480.

Design: The project consists of six-storied buildings (with only stair). The floor area for type A (SDs) unit is 18.75 sqm (60% of total units) and for type B (LIG) is 28.00 sqm (40%of total units). Figure 9 shows the unit plans.

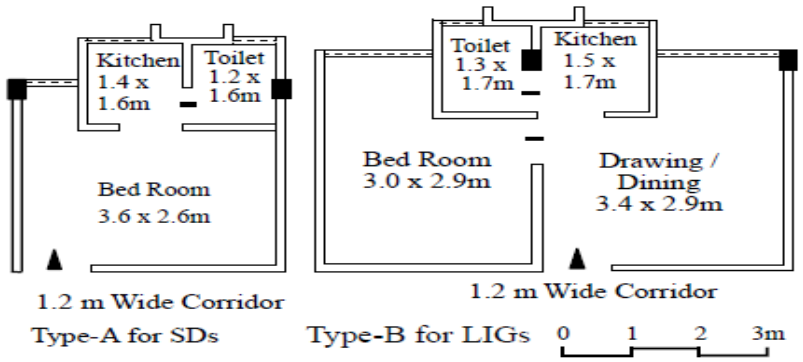


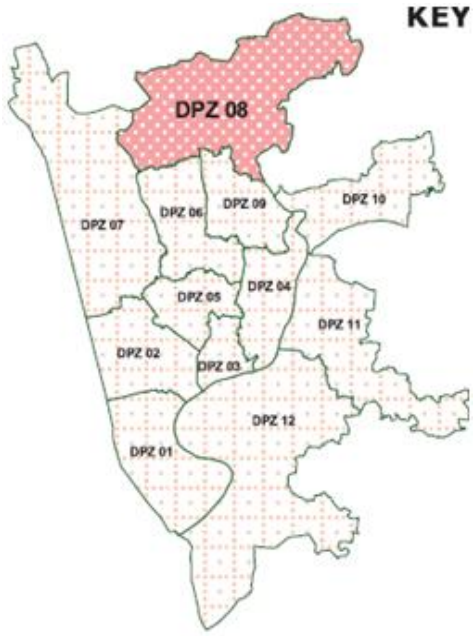
Figure 9: Design of dwelling units

The unit plan of Bhashantek Rehabilitation Project is two types. The room size is 3.6mx2.6m with a toilet and kitchen or SD's people and there are two rooms (Bed room 3.0x2.9 m, hall room 3.4mx2.9m) with a toilet and kitchen for LIG people. The project failed to accommodate the target population due to flawed policy and the prices fixed are beyond the affordability of the target population.

Analysis of New Selected Site for Rehabilitation

The site is located at present at the DPZ 08 which is a proposal site for residential purpose in proposed new township project by Chittagong Development Authority (CDA). In the site analysis, two important issues will be focused- a) the site

surroundings, environments and Land use of the site for housing and b) the special potentiality of the site for the Rehabilitation of the landslide affected people for that site.



Source: DAP 2008, CDA

Figure 10: Map of DBZ of Chittagong city according to DAP 2008

Brief Description of Site

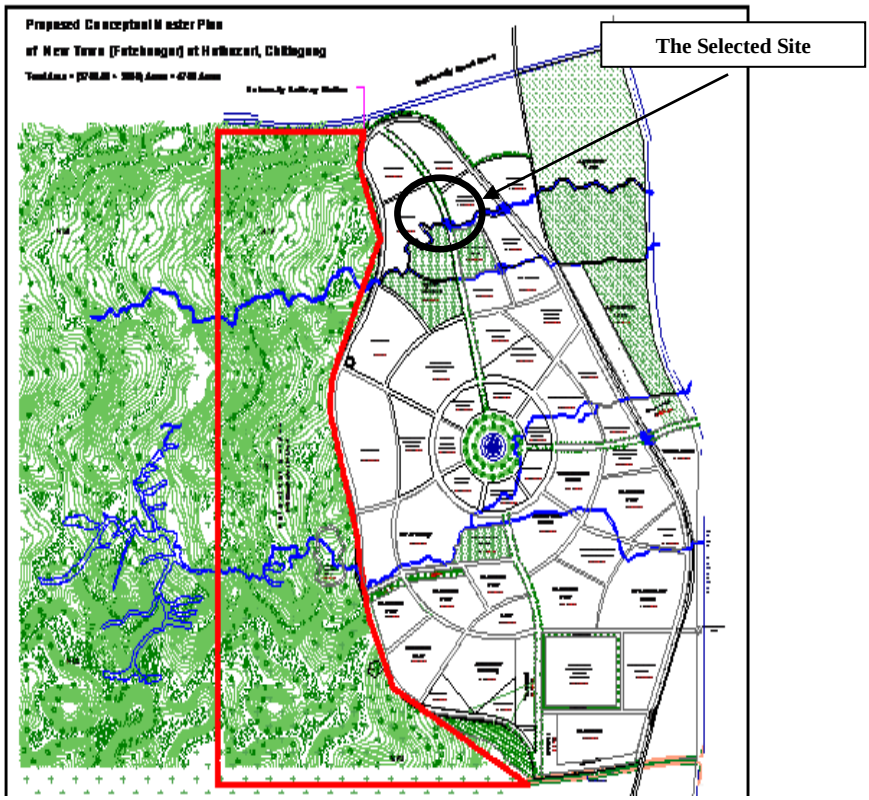
The Site is Located at the northern side of Chittagong at Fathebad in Hathazari Thana (Figure 10). According to Detail Area Plan (DAP,) 2008, a new township was recommended in the zone DPZ 08 which is located at Hathazari and Raozan thana (North Chittagong) by the Hathazari Road and near Chittagong University.

CDA had a proposal for a new township, named Fathenagar New Township where according to the master plan of the new township, the total area is 4700 acres with 2000 acres of reserve forest. It is connected to the City by Hathazari Road (N106) to the main city and by Nazirhat-Sholoshahar Railway. The master plan composed with Government and non-government institutional area, commercial area with a shopping mall, educational area, Cottage industry area, Cultural area with the museum, Health center, industrial plot, Residential area for housing and open playground park, etc. There are a different residential area for a housing project in the master plan and one site which around 42.16 acres is selected based on its potential.

Site Surroundings and Environments

The site is located in new township area. Chittagong. It is around 25 kilometer from the Main Chittagong city but very near to the Chittagong University. The Fatheyabad urban area is also by the side of the area.

North: Chittagong University, University Connection Road and University Railway Station, Residential Village area, East: Fatheabad Urban area, Hathazari Road, Nandir Hat market area and Central Loknath Temple, Fatheyabad Railway Station, and Residential Village. South: Open land and Residential Village. West: Forest area and extension of University area.

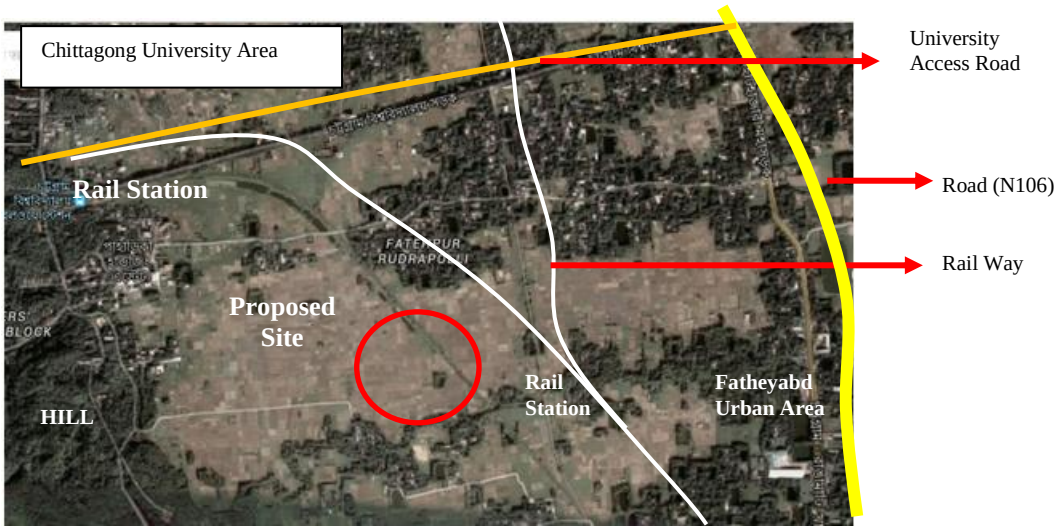


Source: Chittagong Development Authority (CDA)

Figure11: New Township layout plan

Source: Field survey

Figure 12: Hathazari road, and Fateyabad rail station



Source: Map from Google Earth.

Figure 13: Location of the site

There are different residential areas for a housing project in the master plan, and one site with an area of 42.16 acres is selected Figures 11 and 13). According to the master plan of the new township (Figure 11) the selected site is bounded by three roads in East (160′ wide), North (60′ wide), west side (100′ wide) and a Cannel of 60 feet wide at the south. At the west, there are rail tracks which are just after the read and after the rail tracks the reserve forest area is started. In the north side the land use is edu-village and at the east is Cottage industry where the south is an open park and sports complex. The area is connected by road and train (Figure 12).

Proposed Residential Site's Potential

- It is located at DPZ 08 zone of DAP of Chittagong city, and the area is defined as residential area in DAP
- It is safe from the following natural disaster - landslide, flood, and cyclone.
- Good communication to the main city by rail and road. The nearest railway station is only 15 min walking distance.
- Landslide effected EWS people can be able to go to their work places easily by train which is cheaper and economically viable.
- It is located at New Township area which is a proposal of CDA.
- Very near to Chittagong University Area.
- Market, school, and college are available in Fateyabad which is very near to the site.

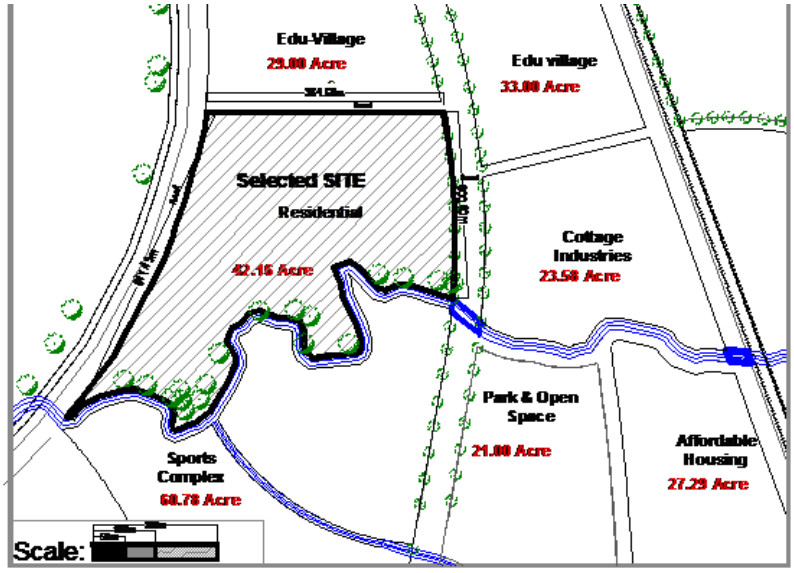
Communication between Residential Site and Chittagong City

The site is connected to the city by rail and road. Tables 2 and 3 provide information on the fare and distance by bus and train from the city to the site. Figure 14 shows the site plan with surrounding land use conditions.

Table 1: Fair of bus from city to the proposed site

Muradpur to Fateyabad(11 Km)	Bus/ Mini Bus	Local: 7 Taka	Non Stop Service: 30 Taka

Source: Field Survey



Source: Chittagong Development Authority (CDA).

Figure 14: Site Plan with adjacent land use

Table 3: Fair of train from city to the proposed site

Rail Station	Distance	Fair
Chittagong Central to Fateyabad	19 Km	6 Taka (local), 20 taka (Commuter)
Sholoshahr to Fateyabad	12 Km	5 Taka (local), 20 taka (Commuter)

Source: Bangladesh Railway

Consideration of Rehabilitation for Landslide Affected People

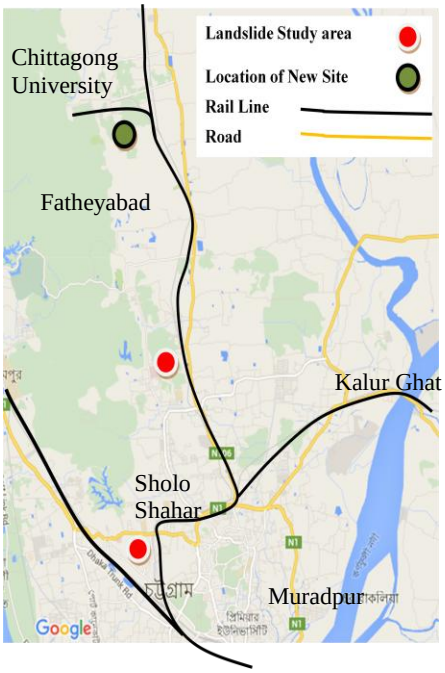
For any rehabilitation program, the most important issue is the proper survey and find out the community demand and ability of people. From the literature review, it was found that relocation can be the solution for disaster housing, but it should be done after proper analysis of social and physical conditions, financial feasibility and local norms and policies. From the primary survey and secondary information on landslide affected people, some major issues need to be considered for providing rehabilitation of housing for landslide affected community in Chittagong, which are discussed here.

Transportation: Now-a-day transportation is an important issue for any relocation. People want to live in the city for many reasons, but if they have good and cheap transportation system, then they can be relocated. Figure 15 shows the connectivity of the existing landslide area with the proposed new site.

Road Network: The new site is just by the side of Hathazari Road (N106) which is important national road and is directly linked with the city and local bus and other transports are available where the travel time is around half an hour.

Railway network: According to the master plan of the new township, there is circular Rail track which will provide mass transport for those inhabitants. This rail track is connected with the existing Nazirhat Sholoshahar Rail tracks at Fatheyabad Junction Station. So by rail networks, the new site is well connected to the city. From Fatheyabad to Sholoshahar (Main City), the travel time is 20 minutes, and the fair is also cheaper (5 taka) which can be affordable for the poor people. The communication cost site to the city is only 5-7% of their Income. That rail track is passing through the existing landslide affected area, so people can easily travel to their previous area from the newly relocated side by train.

Job Opportunity: Poor and low-income people live in that vulnerable area in the city mainly for their job opportunity in the city area. The relocation site also creates job opportunity for that kind of people. They can get a job as a home worker in housing. It is a new township and there is an opportunity to get a job also in the new industrial area. Another important issue is that there is good transport system with the city and for this they can continue their old job from the newly relocated site. Existing Oxygen and Baozeed Bostami area is mainly a Garments factory zone that provides a good opportunity for poor people being located near the new site with good transport system.



Source: Map from Google Earth

Figure 15: Linkage with existing landslide area to new proposed site.

Economic Feasibility Analysis: People are living in landslide risk area because of getting shelter at low price. The economy is the main issue for them. So rehabilitation program should be economically viable for that people. From the primary survey, it is found that the monthly family income is around 8000 to 9000 taka, and they can spend 2500 to 3000 taka (30% of income) for housing. For special program from the government, they can get 2.5 to 3 lakh taka loan for housing. So the price of the home should be limited upto 3 lakh Taka. They requirement of floor area is also 200 to 250 sqft (18.5 to 2323 sqm) and from a case study of Basantek Hosing project, the floor area is 200sft (18.5 sqm). According to the disaster housing policy, land can be given to that people free but at the same time, maximum people should be incorporated in an area with considering present rules. If the rehabilitation is a part of a normal housing, then the urban facilities and other areas can be shared which reduce the land development cost of that people, and the same time the total cost also reduced.

On the other hand, the construction cost of the building has to be minimum with minimum architectural and structural requirements. Considering rehabilitation project as a part of housing, Table 4 states that the cost of the unit is almost 3 lakh taka. If the rehabilitation project has to be taken individually then the land acquisition cost which has consider as free will be almost 84000 (in combine project it is only 34800 taka) taka per family, and it is a great burden for the government. On the other hand, total unit cost is more if the facilities like school and clinic are provided separately. If separate plot is to be provided then only for a unit (unit area 22.3 sqm, plot area 34 sqm), the land acquisition cost is 1.5 lakh which is a burden for government to give free per family. Again land development cost is 0.85 lakh, and Building cost is 2.9 lakh which is not affordable for the poor people and the plot size also too small to build separate building.

Table 4: Cost of a unit for rehabilitation

Serial No.	Aspects of Rehabilitation	Total
1	Total Number of Unit (Number)	2179
2	Average area of Unit (Sqft)	22.3
3	Total area of Unit (Sqm)	48611
4	Floor Number (5.5 FAR Included)	6.00
5	Land for House (3.5 acres)	9722
6	Total Required land area (5.4 acres)	**21861**
7	Land acquisition cost (Taka)	4464
8	Total Land Acquisition cost (Free) in Taka	97578916
9	Land Development Cost (Taka)	1279
10	Total Land Development Cost (Taka)	27962673
11	Total Construction Cost (Tk 1250/sft, 13450 tk/sqm)	653812500
12	Total cost (Land Development + Construction) in Taka	681775173
13	Cost Per Unit of House (Taka)	3,12,830

In this way, the poor landslide affected vulnerable people can be able to get a shelter with free of land acquisition cost where maximum family will share the land according to their demand and within present building construction rules.

Safety from Disaster: According to the literature review, relocation is the best program for the landslide area. But the new site should be free from other natural disasters like cyclone, flood, etc. and also free from pollution. The selected new site is free from Landslide as there is no hill in the area. That area is free from flood and cyclone also. The new site area does not have any pollution, and the natural environment is nice due to reserve forest area at the west. So the relocated people feel safety from a landslide which is their main concern and can also enjoy with natural environments.

Findings and Implications

Findings: By special government initiatives, land slide affected poor people can get a bank loan for purchasing a house and able to return with their income. The area of a house unit is around 20 sqm including bedroom, kitchen, toilet and other common spaces.

Research Limitations/Implications: The study is an effort to create healthy, enjoyable, habitable settlements with a focus on landslide issues on housing in Chittagong. Financing and implementation of project guidelines are also included. The paper depended on the secondary data for evaluation of land price which may not represent the actual scenario of land value. As it is a proposal only, the detailed architectural, structural or other technical working details of design of the building are not provided.

Practical Implication: Practically, it has important impact on the landslide affected people, where, by this policy, they may be able to get a safe shelter considering their economical condition.

Social Implication: The City is facing housing shortage and the shortage of housing increases day by day being impacted by landslides along with other disasters. So by providing safe housing, the people socially benefit in the city area.

Conclusion

The hill management technical committee submitted a plan suggesting proper management of the hills through tree plantation, construction of retaining walls or soil consolidation after rehabilitating people of those areas and other risky areas (NIRAPAD, 2010). According to DAP 2008, the development proposal of landslide area includes conservation of the hilly areas and its environmental protection and enhancement. So rehabilitation is essential for the landslide affected people in Chittagong City. The average income of the family is eight to nine thousand and one-third of the income they are ready for house rent. By special government initiatives, they can get up to Taka three lakh bank loan for purchase of a housing unit. The area of the house of the rehabilitation of people is around 20 sqm including bedroom, kitchen, toilet and others common spaces. But the Rehabilitation project should be economically feasible, safe from disaster, communication should be effective and rehabilitated people should get proper job according to their ability.

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