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# PARTICIPATORY EARTHQUAKE VULNERABILITY ASSESSMENT: A CASE STUDY ON MOTIJHORNA SLUM

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***Abstract****-This paper aims to assess the earthquake vulnerability of Motijhorna Slum in Chittagong City. Like any other slum, it is a densely populated area with high room density. Chittagong is a hilly region & sometimes earthquake has occurred here though their intensity is not very high. If a large earthquake occurs it will bring immeasurable sufferings especially to the study area as it is vulnerable for landslide occurrence also. The area is not well developed & most of the people are poor to build their living structures strong enough which may resist earthquake occurrence. The vulnerability is assessed using participatory approach as it is the best way to make realize the community how vulnerable they are. Different types of risk factors such as Ground Factor, Secondary Hazards, Demographic Factor, Emergency Preparedness and Structural Factors are considered. Different types of PRA tools and modified PRA tools are used in the study to assess the vulnerability of Earthquake.*

**Keywords:** Participatory, Vulnerability, Earthquake, Landslide.

## 1. INTRODUCTION

Vulnerability assessment is important for disaster management. PRA tool can be used in this regard which ensures the peoples participation. It is a growing combination of approaches and methods that enable rural people to share, enhance and analyzes their knowledge of life and conditions which facilitate themto think, plan and take actions about their community problems [1-4].This methods become more participatory as local people play a greater and more active role in the information gathering process [5-6]. The participatory tool has applied on the local people of South Begunbari slum to identify their problems and also to find solutions from their own suggestions [7]. In this study the existing condition of water supply, sanitation and drainage system has been evaluated.

Motijhorna is a hilly area where low income peoples live. Their housing condition is very poor with high room density. Many people live here in very small space. Most of the structures are of semi-pacca with very poor physical condition. These make the area vulnerable for earthquake. As the area surrounded by hills landslide can also cause earthquake to the area. People of this area are unaffordable to face these types of hazards which make the area vulnerable for earthquake.

All these force to take assessment of earthquake vulnerability of the Motijhorna area as the problem of the study. Therefore the research objective has taken as to assess the earthquake vulnerability of Motijhorna area. The area is all surrounded by hills. But the number of low income people is increasing day by day in this area. People have made their living place by cutting the hills. The frequent cutting of hills within the study area increases the vulnerability for frequent landslide. As the area is not well developed and the people here are unable to improve their living structures, the area is also unsafe for earthquake. So the vulnerability assessment mapping for this area is needed to take improvement actions. As PRA is a method of local participation which helps to identify the most vulnerable area for earthquake using the local people's preferences [2].

Different types of modified PRA tools are social mapping, resource mapping, wealth and well-being rankings, Venn diagrams on institutions, resource cards, seasonal calendar, daily activity clocks, income and expenditure matrix, focus group discussion, community workshop, daily meeting and planning workshop etc. [3].

## 2. METHODOLOGY

An organized methodology is needed for conducting a successful research as it shows the path for research completion. Here for assessing the earthquake vulnerability first we need to select the factors which can be responsible for making the hazard. Factors selected for this research are ground factor, secondary hazard, emergency preparedness, structure factor and demographic factor. Ground motion or shaking is the main culprit to damage in earthquake. Loose unconsolidated sediment is subject to more intense shaking than solid bedrock. As the study area is hilly area, landslide can be a secondary effect of earthquake. Fire can be happened as secondary hazard of earthquake as

fire lines can be knocked down and natural gas lines can be ruptured. The area is high dense which means more population and more vulnerability. Also people are not well educated and unconscious which increases the vulnerability. Bad construction materials used for their building structure is also responsible for earthquake vulnerability. More preparedness means less vulnerability which also should be considered in vulnerability assessment.

All these force to select the Motijhorna as the study area. Different literatures are reviewed on earthquake in Chittagong to select the study area. The Study area is Motijhorna is a slum in Chittagong vulnerable to earthquake as-

(a) Earthquake occurred in the area before
(b) Landslide can occur as a secondary effect of earthquake as the area is hilly
(c) The quality of structures is poor

To understand the study area very well PRA tool social mapping and resource mapping are used.

Social mapping is used to understand the population, living groups, housing pattern, ownership, income facilities and soil type of the study area. Approximately there are 1000 households and 60,000 people in this community. People of different professionals are lived here. Most of the houses are katcha and semi-pacca. Approximately 350-400 households are katcha, 550-600 households are semipacca and 100-150 households are pacca. Most of the people are Muslim (about 95%) and some Hindu people and Buddhist people live here. Road conditions are not good here which shown in the table 1. Table 2 shows the community facilities in the study area.

Table 1: Number of roads in Motijhorna slum

| Type | Number |
|---|---|
| Pacca | 3 |
| HBB | 10 |
| Katcha | 12 |

*Source: Field Survey, 2014*

Table 2: Number of Community Facilities in Matijhorna Slum

| Type | Number |
|---|---|
| School | 2 |
| Mosque | 2 |
| Mondir | 2 |

*Source: Field Survey, 2014*


Fig.1: Social Map of Motijhorna Slum (Study Area Map)
*Source: Field Survey, 2014*

Resource mapping is used to record information about natural and physical resources[1].This can be used to analyze the ground factor of vulnerability [4].The area is hilly in nature. The only natural resource of the study area is hill and some vegetation on hill. No other types of natural resource such as water body, vacant land etc. is found here.


Fig.2: Resource Map of Motijhorna Slum
*Source: Field Survey, 2014*

## 3. ANALYSIS OF VUNERABILITY

### 3.1Ground Factor

In the study area the intense of earthquake is almost same over the area. The previous earthquakes were not felt intensely. Every rainy season landslide has occurred here. Landslide never occurred here as a result of earthquake but in present situation if any earthquake will happen here this will cause landslide as secondary hazard.

According to liquefaction potentiality the area is not vulnerable as the soil type is not much water-saturated unconsolidated.

Fig.3: Vulnerable house besides hills
*Source: Field Survey, 2014*

### 3.2 Secondary Hazard

Fire can be happened to open and hanging electricity line or for knocking down of gas line.

### 3.3 Demographic Factor

The density is so much high in the study area. Most of the household is not more than 200 sq.ft. Again almost every houses are row house. The community is vulnerable according to this factor. Other demographic factors responsible for vulnerability in this area are age group (child and old people), lack of education, ownership and income.

Fig.4: Study area residents are low income people
*Source: Field Survey, 2014*

### 3.4 Structure Factor

The study area is vulnerable for this factor as the structure characteristics in this area are bad constructions materials, no shear wall, katcha and semi-pacca type's.

Fig.5: Extremely densely houses
*Source: Field Survey, 2014*

### 3.5 Emergency Preparedness

The institutions working in the slum can be described by the following Venn diagram.

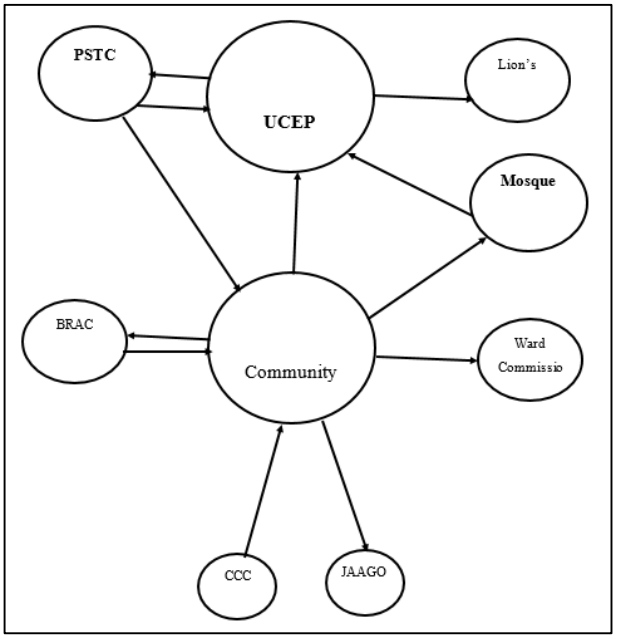


Fig.6: Venn diagram of Institutions working in Motijhorna Slum

The Venn diagram shows that the most dominating institutions working in this community is UCEP School (Underprivileged Children's Educational program). Lion's Eye hospital conducts campaign in the slum. Beside that Lion' arranges awareness program in the UCEP School. Primary Sanitation Training Center (PSTC) also arranges hygienic program in the UCEP School. UCEP School plays a connecting role in the community. PSTC and UCEP are supplements to each other. BRAC, a prominent NGO is working in the community. Besides that ward commissioner's office also play a vital role in the community. Chittagong City Corporation arranges disaster related seminar in the community as the Motijhorna Slum is one of the

vulnerable area in Chittagong. JAAGO Foundation, a splendid voluntary organization is conducting school for Children from the year of 2012. Imam and adult persons of the community play a vital role for the development in the community. They go to the community school and aware people for the better living through worship and wellbeing.

Above Venn diagram shows that the institutions working for disaster is not strong enough. So the community is vulnerable according to this factor.

## 4. FINDINGS

To compare the vulnerability within the community the area has divided into 3 blocks e.g. Block A, Block B and Block C. To find the most earthquake vulnerable area weightage has given as per factors intensity. Three types of weightage has given as per factors intensity in each block. Weightage 1 means less vulnerable, 2 means medium vulnerable and 3 means most vulnerable for the specific factor. From the study and analysis the findings we found are given below in a table.

Table 3: Acceleration vs. frequency of vibration

| Factors | Block | | |
|---|---|---|---|
| | A | B | C |
| Ground Factor | 1 | 3 | 2 |
| Secondary Hazard | 1 | 1 | 1 |
| Demographic Factor | 1 | 2 | 2 |
| Emergency Preparedness | 1 | 1 | 1 |
| Total | 4 | 7 | 6 |

From the table it has seen Block B is most vulnerable area .This block is the most densely part in the whole study area which increases its vulnerability. Again this part of area is vulnerable for earthquake for the ground factor impact as this part is much related with the hills. Block A is the less vulnerable area.

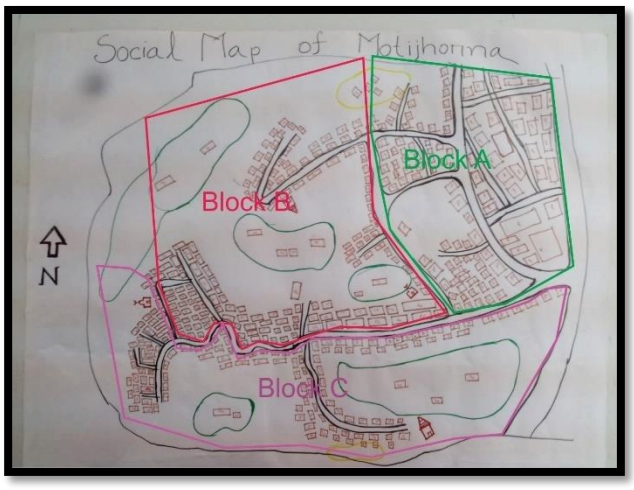


Fig.7: Vulnerability Map of Motijhorna Slum

## 5. CONCLUSION

Participatory Rural Appraisal (PRA) is a very popular tool in case of social analysis. It can also be a useful tool for earthquake vulnerability assessment.This study has intended to reveal this for the study area of Motijhorna which is the most disaster prone slum area in Chittagong. Using the PRA tool this study has found the most vulnerable part in this area through the local people participation. This finding will be helpful for taking precaution actions to reduce earthquake vulnerability in this area.

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