Risk Sensitive Land Use Planning of an Urban Cluster in Kathmandu, Nepal- A Case of Thapathali

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Abstract: The study is conducted to have better understanding of multi hazard scenario in the study area and to propose Risk Sensitive Land Use Plan (RSLUP) as an appropriate measure of disaster risk management. Disaster risk assessment is carried out in terms of earthquake, flood and fire. Whereas vulnerability is studied through detail study of building condition, population density, open spaces, infrastructure and services. Multi hazard risk map specific to the study area is made. RSLUP is proposed with different intervention in identified zones.

Keywords: Disaster Risk; Urbanization; Disaster Risk Reduction; Risk Sensitive Land Use Planning

1. Introduction

Nepal is one of the world's most disaster-prone countries and has experienced several natural catastrophes causing high economic and human losses (Piper, 2009, p. 10). As per (Acharya, 2011, p. 36) Nepal stands 6th, 11th, 30th most vulnerable countries in terms of risk from climate change, earthquake, and flood respectively. Whereas the population pressure, political instability, deficit of appropriate infrastructure and services, lack of awareness contribute for the human induced disaster like epidemics, fire, vandalism, climate change etc. In case of the cities of developing countries situation is severe. Similar is the case of Kathmandu; capital of Nepal. 1934 earthquake hit Kathmandu left 8000 people dead and 60% buildings destroyed. As per 2011 census highest population density is found in Kathmandu district (4,416 people per square km) with fastest decadal growth rate of 61.23%. But there is no specific planning for the safe accommodation of this population influx resulting settlement in hazard prone area, unsafe, sub-standard building and infrastructure construction, lack of open spaces, ecological imbalance and social destitution.

In this context RSLUP is one of the disaster risk reduction tool. It ensures the incorporation of issue of multi hazard into the conventional planning process. 2011 Global Assessment Report (GAR) fully recognized the opportunities of mainstreaming disaster risk reduction into land use planning and urban planning (Nepal, 2012, p. 35). Multi hazard analysis is done to identify the possible risk in the area. Different land use options are formulated to meet the demand over time and accordingly help to set the development goals and objectives. RSLUP involves regulatory and non-regulatory methods, as well as structural and non-structural approaches to provide guidance in adopting suitable risk reduction measures in the development projects in the area. RSLUP prescribe restrictions on building type, use, occupancy and density, spread out location of critical infrastructure, contingency plans, open spaces, escape routes and routes for delivery of relief supplies. Land use plan when combined with provision of essential infrastructure and services, helps to reduce the risks from everyday hazards. RSLUP is a continuous and cyclic process thus ensures the updated inventory of land use classification and vulnerability and an urban spatial and building database to monitor development in hazard-prone areas of the city.

2. Methodology

Based on detail understanding of relevant theories and literature conceptual framework is developed for data collection and analysis. First the selected site is divided into different blocks according to land use and road network. Data on risk assessment is carried out for each block in terms of earthquake fire and flood. First individual disaster risk map is prepared and overlaid with one above another to get multi hazard risk map of the study area. This map illustrates high to low risk blocks. Questionnaire survey is carried taking sample from the people of identified high risk area. Along with this all the critical facilities present are interviewed to understand their preparedness level.

Analyzing the map and other data major reasons behind the increased risk are found out. Risk sensitive land use plan is propose for the study area. Condition of hazard and vulnerability of community is taken as the basis for this planning. Overall three risk zones are identified, ranging from high risk zone (red zone) to low risk zone (green zone). Different development control strategies have been suggested to each zone.

3. Results

Poor land use planning is found as the main reason of increased disaster risk. Highest population density is

found in high risk area, where buildings are dense, open spaces are lacking; streets are narrow and have lots of dead end points.

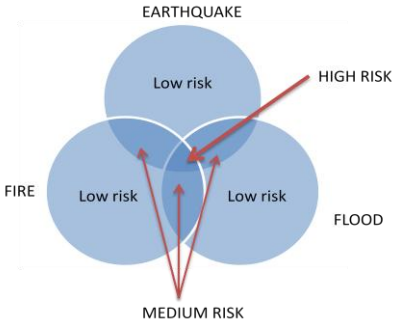

Chart 1: Multi Hazard Risk Analysis Conceptual Framework

More than 60% of settlement lies in high liquefaction zone. Narrow road width, poor structure of boundary walls and high buildings are adding risk to the escape route. One and only public open space in the area has been encroached. Its safety is questionable as it falls under high liquefaction zone. There are only few private open spaces, which can be built upon any time. Violation of building bye laws is common especially FAR and conversion of residential building into high occupancy use.

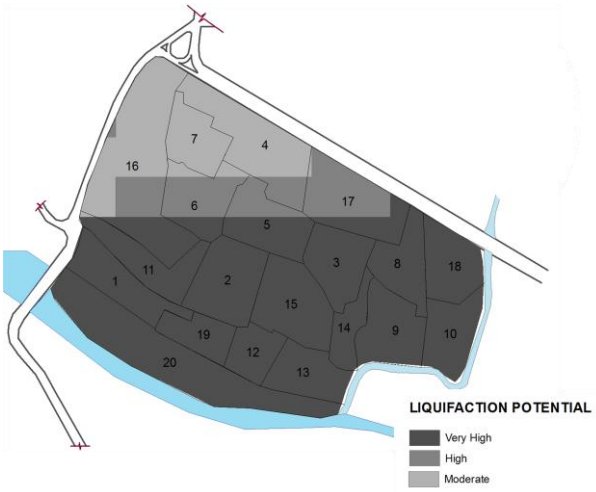

Figure 1: Site Overlay with Liquefaction Potential Map

Increased fire risk is associated with narrow and dead end roads resulting inaccessibility of emergency vehicles. Major fire brigade inaccessible areas are found in high population density zone. Haphazard mess of wire is found obstructing access to fire brigade and resulting short circuit fire. Almost all huts in squatter settlement are made of fire prone materials. In addition to this there is lack of water resources for fire fighting.

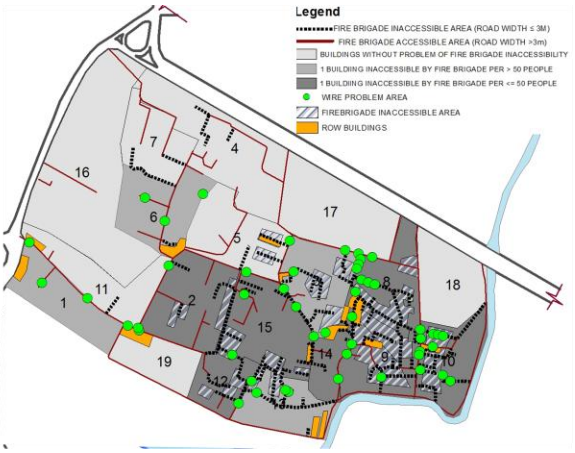

Figure 2: Spatial Overlay of Parameter Considered for Fire Risk assessment

Though river section and flow of water in rivers have been reduced significantly, still there is risk of flood hazard. Buildings along the bank of river are constructed without considering the setback to be maintained. Squatter settlement is at high risk of flooding, flooding of polluted river brings health problems every monsoon. Failure of drainage system to manage monsoon rain have resulted in water logging problem and flooding in squatter area as it is on lower elevation.

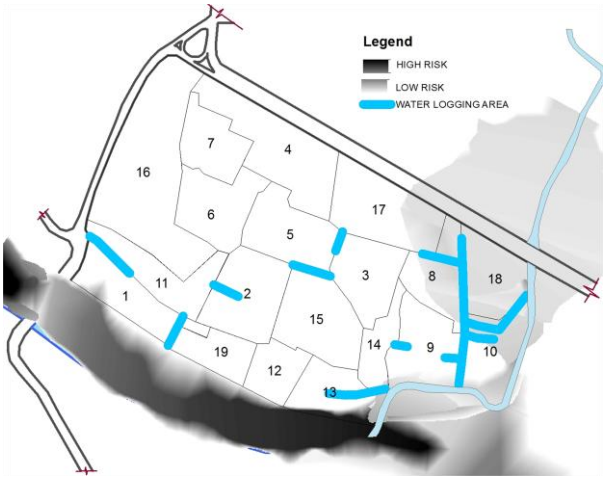

Figure 3: Site Overlay with Flood Hazard Map

In case of people in high risk area (other than squatter settlement) perceive earthquake as major disaster risk. Most of them do not have the feeling of safety because of the poor condition of structures built, narrow escape route, lack of open spaces and threat from adjoining buildings. Negligence of building byelaws is marked such that more than 80% building in high risk area found to have 100% coverage. Main source of information about DRM is from media and in case of children it is through school. There is no DRM program in any section of the site known to people,

though excitement is seen among people to participate in such DRM programs.

Preparedness level of people in squatter settlement reduced greatly ever since government bulldozed their houses. In lack of proper rehabilitation program they are living in poorer condition than before. Some of the people have done insurance of their live though main consideration is to have alternatives during accident and illness. People found ready to invest for their safety but amount that they can afford is for non-structural measures which are relatively cheaper than structural.

All parts of the site are close to critical facilities like hospital, school and government institutions which play important role during mishaps. Comparatively Norvic international Hospital found to be the most well prepared critical facility. Most of the educational institutions are operated in residential building. King's college and Rosebud school which are originally designed for educational purpose are found relatively safe and well prepared. Apart from structural safety and presence of open spaces government institution lack initiatives in other components of safety.

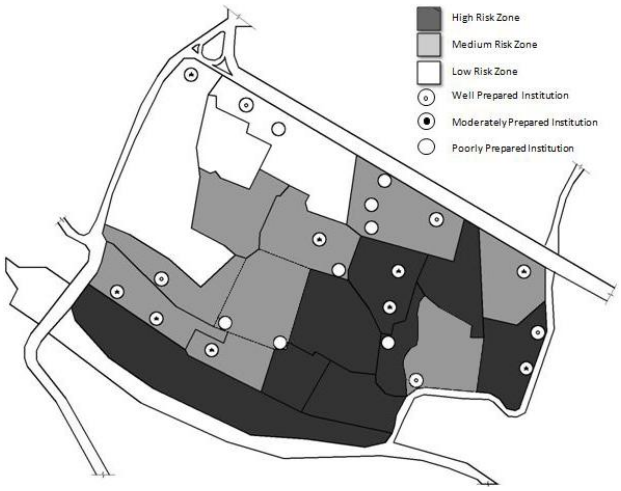

Figure 4: Preparedness Level of Critical Facilities

4. Recommendation

Risk sensitive land use plan is propose for the study area. Overall three risk zones are identified, ranging from high risk zone (red zone) to low risk zone (green zone). Different development control strategies have been suggested to each zone.

Red Zone

Identified highest risk zone in the area is proposed as red zone. It can be taken as high alert zone. It is characterized by high population and built up density, high seismic, liquefaction, flood and fire risk and lack of open spaces. Existing buildings should be checked against building bye laws and necessary improvement should be strictly followed. New building construction should be discouraged with heavy permit fee and land transaction tax. The area should be stringently restricted for high rise structures and large scale industries. In addition to conservation of open spaces, initiatives should be taken for the creation of new.

Figure 5: Proposed Risk Sensitive Land Use Plan

Yellow Zone

In this zone vulnerability of community is lower than in red zone. It can be taken as medium alert zone. The area is comparatively lesser in built up density thus growth can be promoted. As the area falls under high liquefaction zone, strict implementation of bye laws must be ensured both in existing and new structure.

Green zone

This is relatively safe area in whole of the area studied. It is lesser in built up density and with larger open space. The area is suitable to promote growth but care should be taken to conserve the open space as it can serve open space need of nearby dense areas.

Recommendation for Overall Improvement

All critical facilities should carry out vulnerability assessment to examine the structural, non-structural safety. Recommendation made out of the assessment should be strictly followed. In case of school improvement strategy can be relocation as most of them are operated in a rented residential building. From the various disaster and environmental perspective squatter settlement is not safe to settle in any case. Thus the best solution is the relocation of settlement to safer place. Unfortunately, this is real hard to achieve.

For conservation and management priority should be given to poorly suitable open spaces. Being located in high population density areas, they are going to be used by huge number of people. For the emergency use private open space owner should be motivated not to construct boundary. Private open spaces do not provide long term solution. Thus best way to create open space and widen access road without technical and financial difficulty could be the removal of boundary wall at least on road site. Similarly open space within the boundary wall of government institution and hospital can be made directly accessible to public. Small urban parks can be developed to help in regular maintenance and check encroachment. Another technique to conserve land could be the purchase of private land by government.

Figure 6: Boundary Wall Removal to Create Open Space

For the improvement detailed circulation network plan has to be prepared. People must be motivated to contribute land for the through streets. Areas where road width cannot be increased due to close standing of buildings (e.g., between block 2 and 15) should be connected with alternative wider road. Current drainage system should be upgraded to carry storm water. Haphazard solid waste disposal should be strictly controlled and road gradient should be compatible with drainage design. NEA should plan to manage the wire network to avoid sagging and wire mesh. Whereas buildings constructed without necessary setback from transformer should abide to maintain necessary setback.

As the area is already built upon, intervention should be planned to improve the situation of existing household. First of all identified weak structure should be assessed and strengthen immediately. All the buildings should be checked against building code compliance and encourage owner to adopt structural and non-structural safety measures. In case of identified high risk area transfer of development rights could be the feasible option as building owners live somewhere else in the city. Comparing the safety of their land in those areas against current location, transfer of development right can be adopted..

Though study area may have site specific problems, various DRR activities are impossible to carry out in isolation. For example there is no water resource within the study area from which the problem of water supply could be solved. It must be link to water supply project in the larger scale. Likewise the schools in the study area can take benefit from ongoing "Safer School" and "School Earthquake Safety Programme (SESP)". Relocation of squatter settlement is impossible to carry out within the study area. Thus each and every local plan should be co-ordinated with higher level plans for effective and efficient implementation.

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