and international experts and following global standard procedures. Studies reveal that recurrence periods of the fault lines located in the northern and central parts of the country are around 230-350 years, having the potential to generate 7.0-8.0 magnitude earthquakes, while fault lines located in the eastern part of the country calculated around 900 years have the potential to generate ≥ 8.0 magnitude earthquake. Earthquakes occurring even outside the territory of Bangladesh may cause significant damage in the country because of its thick soft-sedimentary cover over the engineering bed-rock (relatively hard and compacted rock).

Earthquake hazard assessment has been conducted for Dhaka, Sylhet and Chittagong city areas to determine ground motion, soil liquefaction and slope failure.

- Ground motion hazard is determined comparing the value of 'g' (980 cm/sec2) to represent the severity of earthquake damages.
- Earthquake hazard sizes can be represented in two terms, magnitude and intensity respectively.
- Magnitude represents the amount of energy released during an earthquake, which is computed from the amplitude of the seismic waves. A magnitude of 7.0 on the Richter scale indicates an extremely strong earthquake. Each whole number on the scale represents an increase of about 32 times more energy released than the previous whole number represents. Therefore, an earthquake measuring 6.0 is about 32 times more powerful than one measuring 5.0.
- Intensity is subjective, depending on observations of damaged structures, presence of secondary effects and the degree to which the quake was felt by individuals. There are 12 levels of intensity indicated by Roman number as per Modifided Mercalli Intensity Scale. For instance, intensity 'VIII' represents collapse of poorly constructed buildings and damages to well built structures, while intensity 'X' represents collapse of even well-built structures. Calculated strong ground motions reflect that Dhaka and Sylhet are susceptible to experiencing intensity VIII, while Chittagong could experience intensity around X. Intensity seems too high for Chittagong because of the proximity of the fault zone and its potential of earthquakes of magnitude around ≥8.0.
- Soil liquefaction is the hazard phenomena which reflects loss of bearing capacity of the soil due to ground shaking. Soil behaves like liquid due to which buildings topple down. For instance, in Chittagong, two to three areas are susceptible due to soil liquefaction, while this figure is less than half for Dhaka and Sylhet.

Building and Lifelines Inventory, Vulnerability and Risk Assessment

Vulnerability is the degree to which a person, system or unit is likely to experience damage due to exposure to hazard. It is estimated that there are 326,000, 182,000, and 52,000 buildings in Dhaka, Chittagong, and Sylhet City Corporation (Fig. 3) areas respectively. Afterwards, building stocks were differentiated into structural types. Such as, in the Dhaka City Corporation area, different types of reinforced concrete and masonry buildings are counted at 85,000 and 180,000 respectively.

To assess the vulnerability of the buildings, three level surveys were conducted in this study, taking into consideration the number of stories, occupancy class, structural type, number of occupants during the day and the night, age of the building, etc. (Level-1); dimensions of columns, concrete and masonry walls (Level-2); and dynamic measurement on few selected buildings in three cities (Level-3).

Using the same methodology for lifeline inventory, essential facility inventory was developed. For instance, the lifeline inventory in the Dhaka City Corporation area includes over 1,270 kilometres of highway road, 10 highway bridges, and pipeline lengths for potable water, waste water and natural gas of 1,100, 630 and 830 kilometres respectively. The essential facility inventories through CDMP study consist of medical care facilities, i.e. hospitals and medical clinics, emergency response facilities, i.e. police stations, fire stations and emergency operation centres and schools. There are 600 hospitals, 2,700 schools, 10 fire stations, 62 police stations and 18 emergency response agency offices in the Dhaka City Corporation area; while in Chittagong, there are 162 hospitals, 1,033 schools, 12 fire stations, 11 police stations and 11 emergency response agency offices; and in Sylhet, there are 87 hospitals, 211 schools, two fire stations, six police stations, and nine emergency response agency offices.

Based on the vulnerability factors of the building stocks and lifelines, vulnerability maps were developed which show the characteristics of the buildings, essential facilities, and lifelines that make them susceptible to the damaging effects of earthquakes. For instance, the most common vulnerability factor in Dhaka city is soft story (ground floor of the building is open for car parking) and overhanging (extension of existing structures over the ground floor).

Risk is the conditional probability and magnitude of damage that occurs on the exposures to a hazard event. Risk assessment reveals that if an