

Consequence of Nepal Earthquake 2015 and Effects in Bangladesh

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ABSTRACT

An earthquake that means sudden and violent motion of earth is a natural disaster that comes every year in different parts of the earth. Among them some of them are very weak and unnoticeable. But some of them are too violent to cause a great loss of lives and destruction of properties. Such an earthquake happened in Nepal on 25th April 2015. More than 8,000 people died and more than 19,000 people got wounded in this earthquake. People of Nepal had anticipated but never experienced such a devastating earthquake. The earthquake also affected many parts of Bangladesh and people were frightened and many were wounded. This paper deals with the Gorkha earthquake in Nepal, its causes and characteristics, consequences and its destruction in Bangladesh.

Keywords: Seismicity, Earthquake, Reverse Fault, Tri axial Accelerometer

1. INTRODUCTION

Nepal is located in south Asia with an area of 147,181 square kilometers and a population of approximately 27 million. It is located in the Himalayas and bordered to the north by the People's Republic of China, and to the south, east and west, by the Republic of India. Nepal is separated from Bangladesh by the narrow Indian Siliguri corridor and from Bhutan by the Indian state of Sikkim. Figure 1 shows the location map of Nepal of south Asia. On June 7th, 1255 AD earthquake of 7.7 Richter scale was first recorded in Nepal when one third of the total population in Kathmandu was killed. On Saturday April 25th, an earthquake of moment magnitude 7.8 struck the Gorkha district of Nepal, and over 367 aftershocks (of ML > 4.0) have also struck the region including a ML 6.8 in the mountains causing a landslide. In 81 years since 1934, it was the biggest earthquake to strike the country. The devastating earthquake was felt across the region from India to China and left immense destruction, flattening sections of Kathmandu and triggering avalanches in Mount Everest region. The earthquake rattled the Dhaka, Chittagong, Barisal, Rajshahi, Dinajpur, Rongpur, Kushtia and different parts of Bangladesh. The 7.8 magnitude earthquake's epicenter was 81 kilometers (50miles) northwest of Kathmandu, Nepal at a depth of 9.3 moles. The Meteorological Department stated that the epicenter of the earthquake was 745 km north-west of Bangladesh. Another Earthquake followed the earlier one as an aftershock at 13.08 on 26th April to hit Nepal with a magnitude of 6.7 along with Bangladesh and India (Prothom Alo; bdnews24.com; the Daily Star, April, 26; and CNN, April, 26).



Figure 1: Map of Nepal (<http://nepalculture.evenweb.com/>)

2. NEPAL EARTHQUAKE 2015

At 25th April 2015, a magnitude of Mw 7.8 earthquake occurred with an epicenter 77 km (48 miles) northwest of Kathmandu. The quake hit at 11:56 am local time (06:11 GMT) according to US Geological Survey (USGS). The devastating earthquake flattened homes, buildings and temples, causing widespread damage across the region and killing more than 8000 and injuring more than 19,000 people. The earthquake centered outside Kathmandu, was the worst to hit Nepal in over 81 years. Fourteen districts severely-affected by the earthquake are Gorkha, Kathmandu, Bhaktapur, Lalitpur, Sindhupalchowk, Sindhuli, Ramechhap, Dolakha, Nuwakot, Dhading, Rasuwa Solukhumbu, Okhaldhunga and Kavre Palanchok districts. An additional 14 districts have reported medium level damages. Many buildings in Kathmandu valley have collapsed, including historical landmarks such as UNESCO World Heritage temples at Basantapur Durbar Square and the historic nine storied Dharahara tower in Kathmandu by the disaster. Mount Everest base camp 1 and Mount Everest base camp 2 were severely damaged as a result of avalanches in the Himalayas. The intensity map of this earthquake of Nepal and its neighbor countries are shown below in Figure 2 and Figure 3.

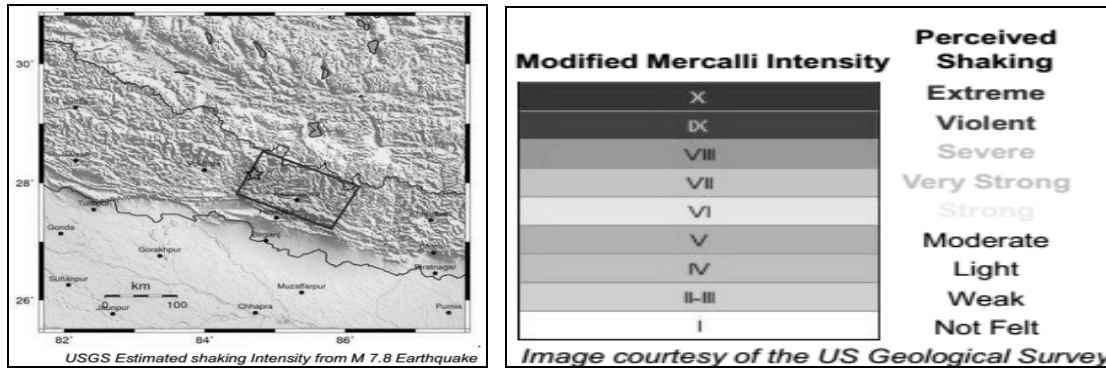


Figure 2: The Modified Mercalli Intensity (MMI) scale depicts shaking severity. The area nearest Katmandu experienced very strong to severe shaking. (www.slideshare.net)

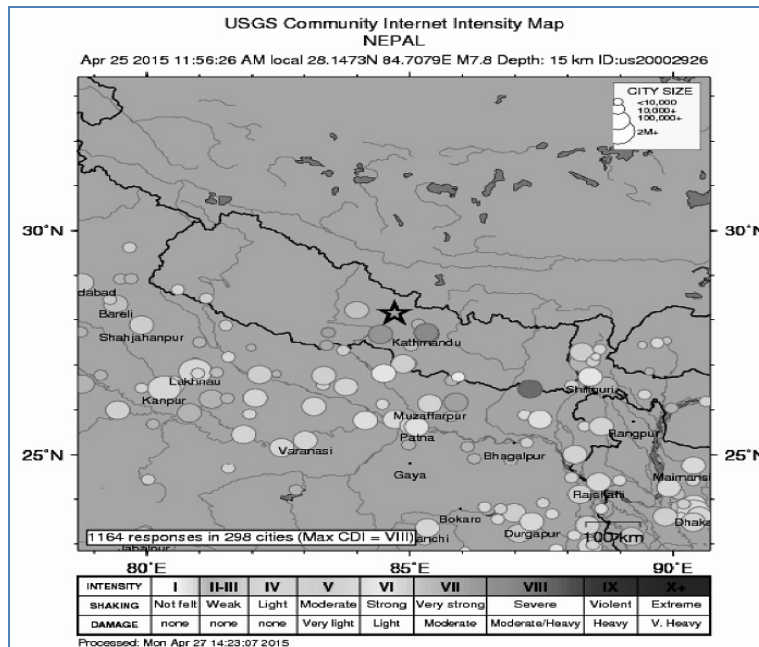


Figure 3: USGS Community Internal Intensity Map (U.S. Department of the Interior U.S. Geological Survey)

A major aftershock of magnitude 6.7 M_w occurred in the same region at 12:55 NST (07:09 UTC) on 26th April 2015, with an epicenter located about 17 km (11 mi) south of Kodari, Nepal. The aftershock caused fresh avalanches on Mount Everest and was felt in many places in northern India

including Kolkata, Siliguri, Jalpaiguri and Assam. The aftershock caused a landslide on the Koshi Highway which blocked the section of the road between Bhedetar and Mulghat. Figure 4 shows the magnitude Mw 7.8 earthquake (main shock) and the distribution of 40 aftershocks of magnitude 4 or larger that occurred over the following 27 hours. The aftershock distribution outlines the rupture zone of the main shock (US Geological Survey). The rupture during the main shock initiated beneath the epicenter and propagated toward the southeast.

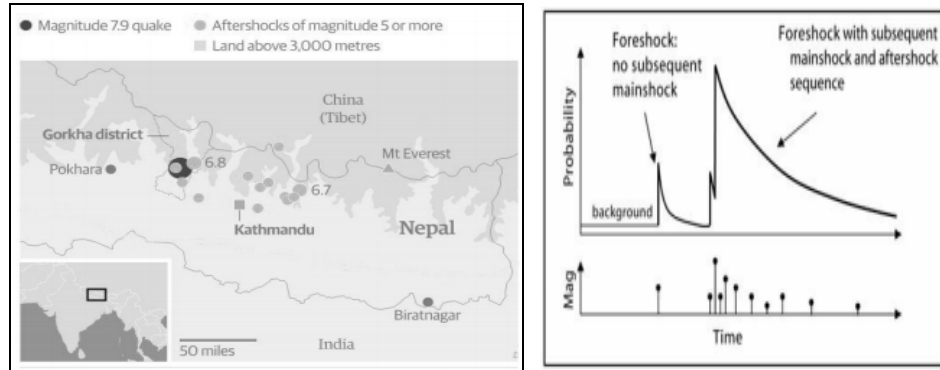


Figure 4: Locations of main shock and aftershock in Nepal (US Geological Survey)

On 12th May 2015, a second major earthquake occurred at 12:51 NST with a moment magnitude (M_w) of 7.3 M_w 18 km (11 mi) southeast of Kodari. The epicenter was at Sunkhani of Dolakha district near the Chinese border between the capital of Kathmandu and Mt. Everest. It struck at the depth of 18.5 km (11.5 miles). This earthquake occurred along the fault close to the original magnitude Mw 7.8 earthquake of 25th April. As such, it was considered to be an aftershock of the 25th April quake. Tremors were also felt in northern parts of India including Bihar, Uttar Pradesh, West Bengal and other North-Indian States. As a result of the aftershock at least 117 died in Nepal and about 2,500 were injured. Seventeen others died in India and one in China. Figure 5 shows the intensity distribution of 12th May earthquake.

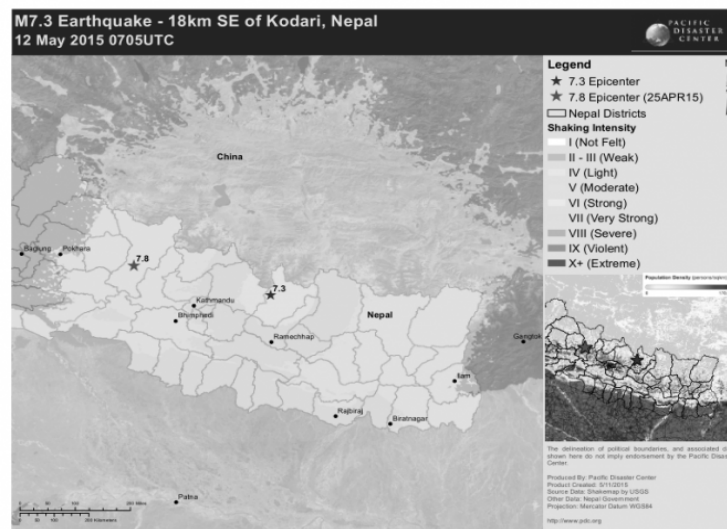


Figure 5: Intensity Distribution of 12th May Earthquake in Nepal (Pacific Disaster Center)

3. DAMAGES IN NEPAL

Thousands of houses were destroyed with entire villages flattened, especially those near the epicenter across many districts of the country. Several of the churches, temples and monasteries in the Kathmandu valley were destroyed. Several pagodas on Kathmandu Durbar Square, a UNESCO World Heritage Site, collapsed, as did the Dharahara tower, built in 1832. At least 180 people were killed by the collapse of the latter structure. Manakamana Temple in Gorkha district is also destroyed.

The northern side of Janaki Mandir in Janakpur was also damaged. Many temples, including Kasthamandap, Panchtale temple, the top levels of the nine-story Basantapur Durbar, the Dasa Avtar temple and two dewals located behind the Shiva Pārbati temple were destroyed by the earthquake. Some other monuments, including the Kumari Temple and the Taleju Bhawani Temple got partially collapsed. The top of the Jaya Bageshwari Temple in Gaushala and some parts of the Pashupatinath Temple, Swyambhunath, Boudhanath Stupa, Ratna Mandir, inside Rani Pokhari, and Durbar High School have been destroyed. In Patan, the Char Narayan Mandir, the statue of Yog Narendra Malla, a pati inside Patan Durbar Square, the Taleju Temple, the Hari Shankar, Uma Maheshwar Temple and the Machhindranath Temple in Bungamati were destroyed by the quake. In Tripureshwar, the Kal Mochan Ghat, a temple inspired by Mughal architecture, was completely destroyed and the nearby Tripura Sundari also suffered significant damage. In Bhaktapur, several monuments, including the Fasi Deva temple, the Chardham temple and the Vatsala Durga Temple of 17th century were fully or partially destroyed. Outside the valley, the Manakamana Temple in Gorkha, the Gorkha Durbar, the Palanchok Bhagwati, in Kabhre Palanchok district, the Rani Mahal in Palpa district, the Churiyamai in Makwanpur district, the Dolakha Bhimsensthan in Dolakha district, and the Nuwakot Durbar were partially destroyed. The north eastern parts of India also received major damage. Heavy shocks were felt including the states Uttarakhand, Uttar Pradesh, West Bengal and many other states. A huge damage was caused to the property and the lives of the people. Figure 6 shows images of different damages in the earthquake.



Figure 6: Different damages in Nepal during the earthquake (National Post News, globalnews.ca, mormonsoprano.com)

4. EFFECTS AND DAMAGES IN BANGLADESH

On April 25 the earthquake rattled the Dhaka, Chittagong, Barisal, Rajshahi, Dinajpur, Rongpur, Kushtia and different parts of the Bangladesh. In Bangladesh, total 5 people were killed and up to 100 people were injured while evacuating. One female was killed by collapse of wall made of mud along with other two women were killed in Pabna and Dhaka. One worker was killed along with 50 injuries in Savar. Another death toll occurred in Sunamganj. 50 readymade garment workers were injured at Ishwardi (*Situation Report, DDM, April 25; Prothom, April, 26*). 23 buildings were damaged in all over Bangladesh (*Situation Report, DDM, and April, 25*).

Department of Disaster Management (DDM) has received further feedback from local level officials in total 19 districts. Figure 7 shows affected districts of Bangladesh during the 25th April Nepal earthquake. Table 1 shows the summary of total losses and damages in Bangladesh during the 25th April Nepal earthquake. Figure 8 shows people frightened and come out of their offices when the strong motion was felt. Figure 9 shows one building have tilted over another one.

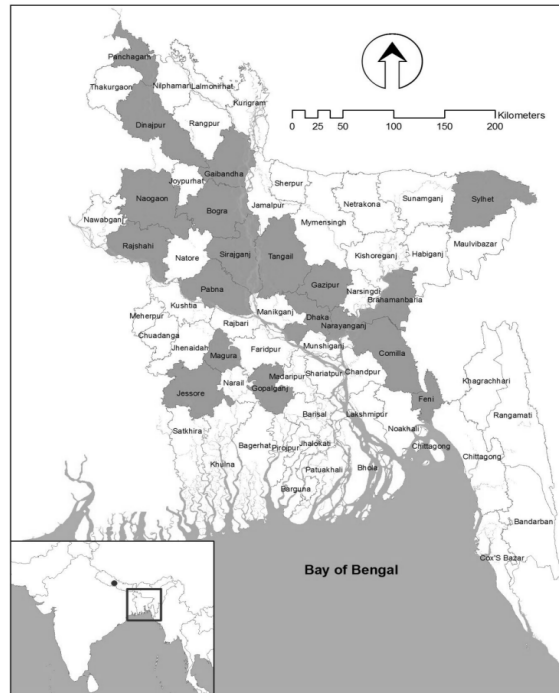


Figure 7: Affected Areas of Bangladesh at 25th April 2015 (Situation Report, DMIC)

Table 1: Losses and Damage in Bangladesh (Situation Report, DMIC)

SL	Location	Infrastructural Damage	Death	Injured Source	Source
1	Dhaka	Total 8 buildings have been affected. Details are as follows Nababpur: Crack has been reported in a 6 storied building close to Police box. Islambag: FSCD reported of a building subsidence of about 3 ft in a 6 storied building. Banani: Hotel Sarina has been slightly tilted Mirpur: Diamond garment has been slightly tilted Bangabazar: Minor Crack in one building Keraniganj: Kaji Bhaban, a 7 Storied building has been slightly tilted. Motijheel: A 6 stored building tilted slightly. Banani: 14 stored building titled slightly.	1 female (age 22) patient jumped from roof top of Dhaka Medical College due to panic and died	Savar: 80-90 labours have been injured at Al Muslim garments while quickly coming out from the building in two days; 10 -12 persons have been injured while quickly coming out of the building of Mission Group	EOC, DDM FSCD
2	Jessore	Wall crack has been reported at Hotel Hasan Int. and Muslim Academy Building.	-	-	EOC, DDM
3	Bogra	Crack observed in few school buildings	One woman (age 55 years) reported dead due to wall collapse	Few students are injured due to panic rash out	EOC, DDM
4	Rajshahi	2 Buildings at a place called Malopara have a bit inclined on the adjacent building. Crack observed 1 primary school. 1 women college tilted.	-	-	Rajshahi City Corporation Engineer & NDRCC

5	Narayanganj	2 building have tilted	-	-	NDRCC Report
6	Gajipur	1 building have tilted	-	-	NDRCC Report
7	Gopalganj	1 school slightly effected	-	-	NDRCC Report
8	Tangail	-	01 woman (rush out)	Few	NDRCC Report
9	Feni	Crack observed in 1 building. Deputy Commissioner sealed it.	-	-	NDRCC Report
10	Comilla	-	-	2 / 3 people injured. 40 / 50 fainted due panic	NDRCC Report
11	Brahmbaria	-	-	Some students slightly injured due to rash out	NDRCC Report
12	Sylhet	Crack observed 1 building	-	-	NDRCC Report
13	Gaibandha	-	-	-	NDRCC Report
14	Pabna	-	1 School Teacher (Panic death)	-	NDRCC Report
15	Sirajganj	-	-	Some student injured due to rush out	NDRCC Report
16	Dinajpur	Crack observed in few buildings	-	-	NDRCC Report
17	Naogaon	4 building tilted	-	-	NDRCC Report
18	Panchagarh	Crack observed in few educational institutes	-	-	NDRCC Report
19	Magura	-	-	Few students injured due to panic	NDRCC Report



Figure 8: Many people come out of their offices when a strong earthquake was felt in Dhaka (The Daily Star)



Figure 9: One building have tilted over another one (bdnews24)

5. CONCLUSIONS

Earthquake is a natural disaster and it may come any time. People of Bangladesh never thought that, such a devastating earthquake may come at the neighbour country Nepal with lots of death and destruction. May be the affect of the earthquake at Bangladesh is not much, but it should be a lesson for the Bangladeshi people. Bangladesh is situated at a very risky zone of Earthquake and any time a devastating earthquake may come. So people of Bangladesh should be much more careful and aware and prepared for earthquake. All buildings should be designed as code. Old and unauthorized and unsafe structures have to be identified and take necessary steps. Much more earthquake data recording stations should be set. Earthquake safety program should be started and continue at every part of Bangladesh by different government and non government organization with support of media.

REFERENCES

- “Nepal Earthquake overview”-USAID (4-25-2015).
- “Magnitude 7.8 NEPAL”-IRIS Education & Public Outreach and University of Portland.
- “M 7.8 Nepal Earthquake of 25 April 201 5”- U.S. Department of the Interior U.S. Geological Survey.
- “Culture of Nepal”-Map of Nepal (<http://nepalculture.evenweb.com>)
- “Nepal Situation Report #2”-Humanity Road – (Activation: Nepal Earthquake- Glide EQ-2015-000048-NPL Publication Date: April 26, 2015 (local Social Media Situation Report).
- “Nepal Earthquake Iom Emergency Response”-Situation Report, (30 April 2015).
- “Earthquake” - Information bulletin Nepal, International Federation of Red Cross and Red Crescent Societies.
- “Nepal and Natural Disaster”-United Nations Human Settlement Program.
- Samyog Shrestha-“Probabilistic Seismic hazard Analysis of Kathmandu City, Nepal”, International Journal of Engineering Research and General Science Volume 2, Issue 1, January 2014 ISSN 2091 -2730.
- IRIS Earthquake Browser (www.iris.edu/ieb)
- “April 2015 Nepal Earthquake”- Wikipedia.
- “Situation Report”-Disaster Management Information System (DMIC), Ministry of Disaster Management and Relief, Date: Sunday, 26 April, 2015: 1900, Countrywide Earthquake Situation.
- “Situation Report”, Network for Information, Response And Preparedness Activities on Disaster (NIRAPAD), Dhaka, April 26, 2015