



Mawlaik Earthquake, Myanmar

Magnitude, $M = 6.9$

Hypocentral depth = 134.8 km (Around Sagaing Fault)

Epicentral Coordinate = $23.133^{\circ}\text{N } 94.900^{\circ}\text{E}$

Modified Mercalli Intensity = VI (Epicenter)

Modified Mercalli Intensity = IV (Chittagong)

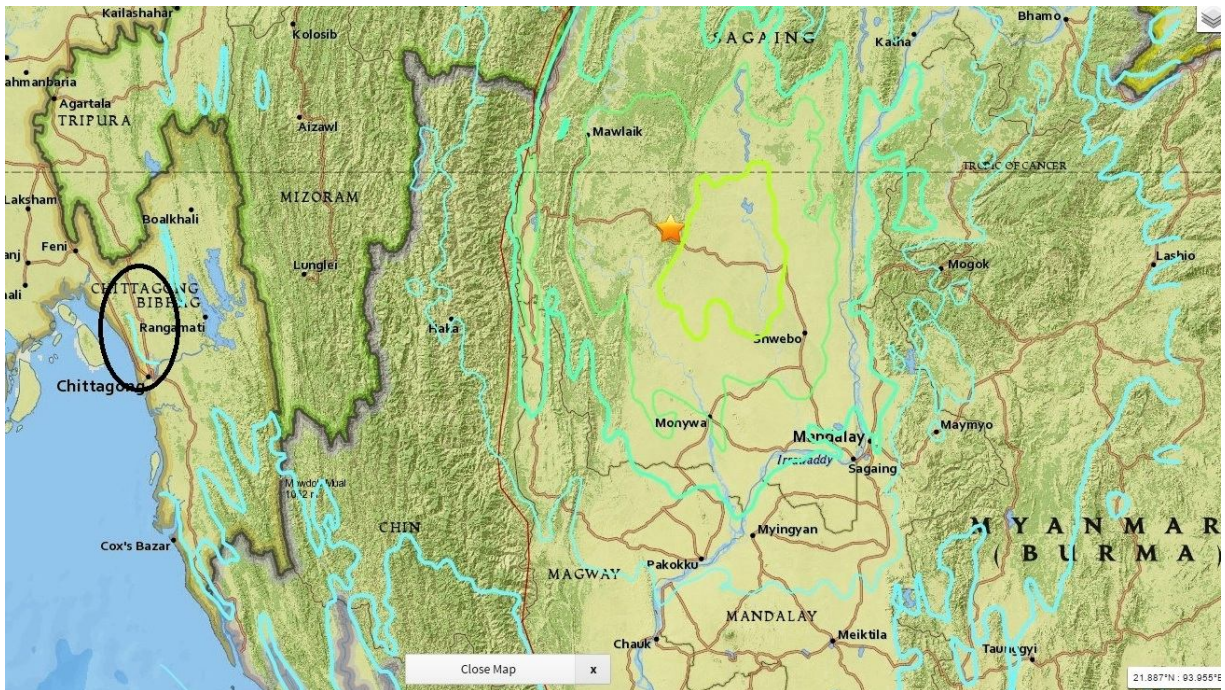


Figure 1: Interactive Map of Mawlaik Earthquake, Myanmar

The April 13, 2016 $M 6.9$ earthquake southeast of Mawlaik, Myanmar, occurred as the result of oblique reverse faulting at an intermediate depth, approximately 134.8 km beneath western Burma. The epicenter of the earthquake is located some 173 km northwest of the Sagaing fault and 500 km to the northeast of the Sunda Trench, where lithosphere of the India plate begins subducting to the northeast beneath Sunda and Eurasia. The location, depth and faulting parameters all indicate this earthquake occurred within the lithosphere of the subducting India plate. At the location of this earthquake, the India plate moves north-northeast with respect to the Sunda and Eurasia plates, at a velocity of 44-49 mm/yr. Regionally the subducted India plate is seismically active to a depth of about 150 km.

Earthquakes like this event, with focal depths between 70 and 300 km, are commonly termed "intermediate-depth" earthquakes. Intermediate-depth earthquakes represent deformation within subducted slabs rather than at the shallow plate interface between subducting and overriding



tectonic plates. They typically cause less severe shaking on the ground surface directly above their foci than is the case with similar magnitude shallow-focus earthquakes, but large intermediate-depth earthquakes beneath populated regions may nonetheless cause damage and casualties, and they may be felt at great distance from their epicenters.

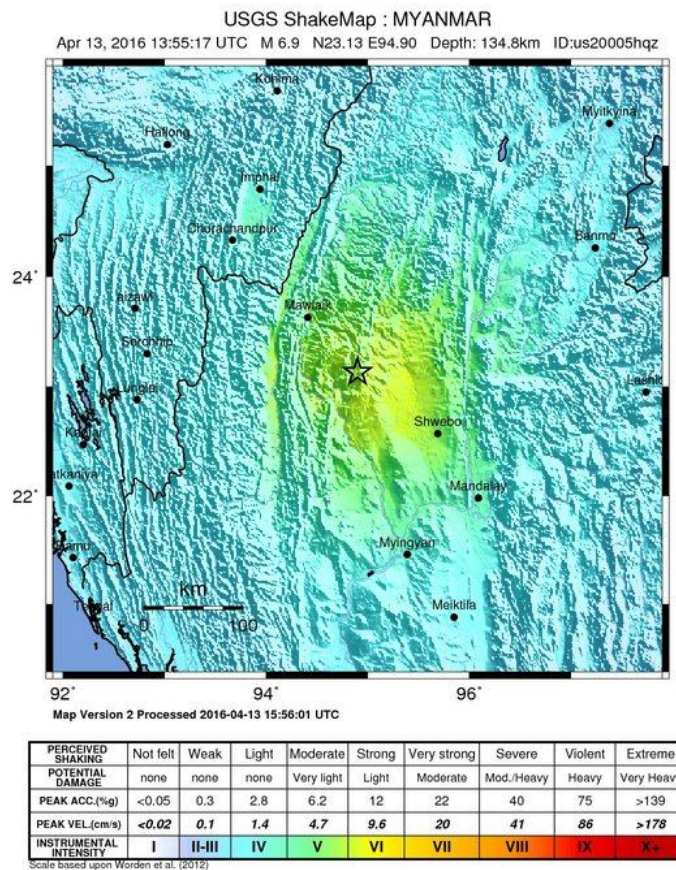


Figure 2: Shake Map of Mawlaik Earthquake, Myanmar

Bangladesh experiences earthquakes somewhat regularly, and 61 events of M 6 or larger have occurred within and around the country over the preceding century. The largest nearby earthquake was a M 8.0 event in September 1946, 130 km to the northeast of the April 2016 earthquake, whose epicenter has been calculated to be within the earth's crust. At intermediate depths, the largest nearby event over the preceding century was M 7.3 earthquake in August 1988 in northern Burma, 200 km to the north of the April 2016 event. The 1988 earthquake caused several fatalities and dozens more injuries [1].

The quake, which centered on the jungle and hills northwest of Mandalay, Myanmar's second-biggest city, was felt in the eastern Indian states of Assam and West Bengal [2]

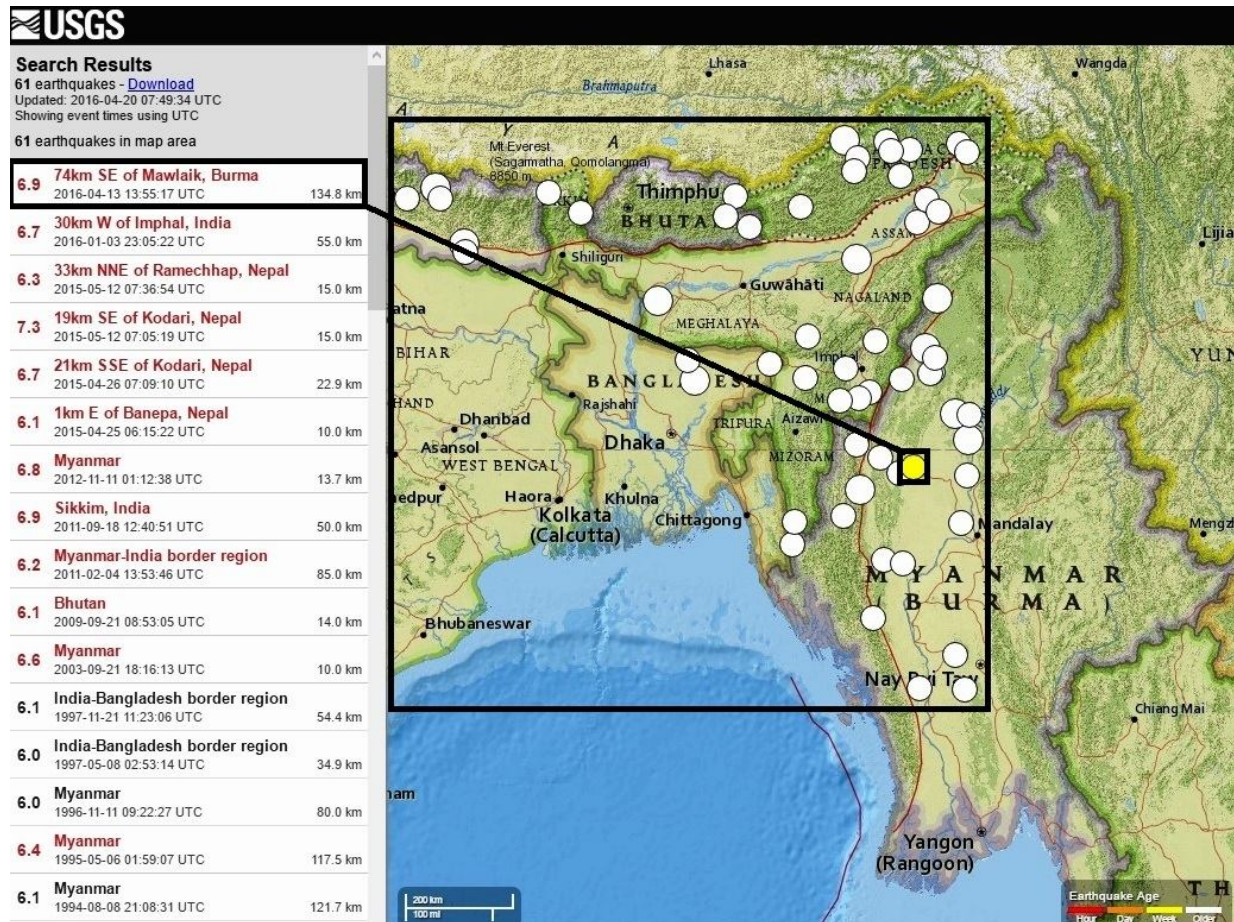


Figure 3: Events of M 6 or larger have occurred within and around Bangladesh over the preceding century (April 13, 1916 to April 13, 2016)

Different major cities of Bangladesh have experienced the shaking of Mawlaik earthquake of April, 2016 with PGA value as following.

Table 1: PGA value of the Mawlaik earthquake at the coordinates of Divisions of Bangladesh

No.	Divisions	Coordinates of Divisions	Epicentral Coordinates	Epicentral distance R (km)	Probable PGA (g)
1	Chittagong	22.34° N, 91.84° E	23.133°N 94.900°E	326.04	0.0085
2	Sylhet	24.90° N, 91.86° E		364.22	0.0070
3	Dhaka	23.81° N, 90.41° E		457.77	0.0048
4	Barisal	22.70° N, 90.35° E		461.44	0.0047
5	Khulna	22.86° N, 89.54° E		542.58	0.0036
6	Rajshahi	24.36° N, 88.62° E		648.13	0.0026
7	Rangpur	25.74° N, 89.28° E		634.55	0.0027





To determine the PGA, Cornell *et. al.* equation has been used as following,

$$\ln \text{PGA (gal)} = 6.74 + 0.859M - 1.80 \ln(R + 25)$$

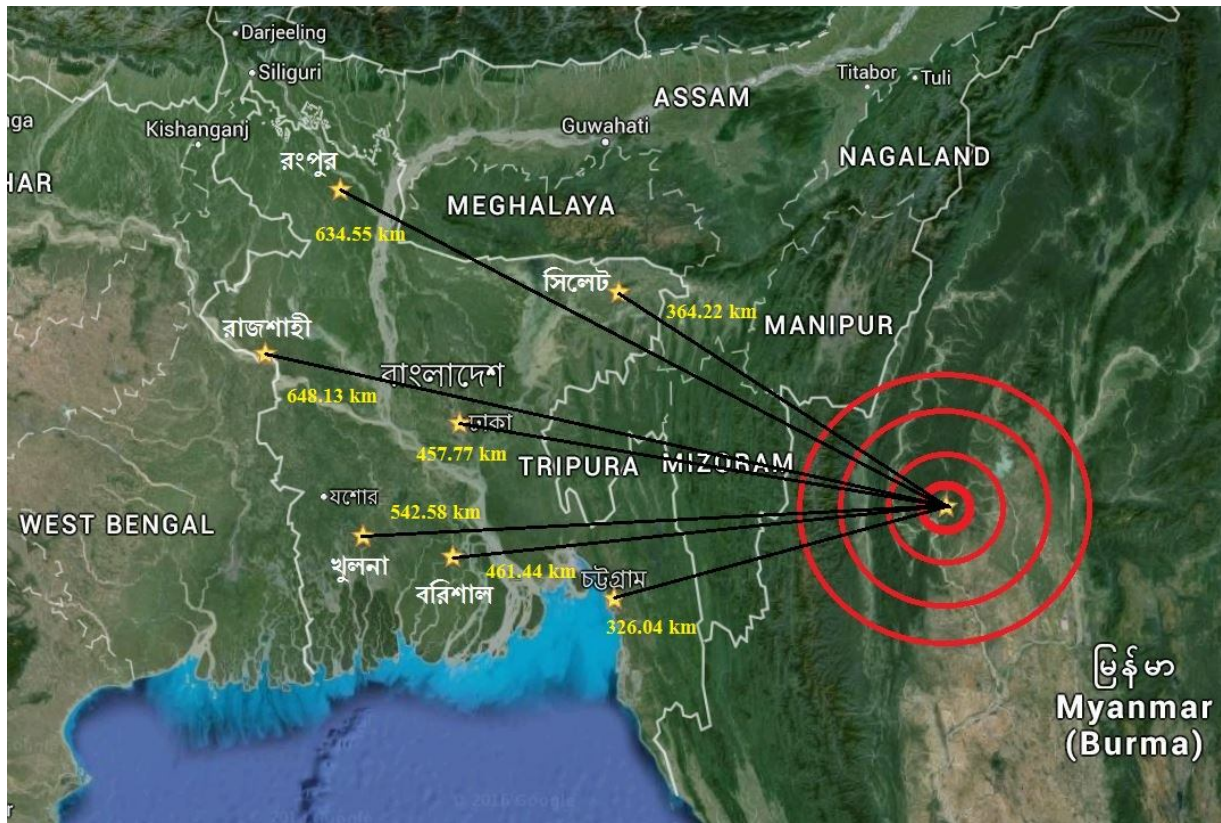


Figure 4: Epicentral distance from 7 Divisions of Bangladesh

Chittagong has experienced the largest PGA and Rajshahi has experienced the smallest PGA from Mawlaik earthquake of April, 2016.

Chittagong city has experienced light shaking with instrumental intensity of scale IV during the Mawlaik earthquake of Myanmar of April 13, 2016 according to shake map provided by USGS [1]. Though the response from the people was larger than the corresponding intensity due to the longer period of earthquake, it was lasted for around one minute according to Xinhua reporters, China [2]. At least 50 people were injured while rushing out of RMG factories in EPZ and Oxygen areas and four buildings tilted in Chittagong city after that quake. Ten people were injured in Oxygen and the rest in EPZ area of the port city while getting out of garment factories in panicky. Meanwhile, a five-storey building in GEC intersection, a six-storey building in Chandgaon, a building in Jubilee Road and one in Darul Fazal Market area were tilted in the jolting in the Chittagong city according to fire service sources [3].



Chittagong city corporation area is divided into 12 police Stations (Thana). The PGA value of the Mawlaik earthquake at the coordinates of Thana will provide information about the earthquake shaking of the corresponding area which will help to estimate future losses and to link information between the strength of shaking with the following disaster happened along with the existing and proposed seismic zone coefficient of Chittagong, which has been showed in the following Table 1. While the PGA at the epicenter of the Mawlaik earthquake of Myanmar of April 13, 2016 was 0.16g [1].

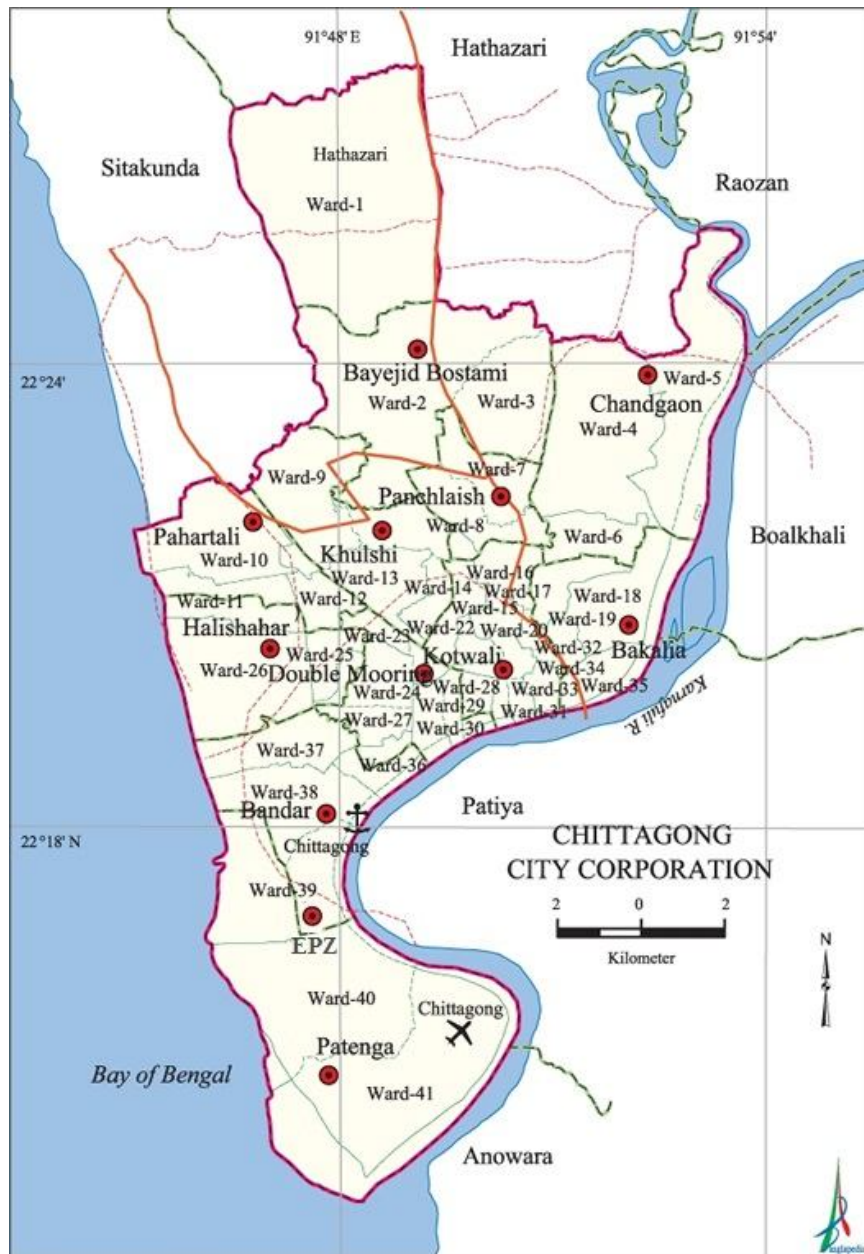


Figure 5: Chittagong city corporation area with 12 Thana



Table 2: PGA value of the Mawlaik earthquake at the coordinates of Thana in Chittagong City Corporation area

No.	Name of Thana	Site Coordinates	Epicentral Coordinates	Epicentral Distance R (km)	Probable PGA (g)
1	Bakoliya	22.35°N 91.85°E	23.133°N 94.900°E	323.97	0.0086
2	Chandgaon	22.37°N 91.84°E		324.21	0.0086
3	Panchlaish	22.37°N 91.83°E		325.56	0.0085
4	Kotwali	22.34°N 91.84°E		326.04	0.0085
5	Bayezid	22.38°N 91.82°E		326.77	0.0084
6	Khulshi	22.36°N 91.81°E		328.01	0.0084
7	Double Mooring	22.34°N 91.81°E		328.92	0.0083
8	Bandar	22.31°N 91.80°E		330.51	0.0083
9	Pahartali	22.37°N 91.78°E		331.09	0.0083
10	Halishahar	22.34°N 91.78°E		332.10	0.0082
11	E.P.Z.	22.29°N 91.78°E		333.00	0.0082
12	Patenga	22.27°N 91.79°E		333.10	0.0082

Bakoliya and Chandgaon Thana experienced comparatively larger PGA of 0.0086g where Halishahar, E.P.Z. and Patenga Thana experienced smaller PGA of 0.0082g compared to the other Thana in the city corporation area. According to BNBC 2006 existing seismic zone coefficient is 0.15 which means buildings constructed in Chittagong region should be capable to withstand earthquakes generating 0.15g at the site while the updated version of BNBC is going to propose a seismic zone coefficient is 0.28 which means buildings constructed in Chittagong region should be capable to withstand earthquakes generating 0.28g at the site. But information regarding this Mawlaik earthquake is providing a warning to the existing structures of Chittagong city.



Figure 6: Probable PGA of 12 Thana in Chittagong city corporation area

References:

1. "M6.9 - 74km SE of Mawlaik, Burma". USGS. Retrieved 13 April 2016.
2. "Strong quake hits Myanmar, tremors felt in India". Aljazeera. Retrieved 2016-04-14.
3. "Earthquake: 50 hurt, 4 buildings tilt in Ctg". The Daily Star.
4. Bangladesh National Building Code (BNBC 2006)