

Nonstructural Damages of Reinforced Concrete Buildings Due to 2015 Ranau Earthquake

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Abstract. On 15th June 2016 a moderate earthquake with magnitude M_w 5.9 was occurred in Sabah, Malaysia. Specifically, the epicentre was located at 16 km northwest of Ranau. Less than two days after the first event, a reconnaissance mission took action to investigate the damages on buildings. Since the reinforced concrete buildings in Ranau were designed based on gravity and wind load only, a lot of minor to severe damages was occurred. This paper presents the damages on the nonstructural elements of reinforced concrete buildings due to Ranau earthquake. The assessment was conducted via in-situ field investigation covering the visual observation, taking photo, and interview with local resident. Based on in-situ field investigation, there was a lot of damages occurred on the nonstructural elements like the brick walls. Such damages cannot be neglected since it can cause injury and fatality to the victims. Therefore, it can be concluded that the installation of nonstructural elements should be reviewed for the sake of safety.

Keywords: Ranau earthquake; Nonstructural damages; In-situ field investigation.

INTRODUCTION

Since 26 December 2004, there was a lot of tremors felt in Malaysia. Most of the tremors occurred due to Sumatra Andaman and Philippine earthquakes. Several local earthquakes in Bukit Tinggi, Pahang also reported in 2007 [1]. These events did not caused any damages on buildings. However, on June 5th 2015, a moderate earthquake with magnitude M_w 5.9 as reported by Malaysia Meteorological Department [2] was occurred in Sabah, Malaysia around 7:15 am local time. The epicentre was located at 16 km northwest from Ranau and the depth is 54 km beneath the earth. The tremors was felt in Ranau, Kundasang, Tambunan, Pedalaman, Tuaran, Kota Kinabalu, and Kota Belud. The main-shock also followed by several tremors with lower magnitude namely as after-shock. Table 1 presents selected events from 2015 Ranau earthquake. This is a nature of earthquake events and can be technically called as repeated earthquake [3]. Since the epicentre is located just around 16 km from Ranau town, it can be considered as near-field earthquake which usually cause greater damages as reported in previous work [4]. Less than two days after the main-shock, a technical team was assigned to investigate the condition of local buildings in Ranau. Therefore, this paper presents the damages on the nonstructural elements of reinforced concrete buildings caused by the earthquake.

Table 1: List of selected events during 2015 Ranau earthquake [2]

No	Date	Time	Latitude	Longitude	Magnitude	Category
1	05/06/15	7:15 am	6.1° N	116.6° E	5.9	Moderate
2	05/06/15	12:05 pm	6.1° N	116.5° E	4.0	Weak
3	05/06/15	9:12 pm	6.0° N	116.6° E	4.3	Weak
4	06/06/15	1:45 pm	6.1° N	116.5° E	4.5	Weak
5	07/06/15	1:32 pm	6.1° N	116.6° E	3.7	Weak