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JANUARY 4TH, 2016 MANIPUR EARTHQUAKE AND DAMAGES TO SOME PUBLIC ENGINEERING STRUCTURES

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Abstract

The Manipur earthquake of January 4th, 2016, measuring M6.7 on the Richter scale, epicentred at 24°49'48.46"N and 93°39'35.88"E with a focal depth of 54Km, rocked the state in the early hours (4.35-4.36am) killing 8 people and injuring more than a hundred. Fault plane solutions of the earthquake provide two nodal planes with average trend around 340°, 49°/NE and 079°, 81°/S giving rise to orientation of the principal stresses at σ_1=20°/203°, σ_2=48°/090°, and σ_3=37°/308° and implying a dextral strike-slip faulting mechanism of the earthquake. Geological and tectonic setting of the region, in combination with the N-S felt motion of the earthquake, suggest that the earthquake occurred in the subducting Indian plate and the nodal plane trending NNW-SSE could be the fault plane that triggered the earthquake.

Ground motion felt during the earthquake was strong to very strong with potential threat of light to medium damage to the engineering structures. The ground motion could have reached a peak acceleration of about 18% of g (acceleration due to gravity) resulting into a velocity of 15cm sec^{-1} especially in the Alluvium of Imphal valley, implying possible major damage in the valley region. Although, almost all the old and new constructions survived the earthquake without much damage, a few, recently constructed civil structures, such as Ima Market (Khwairamband Bazar), Khuman Lampak ISBT buildings were badly damaged during the earthquake. Investigation of the damage of these public buildings indicates major damage to the columns of the structures, many of which burst during the earthquake. The major cause of failure appears to be vertical loading as evident from the well developed conjugate shear fractures in some of the columns. Mechanical strength evaluation of the columns using Schmidt Hammer provides uniaxial compressive strength in the range of 10-15MPa (100-155Kg/cm^2) relatively much lower than the expected cement-concrete strength. Overall observations and analyses of these structures indicate that poor quality control and poor workmanship were the principal cause of the damage of these structures.

Keywords: Earthquake, Epicentre, Manipur, Ground motion, Engineering structures, Ima Market