

Geotechnical engineering and deterministic seismic hazard assessment for Wind Turbine Towers in Zafarana Wind Farm, Gulf of Suez, Egypt

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Abstract

In this study, a multi-channel analysis of Surface Waves (MASW) and shallow seismic refraction techniques are applied to explore the geotechnical parameters of subsurface layers at the Zafarana wind farm. Moreover the seismic hazard procedures based on the stochastic and deterministic techniques are used to estimate hazard for Wind Turbine Towers in Zafarana Wind Farm, Gulf of Suez, Egypt. Seismic activity, in and around the study area which includes many active fault systems along the Gulf of Suez resulting with many moderate and strong earthquakes, is well identified depending on accurate focal mechanism solutions of recent recorded earthquakes around the studied area . These earthquakes resulted in major stress-drops on the Eastern desert and the Gulf of Suez area. These recent findings helped to reshape the seismotectonic environment of Gulf of Suez area which is a perplexing tectonic domain. Based on the collected new information and data, seismic hazard for Gulf of Suez region, particularly Wind Turbine Towers in Zafarana Wind Farm and its vicinity were re-examined using an extended deterministic approach. Alternate seismic source and magnitude-frequency relations combined with various indigenous and “foreign” attenuation relationships were adapted within a logic tree formulation to quantify and project the regional exposure on a set of hazard maps. We select two desired exceedance probabilities (10 and 20%) that any of the applied scenarios may exceed the largest median ground acceleration. The ground motion was calculated at 5th, 16th, 50th, 84th and 95th percentile levels for both selected probabilities of exceeding the median.

Key words: MASW, seismic hazard, Wind Turbine Towers, Zafarana Wind Farm