On 9th of April 2013 at 16:22:50 PM in local time, an earthquake was occurred in Dashti city of Bushehr province in southwestern of Iran. The magnitude and depth of earthquake was 6.2 (ML) and 20km from IIEES and 6.3 (MW) and 10km from USGS reports. The epicenter of earthquake was located at 51.59E-28.48L. Epicentre location of this earthquake has shown in Figure 1. The horizontal recorded peak ground acceleration (PGA) of earthquake was 0.25g.

During this earthquake, several damages and losses in buildings and other facilities were observed in Shonbe, Kaki and Khormuj cities and their around villages.

In this paper, performance of electric power distribution network in this earthquake-stricken area and seismic damages in their structural parts are presented. In addition, seismic vulnerability of some components of distribution network have been assessed using qualitative and quantitative methods and compared with their real behavior subjected to this earthquake. Finally, rehabilitation methods have been proposed and studied for vulnerable components.

Many components of electric power distribution network suffered damage due to this earthquake. A damaged overhead distribution substation has been shown in Figure 3. In this substation, failure of steel support of transformer due to earthquake was lead to overturning and falling transformer. As the other example, crushing occurred in a concrete pole of overhead 20kv distribution line has been shown in Figure 4. This failure occurred in the bottom of pole and was lead to deviation of pole from vertical.
In order to further investigation about failures, a seismic assessment of typical overhead substation in damaged area has been performed using nonlinear dynamic analysis subjected to some recorded earthquake accelerograms (Figures 2 and 5). The results indicated that common unbraced transformers on overhead substations are seismically vulnerable and need to be retrofitted. Furthermore, the qualitative assessment of distribution poles has been performed by seismic capacity curves that shown in Figure 6. These seismic capacity curves have been developed analytically to qualitative assessments of common concrete distribution poles (Zekavati et al., 2013) and needed to be evaluated and verified in real earthquake situation. The qualitative assessment results have shown good agreement with actual observations.

Finally, some rehabilitation methods and details have been proposed for investigated components in the similar situations to prevent failure and increase reliability of distribution network during the future earthquakes.

REFERENCES


www.iiees.ac.ir, International Institute of Earthquake Engineering and Seismology