STUDY OF LIQUEFACTION ON BURIED PIPELINES DURING EARTHQUAKE BY CASE STUDY OF THE 2013 DASHTI EARTHQUAKE

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Buried pipeline damage correlations are critical part of loss estimation procedures applied to lifelines for future earthquakes (Toprak and Taskin 2007). The vulnerability of buried pipelines against earthquake and liquefaction has been observed during some of previous earthquakes and there are a lot of comprehensive reports about this event. One of the main reasons for impairment of buried pipelines during earthquake is liquefaction. Necessary conditions for this phenomenon are loose sandy soil, saturation of soil layer and earthquake intensity. Because of this fact that pipelines structure are very different with other structures (being long and having light mass) by paying attention to the results of previous earthquakes and compare them with other structures, it is obvious that the danger of liquefaction for buried pipelines is not high risked, unless effective parameters like earthquake intensity and non-dense soil and other factors be high (Bargi, 2010). Recent liquefaction researches for buried pipeline include experimental and theoretical ones as well as damage investigations during actual earthquakes. The damage investigations have revealed that a damage ratio of pipelines (Number/km) has much larger values in liquefied grounds compared with one in shaking grounds without liquefaction according to damage statistics during past severe earthquakes, and damages of joints and pipelines connected with manholes were remarkable (Takada et al., 1987).

The purpose of this research is numerical study of buried pipelines under the effect of liquefaction by case study of the 2013 Dashti (Iran) earthquake. Water supply and electrical distribution systems of this township interrupted during earthquake and water transmission pipelines were damaged severely due to occurrence of liquefaction (Dashti Report).

The model, as shown in Figure 1, consists of a polyethylene pipeline with 100 meters length and 0.8 meter diameter which is covered by light sandy soil and the depth of burial is 2.5 meters from surface.

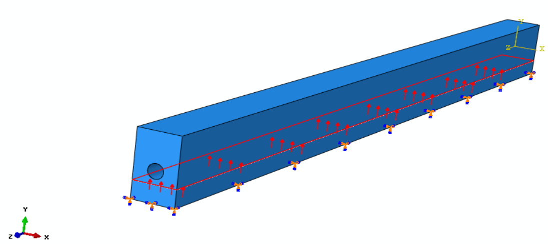

Figure 1. Pipeline and soil model

Since finite element method is used relatively successfully in order to solve geotechnical problems, we used this method for numerical analysis. For evaluating this case, some information like geotechnical information, classification of earthquakes levels, determining the effective parameters in probability of liquefaction, three dimensional numerical finite element modeling of interaction between soil and pipelines are necessary.

The results of this study on buried pipelines indicate that the effect of liquefaction is function of pipe diameter, type of soil, and peak ground acceleration. There is a clear increase in percentage of damage with increasing the liquefaction severity. At the end, there are some retrofit suggestions in order to decrease the risk of liquefaction on buried pipelines. The results indicate that even though in this form of the analysis, the damage is always associated to a certain pipe material, the nominally defined "failures" include by failures of particular components (joints, connections, fire hydrant details, crossovers, laterals) rather than material failures.

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