SEISMIC ASSESSMENT OF POLYETHYLENE PIPELINES UNDER LANDSLIDE

Yadollah DAVARI
PhD Student, Department of Civil Engineering, Qazvin Branch, Islamic Azad University, Qazvin, Iran
Davari8113@yahoo.com

Morteza BASTAMI
Assistant Professor, IIEES, Tehran, Iran
m.bastami@iiees.ac.ir

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This paper tries to investigate failure potential of pipeline under excessive deformations and variation of these parameters. A failure criterion has been proposed based on strain limits of pipeline. Finally, failure potential has been assessed by means of fragility curves. Given results in this paper could be used in practical design codes of water conducting pipeline systems.

The research focuses on the failure mechanisms of buried HDPE (High Density Polyethylene) pipelines due to non-uniform deflection of landslide process. Here, observations based on a typical landslide accident have been used as landslide data. Observations from an accident occurred in Ningbo city show that the length of buried pipeline with non-uniform deflection (the width of landslide area) is about 110 m, and the deflection is mainly at the horizontal direction. The maximum deflection displacement is 15.2 m in the middle of this pipeline segment, and the distribution is close to quartic polynomial curve, which is illustrated in Figure 1.

In order to reproduce the landslide process, numerical analyses have been conducted using ABAQUS. Geometric features of the finite element model are illustrated in Figure 2. The value of reaction force depends on the soil configurations, such as the soil property and soil length in front of pipeline at the horizontal direction and also foundation depth. Parametric investigations from previous works show the large enough values of soil configuration may not affect the results of analyses due to landslide.

In this paper, a parametric 3D finite element model using the software ABAQUS is established to explore the failure mechanisms of buried pipeline. Varying parameters in this paper are surrounding soil conditions and geometry of pipeline section. Therefore four types of soil in 2800 standard seismic code of Iran have been selected. Also the diameter of pipeline varied between 80 cm to 150 cm with fixed thickness of 2.5 cm.

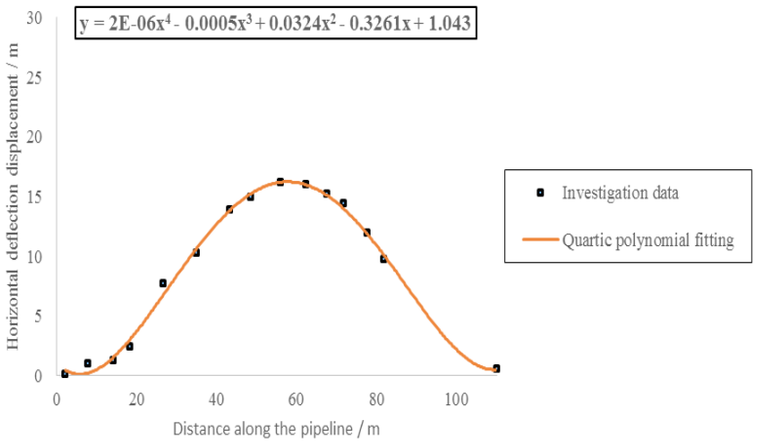

Figure 1. Investigation data and the quartic polynomial fitting of deflection displacement

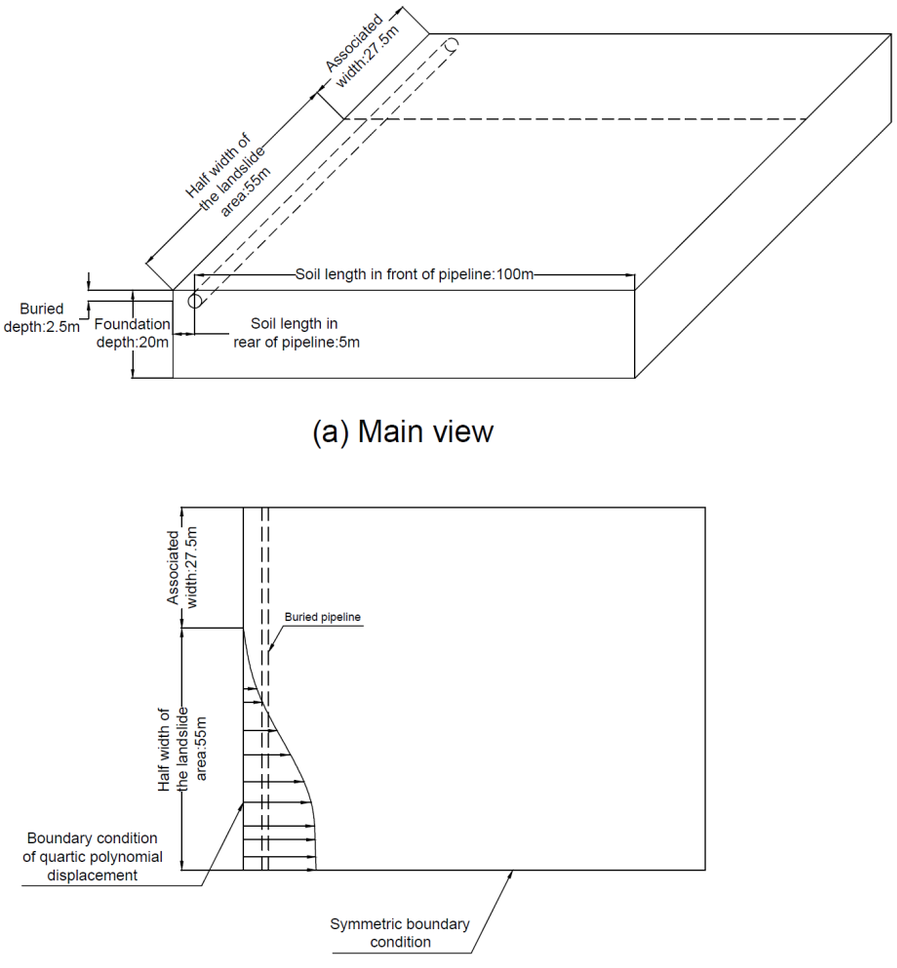

Figure 2. Geometric features of the investigated model