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ANALYTICAL INVESTIGATION OF REVERSE FAULTING EFFECTS ON BURIED STEEL PIPELINES WITH NEW METHOD

Zahra REZAIE DOKHT
M.Sc. Graduate in Earthquake Engineering, IIEES, Tehran, Iran
z.rezaiedokht@iiees.ac.ir

Sayyed MOJTABA MOOSAVI
Assistant Professor in Earthquake Engineering, IIEES, Tehran, Iran
moosavi@iiees.ac.ir

Mohammad Kazem JAFARI
Professor in Earthquake Engineering, IIEES, Tehran, Iran
Jafari@iiees.ac.ir

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During permanent ground displacements such as surface faults, damages on buried pipelines may occur. Many examples of such damages occurred in the past earthquakes. Many analytical methods have been proposed for analysing buried pipelines across the different types of faults such as normal and strike-slip ones up to now.

In this paper, a new approach proposed by establishing analytical method to investigate the effect of reverse faults on buried pipelines. It is necessary to know some basic analytical methods due to the use of elastic beam theory and bending and buckling behaviour as well as the problem of analysing indeterminate beams under certain loadings.

According to previous studies, two modes of deformation can be considered for pipelines affected by reverse faults. The first one is the local buckling and the second one is the beam buckling behaviour of the pipe, which can be occurred under different circumstances depends on the interaction of the soil and pipe. The analytical method presented in this study is specific for pipes that are governed by the bending-local buckling mode.

The bending behaviour and the transverse deformation of the pipeline occur in a limited length around the fault zone, which can be estimated from the existing analytical methods using some reforms in this study. In addition, by increasing the displacement of the reverse fault the bending mode may occur and in a certain displacement of the fault, local buckling may occur. Also care must be taken that in this study just bending behaviour (before buckling mode) is investigated.

By comparison of the results in this study, it can be seen in the problems with buried pipeline crossing reverse fault assuming $q_{u2} > q_{u1}$, the amount of q_{u1} and q_{u2} varies in different displacements of the fault. Also the amount of deformed transverse length of pipeline (L=L1+L2) decreases by increasing the displacement of reverse fault.

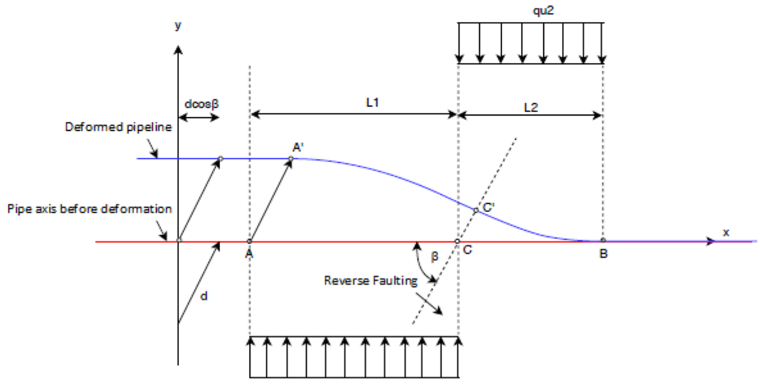

Figure 1. Schematic figure of the deformed area of the reverse active fault.

Table 1. Results using in different methods.

Type of Equations	d (mm)	q_{u1} (kN/m)	q_{u2} (kN/m)	L_1 (m)	L_2 (m)	L (m)
ASCE	75	1.113	3.77	0.76	0.34	1.10
Analytical method	75	6.68	18.83	0.42	0.22	0.64

Table 2. Results using analytical equations at different displacements of reverse faulting.

d(mm)	qu1	qu2	L1	L2	L
10	0.22	0.94	0.76	0.27	1.03
30	0.89	3.01	0.64	0.28	0.92
50	5.56	15.10	0.45	0.23	0.68
75	6.68	18.83	0.42	0.22	0.64

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