

Dimensionless response of underground pipes due to blast loads using finite element method

Abstract

Underground pipes are used for water supply, drainage, oil and gas supply, irrigation, etc. Blast constituent comprises of the ground media, intervening layer, structures, and blast. This study is aimed at determining the response of simulated empty underground pipes due to blast loads using finite element method. In this study, blast load parameters were determined using Unified Facilities Criteria (2008). Time integration technique in Abaqus/Explicit was used to solve the equation of motion. The soil and pipes materials were considered as elastic, homogeneous and isotropic. The material properties as obtained from different researchers and pipe manufacturers were used. Dimensional analysis was used to present the results. From the result of the dimensionless parameters, it was observed that depth of burial of pipes play a significant role in the response of underground pipes due to surface and underground blasts while coefficient of friction has little effect due to underground blast. Dimensionless pressure and deflection of underground pipes reduce as embedment ratios increase in surface and open trench blasts while this is not so in underground blast. Finally guidelines thus established would help in the design of underground pipes to resist effects of blasts. Consequently, the environmental risk and hazards caused by blasts will be reduced.