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Predictive model for the stability of adjacent structures under internal explosions in underground facilities

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ABSTRACT

Recently, the construction of hydrogen refueling stations has increased to meet the growing demand for clean energy solutions. Since urban areas contain facilities with explosion risks, such as gas stations and LPG filling stations, hydrogen storage facilities can be placed underground to utilize the ground as a buffer, thereby ensuring a safe distance. In this study, a model was proposed to evaluate ground vibrations propagating through the surrounding soil following an internal explosion in underground facilities and to predict the stability of adjacent structures. A numerical analysis model was developed using the nonlinear finite element analysis (FEA) method to simulate ground vibrations induced by internal hydrogen gas explosions in underground facilities. Parametric analyses were conducted, considering ground conditions, explosion loads, and overburden depth, leading to the establishment of a database of ground vibration values at different distances. Finally, a predictive model was developed using DNN and CNN algorithms to assess the stability of adjacent structures following an internal explosion in an underground facility.

REFERENCES

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Kim, O., Lee, M., Kim, M., Kim, J. and Joo, H. (2003), “Design consideration and explosion safety of underground ammunition storage facilities”, *J. Korean Tunnelling and Underground Space Association,* **5**(41), 55-70.