Analysis of Underground Train-Induced Structure Vibrations

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Abstract

During the last decades, the railway traffic in densely populated areas has increased. At the same time, passenger trains have become faster and freight trains have become heavier. As a consequence of this, trains are an increasing source to ground vibration, which may be a nuisance to people, buildings and sensitive equipment in the surrounding environment. In this research, a two-dimensional dynamic system, including underground train, sleeper, rail pad, tunnel, soil and adjacent structure in the time domain and using SAP2000 software, based on linear time history dynamic analysis, will be analyzed. The purpose is parametric study about effective factors on peak response of structure (acceleration, velocity and displacement). Among various factors, the effect of this factors, train velocity, soil property, natural period of structure and height of tunnel, will be investigated. Train movement, will be modeled by a series of moving load. Set of ballast, rail pad, sleeper and tunnel will be modeled with appropriate elements. Surrounding soil and 2-dimentional structure on the ground modeled with plane strain element and frame element, respectively. Behavior of the system is assumed linear elastic. The result of linear time history dynamic analysis is recognition of effective factors in responses. The conclusions are soil properties and train velocity are more effective and complicated in contrast with natural period of structure and height of tunnel.

Key Words

vibration, soil-structure system, metro, finite element method.