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Numerical Modeling of Improvement of Soft Soil with Stone Columns under High-Speed Train Crossing

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Rail transport has unique advantages over other modes of transport, such as less environmental vulnerability, less pollution and more safety than other modes of transport. Due to the lack of lands with adequate load-bearing capacity, parts of the railway route are built on soft soils. These types of soil have the possibility of creating instability and subsidence of railway lines in this type of soil is one of the main concerns of engineers. These factors lead to an increase in differential settlements, reduce the speed of the train, and finally cause financial and human losses. High-speed trains are recently used in developed countries to reduce travel time, which can significantly increase the dynamic responses of components on railroad tracks, especially when the train is traveling at a critical speed. One of the ground improvement methods that have been widely used to improve soft sediments and loose fine-grained soils is the stone column method.The main purpose of this study is to investigate and control the amount of settlement and stability of soft clay bed and embankment of the railway under high-speed train crossing as two important factors in the operation and use of the railway complex. In this study, the performance of stone columns in the bed of high-speed trains to reduce soil settlements and prevent the occurrence of differential settlement in different conditions is investigated. The results showed that by increasing the length of the stone column and decreasing its diameter, differential settlement due to the passage of high-speed trains decreases. Also, increasing the stiffness of the encasing geogrid reduces the settlement. In addition, as the train speed rises, the settlement drops and the Excess pore water pressure due to the train passing increases.

Keywords: High Speed Train, Stone Column, Numerical Modeling, Soft Soil.

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