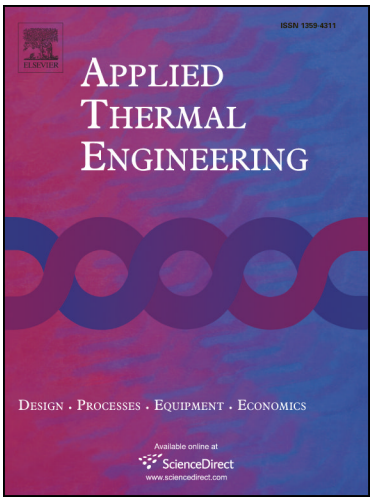

Numerical investigation on thermal insulation layer of a tunnel in seasonally frozen region

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Numerical investigation on thermal insulation layer of a tunnel in seasonally frozen region

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Abstract: As an effective engineering measure, thermal insulation layer is used to prevent tunnel from frost heave damage in seasonally frozen region. Two different methods are generally adopted to lay insulation layer. One is to lay the insulation layer between the preliminary lining and the secondary lining. The other is to lay the insulation layer on the surface of the secondary lining. But, there is no evidence to show which method is more useful. Meantime, the relationship between the insulation effect and thermal conductivity as well as thickness of insulation layer should be identified. To solve these problems, a numerical heat-moisture coupled model for the tunnel in seasonally frozen region is established, which involves heat conduction, water migration and phase transition. And then, a representative tunnel in the Northwest of China is taken as an example to explore the heat-moisture state of the tunnel. Afterwards, the thermal insulation effect and the effect of location of thermal insulation layer on thermal state are analyzed. Subsequently, the methods on thermal conductivity and thickness of thermal insulation layer are constructed and the relationship among the insulation effect, thermal conductivity and thickness is obtained for heat insulation effect.

Keywords: seasonally frozen region; tunnel; thermal insulation; heat-moisture coupled model