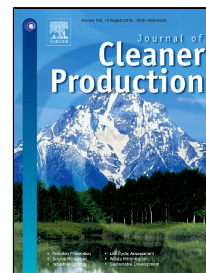


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Sand-layer collapse treatment: An engineering example from Qingdao Metro subway tunnel

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Abstract: In the construction process of shallow subway tunnels, frequent collapses of the sand layer overlying the tunnel pose a serious threat to the safety of the construction operation. With the big data monitoring information, more effective treatments can be applied for sand-layer collapse. Based on the engineering background of the sand-layer collapse disaster in Qingdao Metro Line 2, detailed analysis of the process and mechanism of sand-layer collapse in tunnels was done. Grouting method was used to improve collapse-preventing treatment in the sand layer. For treating the water-bearing sand layer above the tunnel, an advancement of grouting reinforcement system was proposed. The results showed that the main causes of sand-layer collapse are the intrinsic characteristics of the sand layer itself. The cohesive soil content of the sand layer is low and the cementation ability of the sand layer is weak. The advancing grouting method applied in this project is an effective method to strengthen the sand layer; the grouting parameters obtained in this study can be used as a guidance for similar engineering projects.

Keywords: tunneling engineering; sand-layer collapse; advancing grouting; grouting parameters

1. Introduction

During a construction of urban subway tunnels, geological failures often occur, such as collapse, inrush of sand (Marchi et al. 2014; Bezuijen et al. 2011). When the tunnel traverses through the Quaternary water-bearing sand layer, the sand layer can collapse into the tunnel, with

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