Postprint: Applied Research on Shield Earth Chamber Pressure Prediction Based on Random Forest

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Abstract

Earth chamber pressure constitutes one of the critical parameters for controlling ground settlement. This paper proposes a predictive model for earth chamber pressure during earth pressure balance shield tunneling construction based on extensive real-time data collected throughout the shield tunneling process and utilizing the "random forest" algorithm, aiming to provide reasonable setpoint values for earth chamber pressure during shield advancement to achieve settlement control. Application results from the left-line section between Ventilation Shaft No. 7 of the Shanghai Municipal Railway Airport Link Line JCXSG-12 contract section and Lingkong Road Transition Shaft demonstrate that the setpoint values provided by the model remain consistent with actual control values, and settlement control in the test section is satisfactory. This indicates that the model can provide relatively reasonable earth chamber pressure setpoint values during shield advancement to guide construction.

Full Text

Preamble

Title: Application of Random Forest Algorithm for Shield Chamber Pressure Prediction in Shield Tunneling

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Abstract

Chamber pressure represents a critical parameter for controlling ground settlement during shield tunneling operations. This study proposes a predictive

model for chamber pressure during Earth Pressure Balance (EPB) shield tunneling, developed using the Random Forest algorithm and leveraging extensive real-time construction data. The model provides reasonable chamber pressure setpoints during tunneling advancement to achieve effective settlement control. The approach was validated through application to the left-line section between No. 7 ventilation shaft and Lingkong Road conversion shaft of the Shanghai Municipal Railway Airport Link Line (JCXSG-12 标段). Results demonstrate that the model-generated chamber pressure setpoints consistently align with actual control values, with satisfactory settlement control achieved in the test section. These findings confirm that the model can reliably provide appropriate chamber pressure setpoints to guide construction operations.

Keywords: shield tunneling; parameter prediction; Random Forest; machine learning

Note: Figure translations are in progress. See original paper for figures.