

THE EFFECTIVENESS OF POST GROUTING FOR SEALING A HARD ROCK TBM TUNNEL – A CASE STUDY FROM UMA OYA PROJECT, SRI LANKA

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Summary

The Uma Oya project comprises two reservoirs linked by a 3.98 km tunnel, a 15.5 km Headrace Tunnel (HRT), a powerhouse, and a tailrace tunnel. The excavation of the HRT using a tunnel boring machine (TBM) faced significant technical and social challenges, with multiple instances of water ingress causing adverse effects in the "Gramaniladhari" divisions above the 350 m mark. Traditional irrigation wells and springs were affected, causing cracks in houses and the emergence of sinkholes. Despite addressing these issues through a specialized post-grouting method, continuous seepages persisted in the unsupported sections (chainage 4+372 to 4+495) of the HRT. Despite the contractor's efforts to grout and seal the water ingresses, the task proved challenging both technically and socially. Consequently, the study aimed to identify the causes behind the inadequate grouting practices in tunnels and develop an effective grouting method. Additionally, a sociological analysis was conducted to assess whether the impact had been resolved with groundwater recovery.

Method

A detailed geological mapping and 3D modeling of joint patterns were undertaken. The mapping data revealed that existing grout holes could not address the discontinuities, leading to the design of angle holes as a special technique to improve grout retention in the rock mass until it hardened. Monitoring of wells, manometers, stream flow, and vegetation, coupled with discussions with communities in the affected area, were conducted to assess the environmental and sociological impacts.

Results, Observations, Conclusions

Upon completion of grouting in the unsupported sections, water ingress significantly reduced, and the groundwater table improved. Monitoring results indicated a recovery of wells, demonstrating the effectiveness of the applied post-grouting methods. The findings underscore the importance of conducting comprehensive geological assessments and implementing strategic grouting techniques to manage water seepage in tunnel projects. By considering these recommendations, the social impact of future tunnel constructions can be effectively minimized by mitigating water ingress issues while ensuring the stability and functionality of the tunnel structure.

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