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Response Analysis of Twin Tube Tunnels by TBMs under Varying Rock Cover

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Abstract

Numerical analysis is a powerful tool to analyze the behaviour of tunnels in rock mass. In the present paper a response analysis with numerical method is performed for twin tube road tunnels against tunnel boring machines (TBM). Response analysis has been carried out to evaluate the feasibility and suitability of TBMs for road tunnels in varying overburden and with varying strength of rock mass. 2D finite element analysis has been performed for this purpose. In the analysis, rock mass parameters like uniaxial compressive strength, modulus, Geological Strength Index (GSI) etc., have been varied with varying rock cover (overburden). Further horizontal distance between twin tunnels is also varied to find out the horizontal clearance between them. As the tunnels are excavated by TBMs, no disturbance factors are applied. Rock mass stresses after excavation are allowed to release gradually. Responses of the twin tube TBMs tunnels with respect to rock mass parameters, rock cover at crown and horizontal clearance between them, are investigated. The results obtained indicated that with TBMs the surrounding damages of rock mass is minimum, however, if tunnels are placed closely, the plastic zone around tunnels will be overlapped at higher rock cover zones. At shallow overburden, if spacing between twin Tunnels is less than its diameter, the zone of influence or plastic zone developed around the tunnels will lead to collapse of the crowns and stopping of TBMs. Higher uniaxial compressive strength reduces the development of plastic zones around tunnels. Based on the results, it is recommended that before planning the TBMs in shallow or higher rock cover, response analyses of TBMs Tunnels with Rock mass should be properly carried to check the feasibility of TBMs otherwise it leads to several problems like sticking off and damaging of TBMs. The results will be useful for planning long road tunnels in Indian Scenarios to save time.

Keywords: Rock mass, Tunnel, TBM, Numerical analysis, Rock cover

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