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Experiences and Challenges of Tunnelling

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ABSTRACT

Tunneling through weak and jointed rock masses such as in the Himalayas is a challenging task for the planners, designers, engineers and the geologists because of high overburden, thickly vegetated surface, poor rocks and highly varying geology with the presence of numerous small and big shear zones, thrusts, faults, etc. Due to these reasons, tunneling problems such as squeezing ground condition, chimney formation, face collapse, water in rush, etc. have been faced in the past and are still being encountered.

Failures and the problems may be regarded as challenges and opportunities for generating new knowledge base and thereby increasing self-reliance in tunneling. Accordingly, recent experience of (i) tunneling through the poor rocks experiencing the squeezing conditions, (ii) SRF rating in case of competent moderately jointed rock experiencing spalling and rock burst condition, (iii) tunnels under dynamic condition, (iv) the effect of rock type on bolt length and (v) the improvement in rock mass quality Q because of the grouting of full-column rock bolt grout are presented in the paper. The challenges of cost-effective grouting in water charged rocks and swelling ground and TBM tunneling in Himalayas are also briefly highlighted.

KEYWORDS

Tunneling; Squeezing; Rock Burst; Dynamic Condition; Rock Bolt; Grouting; Water-in-rush.

1. INTRODUCTION

With time new methodologies and techniques of tunneling have been developed. These techniques helped in achieving the desired rate of progress in fastest possible time without much accident and tunneling problems. Indian designers, scientists and engineers have successfully completed many tunneling projects in the past, working on new projects currently and planned several such projects to meet out the future demand.

In good and hard rocks, the art of tunneling has evolved into a science of tunneling. In weak and poor rocks, on the other hand, tunneling is in the phase of a mix of art and science. Despite the developments in tunnel mechanics, tunneling in the tectonically disturbed, geologically young

(upper tertiary: max. 30-35 million years) and fragile Himalayas is full of challenges. Himalayan region, therefore, may be regarded as best field laboratory to learn Rock Mechanics and Tunneling Technology for poor and weak rocks. Some of the experiences and challenges of tunneling are briefly highlighted in this paper.

2. SQUEEZING GROUND CONDITION

With new tunneling projects coming up in higher reaches of Himalayas, the squeezing, spalling and rock burst problems are increasing. Theoretically, one can predict the squeezing ground conditions having the reliable values of the in situ stresses and rock mass strength. But, it is expensive and time consuming to obtain these properties. The empirical approach