TBM performance prediction models and influences of rock mass characteristics

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ABSTRACT

Recently, many prediction models have been developed by researchers to estimate TBM performance in hard rock. These models are usually based on empirical relationships of two sets of field measured parameters, namely, machine operation and performance parameters and rock mass parameters. Among recent models two models developed by authors are Gong and Zhao (2009) and Hassanpour et al. (2011). These models have been developed separately, based on data obtained from tunnels in Singapore and Iran respectively. These newly developed prediction models have some similarities in developing method and input and output parameters. In this paper after explaining some aspects of boring process and its influencing parameters, main TBM performance prediction models are introduced. Then two models developed by authors in recent years, are described in more details and compared. Results of comparisons show that output parameters obtained from these two new models coincide and they can be merged to develop a more comprehensive model with wider application range.

1. INTRODUCTION

During the last 30 years, with growing use of TBMs in the world and the necessity to accurately predict performance of machines in different ground conditions, many researchers have worked to develop new prediction models. Research works by Graham (1976), Ozdemir (1977), Blindheim (1979), Farmer and Glossop (1980), Cassinelli et al. (1982), Sanio (1985), Hughes (1986), Sato (1991), Nelson et al. (1994), Palmstrom (1995), Rostami (1997), Bruland (1998), Barton (1999 and 2000), Yagiz (2002, 2008), Sapigni et al. (2002), Ribacchi and Lembo-Fazio (2005), Gong and Zhao (2009), Hassanpour (2009, 2010), Hassanpour et al. (2009, 2010, 2011) are some of the notable works on this topic. Among these several developed models including CSM, NTNU,

Gehring (1995), and Q_{TBM} models have been accepted more and more by engineers. Although these common models have some limitations, they however are applied in many tunneling projects to provide good estimations on project schedule and cost. Other models are usually site specific models with limited application range.

This paper illustrates common prediction models developed by some institutions and individuals in worldwide and also many proposed models from different countries with variable geological conditions. Then two new models developed by authors will be explained in more details.