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# Integrated fuzzy AHP- TOPSIS for selecting the optimal tunnelling method

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## Abstract

Tunnelling method selection is one of the most crucial decisions that should be made by tunnelling engineers. Compatibility of a selected tunnelling method with the geological and geotechnical conditions is crucial to success of a tunnelling project. On the other hand, selecting the proper tunnelling method is a multi-criteria decision-making (MCDM) problem with regard to many geological and geotechnical variables and uncertainties and also unpredictable ground conditions during tunnelling operation. This paper develops an evaluation model based on the analytic hierarchy process (AHP) and the technique for order performance by similarity to ideal solution (TOPSIS), to help the engineers in tunnelling industries for the selection of optimal tunnelling methods in a fuzzy environment. The fuzzy-AHP is used to determine global weights of the criteria and fuzzy TOPSIS method is used to obtain final ranking of alternatives. This approach is applied to select optimal tunnelling method among six tunnelling techniques including open TBM, double shield TBM, single shield TBM, roadheader, drilling & blasting and hydraulic hammer in Cham-shir water conveyance tunnel of Iran. Finally, single shield TBM was selected as optimal tunnelling method in Cham-shir water conveyance tunnel of Iran.

**Key words:** Cham-shir tunnel, fuzzy TOPSIS, fuzzy-AHP, tunnelling method

## 1. Introduction

Tunnelling method selection is a critical point and a strategic issue in the planning stage of a tunnelling project. This is because this decision is almost irreversible and if the selective tunnelling method be not suitable for the ground conditions, it can cause major delays, could be detrimental to the safety of the crew and personnel, and ultimately could bring the project to a halt.

Obviously, accurate characterization of the ground using surface and subsurface investigation will allow the designers to foresee the potential problems and select a method that can cope with the anticipated conditions. This often means selecting a method that can offer optimum performance in the given conditions, and sometimes adding special features and devices that could provide the flexibility and capability to mitigate adverse ground