RISK MANAGEMENT IN CONSTRUCTION OF AHVAZ SUBWAY LINE 1 USING BY LINEAR ASSIGNMENT METHOD

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ABSTRACT

Project of Ahvaz metro, line1, with total length of 23 km, is one of the largest subway lines in this city which its distinctive features like passing through all Ahvaz’s alluvium and under Karun River, facing various geotechnical situations, its depth as well as adaptation of mechanized excavation techniques have made it one the most special tunneling projects so far. Given the respective characteristics, identifying, assessing, controlling and, in fact, managing risks on this massive project is of high importance and necessity. Ranking the risks of this project, especially in case of increased risk factors, is deemed to be an important part of a complicated process i.e. risk management. In the present study, a comprehensive structure of main risks on tunneling and metro projects - composed of three groups: 23 major levels and 198 sub-levels - was initially prepared, and then these risks were subsequently ranked in the tunneling project of Ahvaz subway line 1. To do so, group decision-making and weighted average method have been employed to collect and aggregate experts’ views and data respectively whilst linear assignment, as one of the multi attribute decision making methods, has been used to rank the risks. Risk ranking indices are divided into two groups: primary and secondary. The first has been determined based on risk probability and impact on main objectives of the project (i.e. time, cost, quality and efficiency) with different weights. The latter included risk identification level, socio-economic impacts, environmental affects, risk proximity, risk exposure, risk manageability, level of risk recognition, relative uncertainty, level of risk mitigation. Taking advantage of linear assignment method, risks are better evaluated considering different indices, and, therefore, they are ranked more realistically. At the end, according to results, risks concerning boring operation and employer were at the highest and lowest ranks respectively.

Key words: tunneling, Ahvaz subway system, risk assessment, RBS (Risk Breakdown Structure), ranking, linear assignment

1. INTRODUCTION

Tunneling projects impose high level of risks in virtue of uncertainties connected with them. Managing respective risks effectively and immediately would reduce the probability of risk occurrence or likelihood of its adverse effects on the project objectives. Potential risks in a boring operation could influence health and safety of passengers and employees as well quality of equipment and inflict physical and economic harms. As reported by a global scale survey on the boring operations, poor management has constituted 30 to 50 percent of cost and time overrun in these projects [1]. Other survey (conducted on British corporations) has found the average cost and time overrun of more than 40 percent while it indicated that more than 60 percent of those firms suffered from poor risk management [2]. Risk assessment which is an important element in the risk management is of great importance due to the uncertain nature of tunneling projects besides the necessity of efficient use of resources. The risk assessment is to evaluate the risks on the ground of various indices, namely risk probability and impact. Risk ranking is the keyphase in this process. Since risks will be prioritized during this phase and, consequently, it enables decision makers to do planning for allocation of available resources so as to manage each risk [3].

A great deal of researches has performed to investigate methods of assessing risks in the tunneling projects which are as follow:

International tunneling association (ITA) uses the most common definition of risk in order to do tunneling risk assessment by multiplying risk probability by impact [4]. Also another research group has conducted similar studies besides identifying a number of potential risks on the tunneling and underground construction projects [5]. Isakkson and Stile investigates effect of different risk factors regarding tunnel boring machines (TBM) on perceived cost and time for the tunnel projects and comes up with a probability model for estimation of time and cost for such projects [6]. International Tunnel Insurance Group (ITIG) studies ways of responding to risk by highlighting the role of insurance besides exploiting the conventional method involving risk probability and impact [7]. Other researchers try to estimate cost and time for planning and construction of tunnel and underground projects by understanding risk as a probability function and supply only two indices in order to do risk assessment: risk probability and impact [8]. Jannadji uses a qualitative risk assessment besides detailing various types of potential risks on excavation projects in the Saudi Arabia [9]. Beard examines how to perform safety management and to mitigate inherent risks in the tunneling projects by using several indices and analyzes how to select risk acceptance criteria [10]. As it is noticeable above, most studies make use of “probability” and “impact”, in the form of probability-impact risk rating matrix, so as to do risk assessment [11]. This is an unreliable trend which produces unrealistic outcomes as it ignores many other importance indices. For example, “organization capacity to respond to risk” [12] and “relative uncertainty” [13] are indices taken into account in other research works to do risk impact assessment and prioritization. Moreover, Baccarini and Archer explore risk probability and impact on targets for time, cost and quality of project while rating risks [14]. Waterland and colleagues do risk assessment based on three indices, namely occurrence, severity and detection [15]. Haimes takes advantage of other indices like risk manageability and risk exposure to determine risk rating along with using probability-impact risk rating matrix [16]. Some project management software also incorporates two supplemental indices i.e. risk manageability and risk proximity [17]. Meanwhile other studies on environmental risk assessment make use of socio-economic and environmental effects in their measurements [18]. Another problem regarding the use of probability-impact risk rating matrix is that it may overlook the importance of high-impact, low-probability risks