



Time-Cost-Quality Trade-off Model for Optimal Pile Type Selection Using Discrete Particle Swarm Optimization Algorithm

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Abstract

The cost of pile foundations is part of the super structure cost, and it became necessary to reduce this cost by studying the pile types then decision-making in the selection of the optimal pile type in terms of cost and time of production and quality. So The main objective of this study is to solve the time–cost–quality trade-off (TCQT) problem by finding an optimal pile type with the target of "minimizing" cost and time while "maximizing" quality. There are many types In the world of piles but in this paper, the researcher proposed five pile types, one of them is not a traditional, and developed a model for the problem and then employed particle swarm optimization (PSO) algorithm, as one of evolutionary algorithms with the help of (Mat lab software), as a tool for decision making problem about choosing the best alternative of the traded piles, and proposes a multi objective optimization model, which aims to optimize the time, cost and quality of the pile types, and assist in selecting the most appropriate pile types. The researcher selected 10 of senior engineers to conduct interviews with them. And prepared some questions for interviews and open questionnaire. The individuals are selected from private and state sectors each one have 10 years or more experience in pile foundations work. From personal interviews and field survey the research has shown that most of the experts, engineers are not fully aware of new soft wear techniques to helps them in choosing alternatives, despite their belief in the usefulness of using modern technology and software. The Problem is multi objective optimization problem, so after running the PSO algorithm it is usual to have more than one optimal solution, for five proposed pile types, finally the researcher evaluated and discussed the output results and found out that pre-high tension spun (PHC)pile type was the optimal pile type.

Keywords: PSO Algorithm; PHC; Optimal Pile Type; Decision Making.

1. Introduction

The foundation cost, of real-world structural systems, can vary from 5% to 20% of the construction cost of the superstructure. And that's not a tiny proportion [1, 2]. And it becomes a necessity to find the best pile foundation type in terms of performance and economy. In the initial stage of large construction residential projects, surveys and studies need to be carried out for its details and stages in order to find appropriate designs and alternatives,, which achieve the lowest cost, time and good quality, and This is the first problem that is sought to be solved, so the selection of the right pile type for the foundations is one of these decisions needed to evaluate the performances in terms of time, cost and quality. After this evaluation process, the selection of an optimal type of pile will be carried out the work in the project.

The main types of piles used are driven piles, driven and cast-in-place piles, jacked piles, bored and cast-in-place piles and composite piles. The first three of the above types are also called displacement piles since the soil is displaced. In the case of bored piles, and in some forms of composite piles, the soil is first removed by boring a hole where concrete

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