An Interactive Construction Deployment Planning Model for the SKA Project

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Abstract

The *Square Kilometre Array (SKA)* is a global project to build the world's largest telescope that stretches over at least 3000 km. This paper presents an interactive decision support tool which can be used for the planning of the construction of 190 (Phase 1) and 2400 (Phase 2) antenna foundations and other infrastructure. A simulation-based site layout planning (SLP) model is presented. The SLP model facilitates the manual optimization of the site layout through a series of "what if" analyses during the layout of temporary construction facilities in order to minimize site transportation cost/time, site establishment cost and improve the efficiency of material handling on site. The model uses unique concepts to facilitate integration of site layout planning, material supply and project scheduling. The model provides a graphical user interface and 2D visual communication during planning. It can also be applied to other repetitive construction projects such as the vertical construction of a multi-story building, or the linear construction of a road section.

Keywords: site layout, resource scheduling, repetitive project, optimization, computer programming.

1 Introduction

The *Square Kilometre Array (SKA)* is an international project to build the world's largest telescope that will finally stretch over at least 3000 km.

In Phase 1 of SKA there will be 190 antennas constructed over a 200 km distance in a rural and remote setting in South Africa with approximately 61% in an inner core (radius approximately 1 km), and the remaining 39% located along three spiral arms up to a distance of approximately 100 kilometres from the centre.

Phase 2 of SKA will have 2400 dishes out to 180km distance and a total of 3000 dishes up to 3000km [1]. The construction site in South Africa stretches over a very large area, thus causing the dish (i.e. antenna) foundation units to be located at large distances from each another. It is estimated that there will be approximately 560km of farm roads.

Borrow pits to supply material for the access roads, earth berms and the antenna platforms will be located on farms in the region. Other farms will house concrete batch plants, stores and accommodation for contractors and their staff.

Two problem areas have been identified for the construction deployment of the SKA antenna foundation infrastructure. The first is a site layout problem, due to the large travel distances. The second is a scheduling problem due to the repetitive nature of the construction.

This paper presents an interactive decision support tool which can be used during the planning of the construction of SKA antenna foundation infrastructure to optimise site layout and resource locations. Two models are integrated: (1) a simulation-based site layout planning (SLP) model; and (2) a repetitive project scheduling (RPS) model.

The SLP model facilitates the manual optimization of the site layout through a series of "what if" analyses during the layout of temporary construction facilities in order to minimize site transportation cost/time, site establishment cost and to improve the efficiency of material handling

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