ABSTRACT

In this thesis various Linear Programming Models are developed to refine the scientific approach and to improve its applicability in construction planning and control. Much better practical results are achieved in the use of the Critical Path Method (CPM) in Construction Planning, Compression of Networks, Scheduling of Resources, Bar Charts and in planning of Linear Construction through the development of these linear programming models.

A model is developed to analyse networks which determine the start and finish times of activities and the project completion time. The effectiveness of the use of this model derives from the fact that it enables the construction planner, by the use of add on correction constraint statements, to introduce or change any constraint relevant to the work at any time during construction, with very little additional computations.

Improvements to planning of linear construction projects such as housing, bridges, highways and tunnels are made through the development of a series of models. These models take into consideration all resource constraints and provide information relating to the rate of construction, start and finish time of each activity, project completion time and resource allocations to each activity. A model is also developed to determine the additional resource and overtime requirements when a project is behind schedule. If an extension of time is inevitable, a model to determine the minimum extension of time requirement is also made available.

Resource sharing models are developed for projects comprising both repetitive and non-repetitive activities. The main advantage in the use of these resource sharing models is the treatment of both the activity duration and the resources allocated to it as variables. These models help to determine very realistic values for the activity duration when resources are limited, and provide useful information pertaining to the best use of resources between activities. In the event of overtime being introduced, the model helps to identify which gang (gangs) should work and for what duration. The resource sharing model also indicate whether the introduction of additional resources or working overtime is more economical.

The network compression models that are developed enable construction planners to determine the minimum additional expenditure that will be incurred when expediting work, what activities should be expedited in order to complete the project within the specified time, how much money has to be allocated to each activity, what additional costs will be incurred when expediting work and the earliest start and finish times of all activities. These compression models can be used for networks of any size and networks comprising overlapping activities.

This thesis concludes with a discussion on the usefulness of the models developed.